AMC and G to Regulation (EU) No 1178/2011 as amended, Revision June 2016, Version 03

Contents

Acceptable Means of Compliance and Guidance Material to Part-FCL

Amended by:

ED Decision 2014/022/R of 2 April 2014

ED Decision 2016/008/R of 2 May 2016

SUBPART A — GENERAL REQUIREMENTS

GM1 FCL.005 Scope

INTERPRETATIVE MATERIAL

(a) Whenever licences, ratings, approvals or certificates are mentioned in Part-FCL, these are meant to be valid licences, ratings, approvals or certificates issued in accordance with Part-FCL. In all other cases, these documents are specified.

(b) Whenever a reference is made to Member States to mutual recognition of licences, ratings, approvals or certificates, this means a European Union Member State and states associated to the Agency in accordance with Article 55 of the Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008.

(c) Whenever 'or' is used as an inclusive 'or', it should be understood in the sense of 'and/or'.

GM1 FCL.010 Definitions

ABBREVIATIONS

The following abbreviations apply to the Acceptable Means of Compliance and Guidance Material to Part-FCL:

A	Aeroplane
AC	Alternating Current
ACAS	Airborne Collision Avoidance System
ADF	Automatic Direction Finding
ADS	Aeronautical Design Standard
AFCS	Automatic Flight Control System
AFM	Aircraft Flight Manual
AGL	Above Ground Level
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information regulation and control
AIS	Aeronautical Information Services
AMC	Acceptable Means of Compliance
AeMC	Aero-medical Centre
AME	Aero-medical Examiner
AOM	Aircraft Operating Manual
APU	Auxiliary Power Unit
As	Airship
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Approved Training Organisation
ATP	Airline Transport Pilot
ATPL	Airline Transport Pilot Licence
ATS	Air Traffic Service
AUM	All Up Mass
B	Balloon
BCAR	British Civil Airworthiness Requirement
BEM	Basic Empty Mass
BITD	Basic Instrument Training Device

BPL	Balloon Pilot Licence
CAS	Calibrated Air Speed
CAT	Clear Air Turbulence
CB-IR	Competency-based training course for instrument rating
CDI	Course Deviation Indicator
CFI	Chief Flying Instructor
CG	Centre of Gravity
CGI	Chief Ground Instructor
CP	Co-pilot
CPL	Commercial Pilot Licence
CRE	Class Rating Examiner
CRI	Class Rating Instructor
CRM	Crew Resource Management
CS	Certification Specification
CQB	Central Question Bank
DC	Direct Current
DF	Direction Finding
DME	Distance Measuring Equipment
DPATO	Defined Point After Take-off
DPBL	Defined Point Before Landing
DR	Dead Reckoning navigation
EFIS	Electronic Flight Instrument System
EIR	En route instrument rating
EOL	Engine Off Landings
ERPM	Engine Revolution Per Minute
ETA	Estimated Time of Arrival
ETOPS	Extended-range Twin-engine Operation Performance Standard
FAF	Final Approach Fix
FAR	Federal Aviation Regulations
FCL	Flight Crew Licensing
FE	Flight Examiner
F/E	Flight Engineer
FEM	Flight Examiner Manual
FFS	Full Flight Simulator

FI	Flight Instructor
FIE	Flight Instructor Examiner
FIS	Flight Information Service
FMC	Flight Management Computer
FMS	Flight Management System
FNPT	Flight and Navigation Procedures Trainer
FS	Flight Simulator
FSTD	Flight Simulation Training Device
ft	feet
FTD	Flight Training Device
G	Gravity forces
GLONASS	Global Orbiting Navigation Satellite System
GM	Guidance Material
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
H	Helicopter
HF	High Frequency
HOFCS	High Order Flight Control System
HPA	High Performance Aeroplane
hrs	Hours
HUMS	Health and Usage Monitoring System
HT	Head of Training
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organisation
IGE	In Ground Effect
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IR	Instrument Rating
IRE	Instrument Rating Examiner
IRI	Instrument Rating Instructor
ISA	International Standard Atmosphere
JAR	Joint Aviation Requirements
kg	Kilogram

LAPL	Light Aircraft Pilot Licence
LDP	Landing Decision Point
LMT	Local Mean Time
LO	Learning Objectives
LOFT	Line Orientated Flight Training
m	Meter
MCC	Multi-Crew Cooperation
MCCI	Multi-Crew Cooperation Instructor
ME	Multi-engine
MEL	Minimum Equipment List
MEP	Multi-engine Piston
MET	Multi-engine Turboprop
METAR	Meteorological Aerodrome Report
MI	Mountain Rating Instructor
MP	Multi-pilot
MPA	Multi-pilot Aeroplane
MPL	Multi-crew Pilot Licence
MPH	Multi-pilot Helicopter
MTOM	Maximum Take-off Mass
NDB	Non-directional Beacon
NM	Nautical Miles
NOTAM	Notice To Airmen
NOTAR	No Tail Rotor
OAT	Outside Air Temperature
OBS	Omni Bearing Selector
OEI	One Engine Inoperative
OGE	Out of Ground Effect
OML	Operational Multi-pilot Limitation
OSL	Operational Safety Pilot Limitation
OTD	Other Training Devices
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot-In-Command
PICUS	Pilot-In-Command Under Supervision

PL	Powered-lift
PNF	Pilot Not Flying
PPL	Private Pilot Licence
QDM	Magnetic heading
QFE	Atmospheric pressure at aerodrome elevation
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RNAV	Radio Navigation
RPM	Revolution Per Minute
RRPM	Rotor Revolution Per Minute
R/T	Radiotelephony
S	Sailplane
SATCOM	Satellite communication
SE	Single-engine
SEP	Single-engine Piston
SET	Single-engine Turboprop
SFE	Synthetic Flight Examiner
SFI	Synthetic Flight Instructor
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Weather
SLPC	Single Lever Power Control
SOP	Standard Operating Procedure
SP	Single-pilot
SPA	Single-pilot Aeroplane
SPH	Single-pilot Helicopter
SPIC	Student PIC
SPL	Sailplane Pilot Licence
SSR	Secondary Surveillance Radar
STI	Synthetic Training Instructor
TAF	(Terminal Area Forecasts) Aerodrome Forecast
TAS	True Air Speed
TAWS	Terrain Awareness Warning System
TDP	Take-off Decision Point
TEM	Threat and Error Management
TK	Theoretical knowledge

TMG	Touring Motor Glider
TORA	Take-off Run Available
TODA	Take-off Distance Available
TR	Type Rating
TRE	Type Rating Examiner
TRI	Type Rating Instructor
UTC	Coordinated Universal Time
V	Velocity
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omni-directional Radio Range
ZFTT	Zero Flight Time Training
ZFM	Zero Fuel Mass

GM2 FCL.010 Definitions — lateral and vertical navigation

Lateral and vertical navigation guidance refers to the guidance provided either by:
(a) a ground-based radio navigation aid; or

(b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these

AMC1 FCL.015 Application and issue of licences, ratings and certificates

APPLICATION AND REPORT FORMS

Common application and report forms can be found:

(a) For skill tests, proficiency checks for issue, revalidation or renewal of LAPL, BPL, SPL, PPL, CPL and IR in AMC1 to Appendix 7.

(b) For training, skill tests or proficiency checks for ATPL, MPL and class and type ratings, in AMC1 to Appendix 9.

(c) For assessments of competence for instructors, in AMC5 FCL.935.

AMC1 FCL.025 Theoretical knowledge examinations for the issue of licences

TERMINOLOGY

The meaning of the following terms used in FCL.025 should be as follows:

(a) 'Entire set of examinations': an examination in all subjects required by the licence level.

(b) 'Examination': the demonstration of knowledge in one or more examination papers.

(c) 'Examination paper': a set of questions to be answered by a candidate for examination.

(d) 'Attempt': a try to pass a specific paper.

(e) 'Sitting': a period of time established by the competent authority within which a candidate can take an examination. This period should not exceed 10 consecutive days. Only one attempt at each examination paper is allowed in one sitting.

AMC1 FCL.050 Recording of flight time

GENERAL

(a) The record of the flights flown should contain at least the following information:

(1) personal details: name(s) and address of the pilot;

(2) for each flight:

(i) name(s) of PIC;

(ii) date of flight;

(iii) place and time of departure and arrival;

(iv) type, including make, model and variant, and registration of the aircraft;

(v) indication if the aircraft is SE or ME, if applicable;

(vi) total time of flight;

(vii) accumulated total time of flight.

(3) for each FSTD session, if applicable:

(i) type and qualification number of the training device;

(ii) FSTD instruction;

(iii) date;

(iv) total time of session;

(v) accumulated total time.

(4) details on pilot function, namely PIC, including solo, SPIC and PICUS time, co-pilot, dual, FI or FE;

(5) Operational conditions, namely if the operation takes place at night, or is conducted under instrument flight rules.

(b) Logging of time:

(1) PIC flight time:

(i) the holder of a licence may log as PIC time all of the flight time during which he or she is the PIC;

(ii) the applicant for or the holder of a pilot licence may log as PIC time all solo flight time, flight time as SPIC and flight time under supervision provided that such SPIC time and flight time under supervision are countersigned by the instructor;

(iii) the holder of an instructor certificate may log as PIC all flight time during which he or she acts as an instructor in an aircraft;

(iv) the holder of an examiner's certificate may log as PIC all flight time during which he or she occupies a pilot's seat and acts as an examiner in an aircraft;

(v) a co-pilot acting as PICUS on an aircraft on which more than one pilot is required under the type certification of the aircraft or as required by operational requirements provided that such PICUS time is countersigned by the PIC;

(vi) if the holder of a licence carries out a number of flights upon the same day returning on each occasion to the same place of departure and the interval between successive flights does not exceed 30 minutes, such series of flights may be recorded as a single entry.

(2) co-pilot flight time: the holder of a pilot licence occupying a pilot seat as co-pilot may log all flight time as co-pilot flight time on an aircraft on which more than one pilot is required under the type certification of the aircraft, or the regulations under which the flight is conducted;

(3) cruise relief co-pilot flight time: a cruise relief co-pilot may log all flight time as co-pilot when occupying a pilot's seat;

(4) instruction time: a summary of all time logged by an applicant for a licence or rating as flight instruction, instrument flight instruction, instrument ground time, etc., may be logged if certified by the appropriately rated or authorised instructor from whom it was received;

(5) PICUS flight time: provided that the method of supervision is acceptable to the competent authority, a co-pilot may log as PIC flight time flown as PICUS when all the duties and functions of PIC on that flight were carried out in such a way that the intervention of the PIC in the interest of safety was not required.

(c) Format of the record:

(1) details of flights flown under commercial air transport may be recorded in a computerised format maintained by the operator. In this case an operator should make the records of all flights operated by the pilot, including differences and familiarisation training, available upon request to the flight crew member concerned;

(2) for other types of flight, the pilot should record the details of the flights flown in the following logbook format. For sailplanes and balloons, a suitable format should be used that contains the relevant items mentioned in (a) and additional information specific to the type of operation.

PILOT LOGBOOK

Holder's name(s) ______________________________

Holder's licence number ______________________________

HOLDER'S ADDRESS:	
______________________________ ______________________________ ______________________________	______________________________ ______________________________ ______________________________ *[space for address change]*
______________________________ ______________________________ ______________________________ *[space for address change]*	______________________________ ______________________________ ______________________________ *[space for address change]*
______________________________ ______________________________ ______________________________ *[space for address change]*	______________________________ ______________________________ ______________________________ *[space for address change]*

1	**2**		**3**		**4**		**5**				**6**		**7**	**8**	
DATE dd/mm/yy)	DEPARTURE		ARRIVAL		AIRCRAFT		SINGLE-PILOT TIME		MULTI-PILOT TIME		TOTAL TIME OF FLIGHT		NAME(S) PIC	LANDINGS	
	PLACE	*TIME*	*PLACE*	*TIME*	*MAKE, MODEL, VARIANT*	*REGISTRATION*	*SE*	*ME*						*DAY*	*NIGHT*
						TOTAL THIS PAGE									
						TOTAL FROM PREVIOUS PAGES									
						TOTAL TIME									

9				10								11				12
OPERATIONAL CONDITION TIME				PILOT FUNCTION TIME								FSTD SESSION				REMARKS AND ENDORSEMENTS
NIGHT		*IFR*		*PIC*		*CO-PILOT*		*DUAL*		*INSTRUCTOR*		*DATE (dd/mm/yy)*	*TYPE*	*TOTAL TIME OF SESSION*		
																I certify that the entries in this log are true.
																PILOT'S SIGNATURE

INSTRUCTIONS FOR USE

(d) FCL.050 requires holders of a pilot licence to record details of all flights flown. This logbook enables pilot licence holders to record flying experience in a manner which will facilitate this process while providing a permanent record of the licence holders flying. Pilots who fly regularly aeroplanes and helicopters or other aircraft categories are recommended to maintain separate logbooks for each aircraft category.

(e) Flight crew logbook entries should be made as soon as practicable after any flight undertaken. All entries in the logbook should be made in ink or indelible pencil.

(f) The particulars of every flight in the course of which the holder of a flight crew licence acts as a member of the operating crew of an aircraft are to be recorded in the appropriate columns using one line for each flight, provided that if an aircraft carries out a number of flights upon the same day returning on each occasion to the same place of departure and the interval between successive flights does not exceed 30 minutes, such series of flights may be recorded as a single entry.

(g) Flight time is recorded:

 (1) for aeroplanes, touring motor gliders and powered-lift aircraft, from the moment an aircraft first moves to taking off until the moment it finally comes to rest at the end of the flight;

 (2) for helicopters, from the moment a helicopter's rotor blades start turning until the moment the helicopter finally comes to rest at the end of the flight, and the rotor blades are stopped;

 (3) for airships, from the moment an airship is released from the mast to taking off until the moment the airship finally comes to rest at the end of the flight, and is secured on the mast;

(h) When an aircraft carries two or more pilots as members of the operating crew, one of them shall, before the flight commences, be designated by the operator as the aircraft PIC, according to operational requirements, who may delegate the conduct of the flight to another suitably qualified pilot. All flying carried out as PIC is entered in the logbook as 'PIC'. A pilot flying as 'PICUS' or 'SPIC' enters flying time as 'PIC' but all such entries are to be certified by the PIC or FI in the 'Remarks' column of the logbook.

(i) Notes on recording of flight time:

 (1) column 1: enter the date (dd/mm/yy) on which the flight commences;

 (2) column 2 or 3: enter the place of departure and destination either in full or the internationally recognised three or four letter designator. All times should be in UTC;

 (3) column 5: indicate whether the operation was SP or MP, and for SP operation whether SE or ME;

Example:

1	2		3		4		5				6		7	8	
DATE (dd/mm/yy)	DEPARTURE		ARRIVAL		AIRCRAFT		SINGLE PILOT TIME		MULTI-PILOT TIME		TOTAL TIME OF		NAME(S) PIC	LANDINGS	
	PLACE	*TIME*	*PLACE*	*TIME*	*MAKE, MODEL, VARIANT*	*REGISTR ATION*	*SE*	*ME*			FLIGHT			*DAY*	*NIGHT*
08/04/12	LFAC	1025	EGBJ	1240	PA34-250	G-SENE		✓			2	15	SELF	1	
09/04/12	EGBJ	1810	EGBJ	1930	C152	G-NONE	✓				1	20	SELF		2
11/04/12	LGW	1645	LAX	0225	B747-400	G-ABCD			9	40	9	40	NAME(S) PIC		1

(4) column 6: total time of flight may be entered in hours and minutes or decimal notation as desired;

(5) column 7: enter the name(s) of PIC or SELF as appropriate;

(6) column 8: indicate the number of landings as pilot flying by day or night;

(7) column 9: enter flight time undertaken at night or under instrument flight rules if applicable;

(8) column 10: pilot function time:

(i) enter flight time as PIC, SPIC and PICUS as PIC;

(ii) all time recorded as SPIC or PICUS is countersigned by the aircraft PIC/FI in the 'remarks' (column 12);

(iii) instructor time should be recorded as appropriate and also entered as PIC.

(9) column 11: FSTD:

(i) for any FSTD enter the type of aircraft and qualification number of the device. For other flight training devices enter either FNPT I or FNPT II as appropriate;

(ii) total time of session includes all exercises carried out in the device, including pre- and after-flight checks;

(iii) enter the type of exercise performed in the 'remarks' (column 12), for example operator proficiency check, revalidation.

(10) column 12: the 'remarks' column may be used to record details of the flight at the holder's discretion. The following entries, however, should always be made:

(i) instrument flight time undertaken as part of the training for a licence or rating;

(ii) details of all skill tests and proficiency checks;

(iii) signature of PIC if the pilot is recording flight time as SPIC or PICUS;

(iv) signature of instructor if flight is part of an SEP or TMG class rating revalidation.

(j) When each page is completed, accumulated flight time or hours should be entered in the appropriate columns and certified by the pilot in the 'remarks' column.

Example:

9				**10**								**11**				**12**
OPERATIONAL CONDITION TIME				PILOT FUNCTION TIME								FSTD SESSION				REMARKS AND ENDORSEMENTS
NIGHT		*IFR*		*PIC*		*CO-PILOT*		*DUAL*		*INSTRUCTOR*		*DATE (dd/mm/yy)*	*TYPE*	*TOTAL TIME OF SESSION*		
		2	15	2	15											
1	20			1	20					1	20					Night rating training
												10/04/12	B747-400 (Q1234)	4	10	Revalidation proficiency check
8	10	9	40	9	40											PIC(US): signature of NAME(S) PIC

AMC1 FCL.055 Language proficiency

GENERAL

(a) The language proficiency assessment should be designed to reflect a range of tasks undertaken by pilots but with specific focus on language rather than operational procedures.

(b) The assessment should determine the applicant's ability to:

(1) communicate effectively using standard R/T phraseology;

(2) deliver and understand messages in plain language in both usual and unusual situations that necessitate departure from standard R/T phraseology.

Note: refer to the 'Manual on the Implementation of ICAO Language Proficiency Requirements' (ICAO Doc 9835), Appendix A Part III and Appendix B for further guidance.

ASSESSMENT

(c) The assessment may be subdivided into three elements, as follows:

(1) listening: assessment of comprehension;

(2) speaking: assessment of pronunciation, fluency, structure and vocabulary;

(3) interaction.

(d) The three elements mentioned above may be combined and they can be covered by using a wide variety of means or technologies.

(e) Where appropriate, some or all of these elements may be achieved through the use of the R/T testing arrangements.

(f) When the elements of the testing are assessed separately, the final assessment should be consolidated in the language proficiency endorsement issued by the competent authority.

(g) The assessment may be conducted during one of the several existing checking or training activities, such as licence issue or rating issue and revalidation, line training, operator line checks or proficiency checks.

(h) The competent authority may use its own resources in developing or conducting the language proficiency assessment, or may delegate this task to language assessment bodies.

(i) The competent authority should establish an appeal procedure for applicants.

(j) The holder of a licence should receive a statement containing the level and validity of the language endorsements.

(k) Where the assessment method for the English language established by the competent authority is equivalent to that established for the assessment of use of the English language in accordance with AMC2 FCL.055, the same assessment may be used for both purposes.

BASIC ASSESSMENT REQUIREMENTS

(l) The aim of the assessment is to determine the ability of an applicant for a pilot licence or a licence holder to speak and understand the language used for R/T communications.

(1) The assessment should determine the ability of the applicant to use both:

(i) standard R/T phraseology;

(ii) plain language, in situations when standardised phraseology cannot serve an intended transmission.

(2) The assessment should include:

(i) voice-only or face-to-face situations;

(ii) common, concrete and work-related topics for pilots.

(3) The applicants should demonstrate their linguistic ability in dealing with an unexpected turn of events, and in solving apparent misunderstandings.

(4) The assessment should determine the applicant's speaking and listening abilities. Indirect assessments, of grammatical knowledge, reading and writing, are not appropriate.

(5) The assessment should determine the language skills of the applicant in the following areas:

(i) pronunciation:

(A) the extent to which the pronunciation, stress, rhythm and intonation are influenced by the applicant's first language or national variations;

(B) how much they interfere with ease of understanding.

(ii) structure:

(A) the ability of the applicant to use both basic and complex grammatical structures;

(B) the extent to which the applicant's errors interfere with the meaning.

(iii) vocabulary:

(A) the range and accuracy of the vocabulary used;

(B) the ability of the applicant to paraphrase successfully when lacking vocabulary.

(iv) fluency:

(A) tempo;

(B) hesitancy;

(C) rehearsed versus spontaneous speech;

(D) use of discourse markers and connectors.

(v) comprehension:

(A) on common, concrete and work-related topics;

(B) when confronted with a linguistic or situational complication or an unexpected turn of events.

Note: the accent or variety of accents used in the test material should be sufficiently intelligible for an international community of users.

(vi) interactions:

(A) quality of response (immediate, appropriate, and informative);

(B) the ability to initiate and maintain exchanges:

(a) on common, concrete and work-related topics;

(b) when dealing with an unexpected turn of events.

(C) the ability to deal with apparent misunderstandings by checking, confirming or clarifying.

Note: the assessment of the language skills in the areas mentioned above is conducted using the rating scale in AMC2 FCL.055.

(6) When the assessment is not conducted in a face-to-face situation, it should use appropriate technologies for the assessment of the applicant's abilities in listening and speaking, and for enabling interactions (for example: simulated pilot or controller communication).

ASSESSORS

(m) It is essential that the persons responsible for language proficiency assessment ('assessors') are suitably trained and qualified. They should be either aviation specialists (for example current or former flight crew members or air traffic controllers), or language specialists with additional aviation-related training. An alternative approach would be to form an assessment team consisting of an operational expert and a language expert.

(1) The assessors should be trained on the specific requirements of the assessment.

(2) The assessors should not test applicants to whom they have given language training.

CRITERIA FOR THE ACCEPTABILITY OF LANGUAGE ASSESSMENT BODIES

(n) To ensure an impartial assessment process, the language assessment should be independent of the language training.

(1) To be accepted, the language assessment bodies should demonstrate:

(i) appropriate management and staffing;

(ii) quality system established and maintained to ensure compliance with, and adequacy of, assessment requirements, standards and procedures.

(2) The quality system established by a language assessment body should address the following:

(i) management;

(ii) policy and strategy;

(iii) processes;

(iv) the relevant provisions of ICAO or Part-FCL, standards and assessment procedures;

(v) organisational structure;

(vi) responsibility for the development, establishment and management of the quality system;

(vii) documentation;

(viii) quality assurance programme;

(ix) human resources and training (initial and recurrent);

(x) assessment requirements;

(xi) customer satisfaction.

(3) The assessment documentation and records should be kept for a period of time determined by the competent authority and made available to this competent authority, on request.

(4) The assessment documentation should include at least the following:

(i) assessment objectives;

(ii) assessment layout, time scale, technologies used, assessment samples, voice samples;

(iii) assessment criteria and standards (at least for the levels 4, 5 and 6 of the rating scale mentioned in AMC2 FCL.055);

(iv) documentation demonstrating the assessment validity, relevance and reliability;

(v) assessment procedures and responsibilities:

(A) preparation of individual assessment;

(B) administration: location(s), identity check and invigilation, assessment discipline, confidentiality or security;

(C) reporting and documentation provided to the competent authority or to the applicant, including sample certificate;

(D) retention of documents and records.

Note: refer to the 'Manual on the Implementation of ICAO Language Proficiency Requirements' (ICAO Doc 9835) for further guidance.

AMC2 FCL.055 Language proficiency

RATING SCALE

The following table describes the different levels of language proficiency:

LEVEL	***PRONUNCIATION*** *Assumes a dialect or accent intelligible to the aeronautical community*	***STRUCTURE*** *Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*	***VOCABULARY***	***FLUENCY***	***COMPREHENSION***	***INTERACTIONS***
Expert (Level 6)	Pronunciation, stress, rhythm, and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced and sensitive to register.	Able to speak at length with a natural, effortless flow. Varies speech flow for stylistic effect, for example to emphasise a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and non-verbal cues, and responds to them appropriately.
Extended (Level 5)	Pronunciation, stress, rhythm, and intonation, though influenced by the	Basic grammatical structures and sentence patterns are consistently	Vocabulary range and accuracy are sufficient to communicate	Able to speak at length with relative ease on familiar topics, but may not	Comprehension is accurate on common, concrete, and work-related	Responses are immediate, appropriate, and informative.

LEVEL	PRONUNCIATION	STRUCTURE	VOCABULARY	FLUENCY	COMPREHENSION	INTERACTIONS
	Assumes a dialect or accent intelligible to the aeronautical community	*Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*				
	first language or regional variation, rarely interfere with ease of understanding.	well controlled. Complex structures are attempted but with errors which sometimes interfere with meaning.	effectively on common, concrete, and work-related topics. Paraphrases consistently and successfully. Vocabulary is sometimes idiomatic.	vary speech flow as a stylistic device. Can make use of appropriate discourse markers or connectors.	topics and mostly accurate when the speaker is confronted with a linguistic or situational complication or an unexpected turn of events. Is able to comprehend a range of speech varieties (dialect or accent) or registers.	Manages the speaker or listener relationship effectively.
Operatio-nal (Level 4)	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to	Comprehension is mostly accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn

LEVEL	*PRONUNCIATION* *Assumes a dialect or accent intelligible to the aeronautical community*	*STRUCTURE* *Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task*	*VOCABULARY*	*FLUENCY*	*COMPREHENSION*	*INTERACTIONS*
		unexpected circumstances, but rarely interfere with meaning.	Can often paraphrase successfully when lacking vocabulary particularly in unusual or unexpected circumstances.	spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers and connectors. Fillers are not distracting.	community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.	of events. Deals adequately with apparent misunderstandings by checking, confirming, or clarifying.
Pre-Operatio-nal (Level 3)	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns associated with predictable situations are not always well controlled. Errors frequently interfere with meaning.	Vocabulary range and accuracy are often sufficient to communicate effectively on common, concrete, and work-related topics but range is limited and the word choice often inappropriate. Is	Produces stretches of language, but phrasing and pausing are often inappropriate. Hesitations or slowness in language processing may prevent effective communication.	Comprehension is often accurate on common, concrete, and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users.	Responses are sometimes immediate, appropriate, and informative. Can initiate and maintain exchanges with reasonable ease on familiar topics and in predictable

LEVEL	*PRONUNCIATION* Assumes a dialect or accent intelligible to the aeronautical community	*STRUCTURE* Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task	*VOCABULARY*	*FLUENCY*	*COMPREHENSION*	*INTERACTIONS*
			often unable to paraphrase successfully when lacking vocabulary.	Fillers are sometimes distracting.	May fall to understand a linguistic or situational complication or an unexpected turn of events.	situations. Generally inadequate when dealing with an unexpected turn of events.
Elemen-tary (Level 2)	Pronunciation, stress, rhythm, and intonation are heavily influenced by the first language or regional variation and usually interfere with ease of understanding.	Shows only limited control of few simple memorised grammatical structures and sentence patterns.	Limited vocabulary range consisting only of isolated words and memorised phrases.	Can produce very short, isolated, memorised utterances with frequent pausing and a distracting use of fillers to search for expressions and articulate less familiar words.	Comprehension is limited to isolated, memorised phrases when they are carefully and slowly articulated.	Response time is slow, and often inappropriate. Interaction is limited to simple routine exchanges.
Pre-Elemen-tary (Level 1)	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.	Performs at a level below the elementary level.

Note: operational Level (Level 4) is the minimum required proficiency level for R/T communication.

Levels 1 through 3 describe pre-elementary, elementary and pre-operational levels of language proficiency respectively, all of which describe a level below the language proficiency requirement.

Levels 5 and 6 describe extended and expert levels at levels of proficiency more advanced than the minimum required standard.

AMC3 FCL.055 Language proficiency

SPECIFIC REQUIREMENTS FOR HOLDERS OF AN IR

USE OF ENGLISH LANGUAGE

(a) The requirement of FCL.055(d) includes the ability to use the English language for the following purposes:

(1) flight: R/T relevant to all phases of flight, including emergency situations.

(2) ground: all information relevant to the accomplishment of a flight:

(i) be able to read and demonstrate an understanding of technical manuals written in English, for example an operations manual, a helicopter flight manual, etc.;

(ii) pre-flight planning, weather information collection, NOTAMs, ATC flight plan, etc.;

(iii) use of all aeronautical en-route, departure and approach charts and associated documents written in English.

(3) communication: be able to communicate with other crew members in English during all phases of flight, including flight preparation.

(b) Alternatively, the items in (a) above may be demonstrated:

(1) by having passed a specific examination given by the competent authority after having undertaken a course of training enabling the applicant to meet all the objectives listed in (a) above; or

(2) the item in (a)(1) above is considered to be fulfilled, if the applicant has passed an IR, MPL or ATPL skill test and proficiency check during which the two-way R/T communication is performed in English;

(3) the item in (a)(2) above is considered to be fulfilled if the applicant has graduated from an IR, MPL or ATP course given in English or if he or she has passed the theoretical IR or ATPL examination in English;

(4) the item in (a)(3) above is considered to be fulfilled, if the applicant for or the holder of an IR has graduated from an MCC course given in English and is holding a certificate of satisfactory completion of that course or if the applicant has passed a MP skill test and proficiency check for the issue of a class or type rating during which the two-way R/T communication and the communication with other crew members are performed in English.

(c) Where the examination methods referred to above are equivalent to those established for the language proficiency requirements in accordance with AMC1 FCL.055, the examination may be used to issue a language proficiency endorsement.

AMC1 FCL.060(b)(1) Recent experience

When a pilot needs to carry out one or more flights with an instructor or an examiner to comply with the requirement of FCL.060(b)(1) before the pilot can carry passengers, the instructor or examiner on board those flights will not be considered as a passenger.

GM1 FCL.060(b)(1) Recent experience

AEROPLANES, HELICOPTERS, POWERED-LIFT, AIRSHIPS AND SAILPLANES

If a pilot or a PIC is operating under the supervision of an instructor to comply with the required three take-offs, approaches and landings, no passengers may be on board.

AMC1 FCL.060(b)(5) Recent experience

NON-COMPLEX HELICOPTERS

Grouping of non-complex helicopters with similar handling and operational characteristics:

(a) Group 1: Bell 206/206L, Bell 407;

(b) Group 2: Hughes 369, MD 500N, MD 520N, MD 600;

(c) Group 3: SA 341/342, EC 120;

(d) Group 4: SA 313/318, SA 315/316/319, AS 350, EC 130;

(e) Group 5: all types listed in AMC1 FCL.740.H (a)(3) and R 22 and R 44.

SUBPART B — LIGHT AIRCRAFT PILOT LICENCE — LAPL

AMC1 FCL.115; FCL.120

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE LAPL

(a) The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated with the licence and the activity. The theoretical knowledge instruction provided by the ATO should include a certain element of formal classroom work but may also include other methods of delivery for example interactive video, slide or tape presentation, computer-based training and other media distance learning courses. The training organisation responsible for the training has to check if all the appropriate elements of the training course of theoretical knowledge instruction have been completed to a satisfactory standard before recommending the applicant for the examination.

(b) The following tables contain the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the LAPL(B) and LAPL(S). The syllabi for the theoretical knowledge instruction and examination for the PPL(A) and PPL(H) in AMC1 FCL.210 and FCL.215 should be used for the LAPL(A) and the LAPL(H), respectively.

I. COMMON SUBJECTS

[FOR LAPL(S) AND LAPL(B)]

1.	**AIR LAW AND ATC PROCEDURES**
1.1.	International law: conventions, agreements and organisations
1.2.	Airworthiness of aircraft
1.3.	Aircraft nationality and registration marks
1.4.	Personnel licensing
1.5.	Rules of the air
1.6.	Procedures for air navigation: aircraft operations
1.7.	Air traffic regulations: airspace structure
1.8.	ATS and air traffic management
1.9.	AIS
1.10.	Aerodromes, external take-off sites
1.11.	Search and rescue
1.12.	Security
1.13.	Accident reporting
1.14.	National law
2.	**HUMAN PERFORMANCE**
2.1.	Human factors: basic concepts
2.2.	Basic aviation physiology and health maintenance
2.3.	Basic aviation psychology

3.	**METEOROLOGY**
3.1.	The atmosphere
3.2.	Wind
3.3.	Thermodynamics
3.4.	Clouds and fog
3.5.	Precipitation
3.6.	Air masses and fronts
3.7	Pressure systems
3.8.	Climatology
3.9.	Flight hazards
3.10.	Meteorological information
4.	**COMMUNICATIONS**
4.1.	VFR communications
4.2.	Definitions
4.3.	General operating procedures
4.4.	Relevant weather information terms (VFR)
4.5.	Action required to be taken in case of communication failure
4.6.	Distress and urgency procedures
4.7.	General principles of VHF propagation and allocation of frequencies

II. ADDITIONAL SUBJECTS FOR EACH CATEGORY

II.A. SAILPLANES

5.	**PRINCIPLES OF FLIGHT - SAILPLANE**
5.1.	Aerodynamics (airflow)
5.2.	Flight mechanics
5.3.	Stability
5.4.	Control
5.5.	Limitations (load factor and manoeuvres)
5.6.	Stalling and spinning
6.	**OPERATIONAL PROCEDURES - SAILPLANE**
6.1.	General requirements
6.2.	Launch methods
6.3.	Soaring techniques
6.4.	Circuits and landing
6.5.	Outlanding
6.6.	Special operational procedures and hazards
6.7.	Emergency procedures

7.	**FLIGHT PERFORMANCE AND PLANNING - SAILPLANE**
7.1.	Verifying mass and balance
7.2.	Speed polar of sailplanes or cruising speed
7.3.	Flight planning and task setting
7.4.	ICAO flight plan (ATS flight plan)
7.5.	Flight monitoring and in-flight re-planning
8.	**AIRCRAFT GENERAL KNOWLEDGE, AIRFRAME AND SYSTEMS AND EMERGENCY EQUIPMENT – SAILPLANE**
8.1.	Airframe
8.2.	System design, loads and stresses
8.3.	Landing gear, wheels, tyres and brakes
8.4.	Mass and balance
8.5.	Flight controls
8.6.	Instruments
8.7.	Manuals and documents
8.8.	Airworthiness and maintenance
9.	**NAVIGATION – SAILPLANE**
9.1.	Basics of navigation
9.2.	Magnetism and compasses
9.3.	Charts
9.4.	Dead reckoning navigation
9.5.	In-flight navigation
9.6.	Global navigation satellite systems

II.B. BALLOONS

5.	**PRINCIPLES OF FLIGHT – BALLOON**
5.1.	Principles of flight
5.2.	Aerostatics
5.3.	Loading limitations
5.4.	Operational limitations
6.	**OPERATIONAL PROCEDURES – BALLOON**
6.1.	General requirements
6.2.	Special operational procedures and hazards (general aspects)
6.3.	Emergency procedures
7.	**FLIGHT PERFORMANCE AND PLANNING – BALLOON**
7.1.	Mass
7.1.1.	Purpose of mass considerations

7.1.2.	Loading
7.2.	Performance
7.2.1.	Performance: general
7.3.	Flight planning and flight monitoring
7.3.1.	Flight planning: general
7.3.2.	Fuel planning
7.3.3.	Pre-flight preparation
7.3.4.	ICAO flight plan (ATS flight plan)
7.3.5.	Flight monitoring and in-flight re-planning
8.	**AIRCRAFT GENERAL KNOWLEDGE, ENVELOPE AND SYSTEMS AND EMERGENCY EQUIPMENT – BALLOON**
8.1.	System design, loads, stresses and maintenance
8.2.	Envelope
8.3.	Burner (hot-air balloon and hot-air airship)
8.4.	Fuel cylinders (hot-air balloon or hot-air airship)
8.5.	Basket or gondola
8.6.	Lifting gas (gas balloon)
8.7.	Burning gas (hot-air balloon or hot-air airship)
8.8.	Ballast (gas balloon)
8.9.	Engine (hot-air airship only)
8.10.	Instruments
8.11.	Emergency equipment
9.	**NAVIGATION – BALLOON**
9.1.	General navigation
9.2.	Basics of navigation
9.3.	Magnetism and compasses
9.4.	Charts
9.5.	Dead reckoning navigation
9.6.	In-flight navigation
9.7.	GNSS

AMC1 FCL.120; FCL.125

THEORETICAL KNOWLEDGE EXAMINATION AND SKILL TEST FOR THE LAPL

(a) Theoretical knowledge examination

(1) The examinations should be in written form and should comprise a total of 120 multiple-choice questions covering all the subjects.

(2) For the subject 'communication' practical classroom testing may be conducted.

(3) The competent authority should inform applicants of the language(s) in which the examinations will be conducted.

(b) Skill test

Further training may be required following any failed skill test or part thereof. There should be no limit to the number of skill tests that may be attempted.

(c) Conduct of the test

(1) If the applicant chooses to terminate a skill test for reasons considered inadequate by the FE, the applicant should retake the entire skill test. If the test is terminated for reasons considered adequate by the FE, only those sections not completed should be tested in a further flight.

(2) Any manoeuvre or procedure of the test may be repeated once by the applicant. The FE may stop the test at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest.

(3) An applicant should be required to fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

AMC1 FCL.125 LAPL — Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(A)

(a) The route to be flown for the skill test should be chosen by the FE. The route should end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should have a duration of at least 30 minutes which allows the pilot to demonstrate his/her ability to complete a route with at least two identified waypoints and may, as agreed between applicant and FE, be flown as a separate test.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the flight manual or the authorised checklist for the aeroplane or TMG on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane or TMG used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the aeroplane or TMG within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the aeroplane or TMG at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the aeroplane or TMG used:

(1) height:

normal flight ± 150 ft

(2) speed:

(i) take-off and approach +15/-5 knots

(ii) all other flight regimes ± 15 knots

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(A):

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of checklist, airmanship, control of aeroplane or TMG by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Pre-flight documentation, NOTAM and weather briefing
b	Mass and balance and performance calculation
c	Aeroplane or TMG inspection and servicing
d	Engine starting and after starting procedures
e	Taxiing and aerodrome procedures, pre-take-off procedures
f	Take-off and after take-off checks
g	Aerodrome departure procedures
h	ATC liaison: compliance

SECTION 2 GENERAL AIRWORK	
a	ATC liaison
b	Straight and level flight, with speed changes
c	Climbing: i. best rate of climb; ii. climbing turns; iii. levelling off.
d	Medium (30° bank) turns, look-out procedures and collision avoidance
e	Steep (45 ° bank) turns
f	Flight at critically low air speed with and without flaps
g	Stalling: i. clean stall and recover with power; ii. approach to stall descending turn with bank angle 20 °, approach configuration; iii. approach to stall in landing configuration.
h	Descending: i. with and without power; ii. descending turns (steep gliding turns); iii. levelling off.
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed
c	Orientation, airspace structure, timing and revision of ETAs, log keeping
d	Diversion to alternate aerodrome (planning and implementation)
e	Flight management (checks, fuel systems, carburettor icing, etc.)
f	ATC liaison: compliance

SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures
b	Collision avoidance (look-out procedures)
c	Precision landing (short field landing) and crosswind, if suitable conditions available
d	Flapless landing (if applicable)
e	Approach to landing with idle power
f	Touch and go
g	Go-around from low height
h	ATC liaison
i	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with Sections 1 through 4	
a	Simulated engine failure after take-off
b	* Simulated forced landing
c	* Simulated precautionary landing
d	Simulated emergencies
e	Oral questions

* These items may be combined, at the discretion of the FE.

AMC2 FCL.125 LAPL — Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(H)

(a) The area and route to be flown for the skill test should be chosen by the FE. The route should end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should consist of at least two legs, each leg of a minimum duration of 10 minutes. The skill test may be conducted in two flights.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the flight manual or the authorised checklist or pilot operating handbook for the helicopter on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the helicopter used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the helicopter within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the helicopter used:

(1) height:

(i) normal forward flight	± 150 ft
(ii) with simulated major emergency	± 200 ft
(iii) hovering IGE flight	± 2 ft

(2) speed:

(i) take-off approach	+15 knots /-10 knots
(ii) all other flight regimes	± 15 knots

(3) round drift:

(i) take-off hover IGE	± 3 ft
(ii) landing	no sideways or backwards movement

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(H):

SECTION 1 PRE-FLIGHT OR POST-FLIGHT CHECKS AND PROCEDURES	
Use of checklist, airmanship, control of helicopter by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Helicopter knowledge (for example technical log, fuel, mass and balance, performance), flight planning, NOTAM, and weather briefing
b	Pre-flight inspection or action, location of parts and purpose
c	Cockpit inspection, starting procedure
d	Communication and navigation equipment checks, selecting and setting frequencies
e	Pre-take-off procedure and ATC liaison
f	Parking, shutdown and post-flight procedure
SECTION 2 HOVER MANOEUVRES, ADVANCED HANDLING AND CONFINED AREAS	
a	Take-off and landing (lift off and touch down)
b	Taxi and hover taxi
c	Stationary hover with head, cross and tail wind
d	Stationary hover turns, 360 ° left and right (spot turns)
e	Forward, sideways and backwards hover manoeuvring
f	Simulated engine failure from the hover
g	Quick stops into and downwind
h	Sloping ground or unprepared sites landings and take-offs
i	Take-offs (various profiles)
j	Crosswind and downwind take-off (if practicable)
k	Take-off at maximum take-off mass (actual or simulated)
l	Approaches (various profiles)
m	Limited power take-off and landing
n	Autorotations (FE to select two items from the following: basic, range, low speed, and 360 ° turns)
o	Autorotative landing
p	Practice forced landing with power recovery
q	Power checks, reconnaissance technique, approach and departure technique

SECTION 3 NAVIGATION AND EN-ROUTE PROCEDURES	
a	Navigation and orientation at various altitudes or heights and map reading
b	Altitude or height, speed, heading control, observation of airspace and altimeter setting
c	Monitoring of flight progress, flight-log, fuel usage, endurance, ETA, assessment of track error, re-establishment of correct track and instrument monitoring
d	Observation of weather conditions and diversion planning
e	Collision avoidance (look-out procedures)
f	ATC liaison with due observance of regulations
SECTION 4 FLIGHT PROCEDURES AND MANOEUVRES	
a	Level flight, control of heading, altitude or height and speed
b	Climbing and descending turns to specified headings
c	Level turns with up to 30 ° bank, 180 ° to 360 ° left and right
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES (SIMULATED WHERE APPROPRIATE)	
Note: The FE selects 4 items from the following:	
a	Engine malfunctions, including governor failure, carburettor or engine icing and oil system, as appropriate
b	Fuel system malfunction
c	Electrical system malfunction
d	Hydraulic system malfunction, including approach and landing without hydraulics, as applicable
e	Main rotor or anti-torque system malfunction (FFS or discussion only)
f	Fire drills, including smoke control and removal, as applicable
g	Other abnormal and emergency procedures as outlined in appropriate flight manual

AMC1 FCL.125; FCL.235

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(S) AND OF AN SPL

(a) An applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) The applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the sailplane on which the test is being taken.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the sailplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the sailplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(S) and of an SPL:

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of checklist, airmanship (control of sailplane by external visual reference), look-out. Apply in all sections.	
a	Pre-flight sailplane (daily) inspection, documentation, NOTAM and weather briefing
b	Verifying in-limits mass and balance and performance calculation
c	Sailplane servicing compliance
d	Pre-take-off checks
SECTION 2 LAUNCH METHOD Note: at least for one of the three launch methods all the mentioned items are fully exercised during the skill test	
SECTION 2 (A) WINCH OR CAR LAUNCH	
a	Signals before and during launch, including messages to winch driver

b	Adequate profile of winch launch
c	Simulated launch failure
d	Situational awareness
SECTION 2 (B) AEROTOW LAUNCH	
a	Signals before and during launch, including signals to or communications with tow plane pilot for any problems
b	Initial roll and take-off climb
c	Launch abandonment (simulation only or 'talk-through')
d	Correct positioning during straight flight and turns
e	Out of position and recovery
f	Correct release from tow
g	Look-out and airmanship through whole launch phase
SECTION 2 (C) SELF-LAUNCH (powered sailplanes only)	
a	ATC compliance (if applicable)
b	Aerodrome departure procedures
c	Initial roll and take-off climb
d	Look-out and airmanship during the whole take-off
e	Simulated engine failure after take-off
f	Engine shut down and stowage
SECTION 3 GENERAL AIRWORK	
a	Maintain straight flight: attitude and speed control
b	Coordinated medium (30 ° bank) turns, look-out procedures and collision avoidance
c	Turning on to selected headings visually and with use of compass
d	Flight at high angle of attack (critically low air speed)
e	Clean stall and recovery

f	Spin avoidance and recovery
g	Steep (45 ° bank) turns, look-out procedures and collision avoidance
h	Local area navigation and awareness
SECTION 4 CIRCUIT, APPROACH AND LANDING	
a	Aerodrome circuit joining procedure
b	Collision avoidance: look-out procedures
c	Pre-landing checks
d	Circuit, approach control and landing
e	Precision landing (simulation of out-landing and short field)
f	Crosswind landing if suitable conditions available

AMC2 FCL.125; FCL.235

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A LAPL(B) AND A BPL

(a) The take-off site should be chosen by the applicant depending on the actual meteorological conditions, the area which has to be over flown and the possible options for suitable landing sites. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the balloon on which the test is being taken. During pre-flight preparation for the test the applicant should be required to perform crew and passenger briefings and demonstrate crowd control. The load calculation should be performed by the applicant in compliance with the operations manual or flight manual for the balloon used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the balloon within its limitations;

(2) complete all manoeuvres with smoothness and accuracy

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the balloon at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The skill test contents and sections set out in this paragraph should be used for the skill test for the issue of a LAPL(B) (hot-air balloon) and a BPL (hot-air balloon):

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control, crew and passenger briefings
e	Assembly and layout
f	Inflation and pre-take-off procedures
g	Take-off
h	ATC compliance(if applicable)

SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance (if applicable)
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation and airspace structure
d	Maintenance of altitude
e	Fuel management
f	Communication with retrieve crew
g	ATC compliance
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level, missed approach and fly on
b	Approach from high level, missed approach and fly on
c	Pre-landing checks
d	Passenger pre-landing briefing
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance (if applicable)
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
a	Simulated fire on the ground and in the air

b	Simulated pilot light and burner failures
c	Other abnormal and emergency procedures as outlined in the appropriate flight manual.
d	Oral questions

(e) The skill test contents and sections set out in this paragraph should be used for the skill test for the issue of a LAPL(B) (gas balloon) and a BPL (gas balloon):

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control, crew and passenger briefings
e	Assembly and layout
f	Inflation and pre-take-off procedures
g	Take-off
h	ATC compliance (if applicable)
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance (if applicable)
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time

c	Orientation and airspace structure
d	Maintenance of altitude
e	Ballast management
f	Communication with retrieve crew
g	ATC compliance
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level, missed approach and fly on
b	Approach from high level, missed approach and fly on
c	Pre-landing checks
d	Passenger pre-landing briefing
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance (if applicable)
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
a	Simulated closed appendix during take-off and climb
b	Simulated parachute or valve failure
c	Other abnormal and emergency procedures as outlined in the appropriate flight manual
d	Oral questions

AMC1 FCL.110.A LAPL(A) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE LAPL (A)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL (A) flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including mass and balance determination, aircraft inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at critically low air speeds, recognition of, and recovery from, incipient and full stalls;

(v) flight at critically high air speeds, recognition of, and recovery from, spiral dive;

(vi) normal and crosswind take-offs and landings;

(vii) maximum performance (short field and obstacle clearance) take-offs, short-field landings;

(viii) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(ix) emergency operations, including simulated aeroplane equipment malfunctions;

(x) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the aeroplane or TMG type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the aeroplane or TMG:

(A) characteristics of the aeroplane or TMG;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and aeroplane or TMG acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) harness, seat or rudder panel adjustments;

(G) starting and warm-up checks;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing (for example tie down);

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects when laterally level and when banked;

(B) further effects of aileron and rudder;

(C) effects of:

(a) air speed;

(b) slipstream;

(c) power;

(d) trimming controls;

(e) flaps;

(f) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5a: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures.

(vii) Exercise 5b: Emergencies: brake and steering failure.

(viii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance, trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb, levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(x) Exercise 8: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(xi) Exercise 9: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (in correct pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) slipping turns (for suitable types);

(G) turns onto selected headings, use of gyro heading indicator and compass;

(H) use of instruments for precision.

(xii) Exercise 10a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the aeroplane or TMG in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xiii) Exercise 10b: Stalling:

(A) safety checks;

(B) symptoms;

(C) recognition;

(D) clean stall and recovery without power and with power;

(E) recovery when a wing drops;

(F) approach to stall in the approach and in the landing configurations, with and without power and recovery at the incipient stage.

(xiv) Exercise 11: Spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45°);

(C) instructor induced distractions during the stall.

(xv) Exercise 12: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel (if applicable);

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure or techniques including performance calculations;

(G) noise abatement procedures.

(xvi) Exercise 13: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel (if applicable);

(D) effect of wind on approach and touchdown speeds and use of flaps;

(E) crosswind approach and landing;

(F) glide approach and landing;

(G) short landing and soft field procedures or techniques;

(H) flapless approach and landing;

(I) wheel landing (tail wheel aeroplanes);

(J) missed approach and go-around;

(K) noise abatement procedures.

(xvii) Exercise 12/13: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety, it will be necessary for pilots trained on nose wheel aeroplanes or TMGs to undergo dual conversion training before flying tail wheel aeroplanes or TMGs, and vice versa.

(xviii) Exercise 14: First solo:

(A) instructor's briefing including limitations;

(B) use of required equipment;

(C) observation of flight and de-briefing by instructor.

Note: during flights immediately following the solo circuit consolidation the following should be revised:

(A) procedures for leaving and rejoining the circuit;

(B) the local area, restrictions, map reading;

(C) use of radio aids for homing;

(D) turns using magnetic compass, compass errors.

(xix) Exercise 15: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xx) Exercise 16: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine cooling;

(G) engine failure checks;

(H) use of radio;

(I) base leg;

(J) final approach;

(K) landing;

(L) actions after landing.

(xxi) Exercise 17: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating a precautionary landing;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xxii) Exercise 18a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) mass and performance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) aeroplane or TMG documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of altitude and heading;

(d) revisions of ETA and heading;

(e) log keeping;

(f) use of radio;

(g) minimum weather conditions for continuation of flight;

(h) in-flight decisions;

(i) transiting controlled or regulated airspace;

(j) diversion procedures;

(k) uncertainty of position procedure;

(l) lost procedure.

(C) arrival and aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of aeroplane or TMG;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xxiii) Exercise 18b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles, and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxiv) Exercise 18c: Radio navigation (basics):

(A) use of GNSS or VOR/ADF:

(a) selection of waypoints or stations;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(xxv) Exercise 19: Stopping and restarting the engine (in the case of TMGs only):

(A) engine cooling;

(B) switching-off procedure;

(C) restarting of the engine.

AMC2 FCL.110.A LAPL(A) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST
The pre-entry flight test referred to in FCL.110.A(c) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(A), in accordance with AMC1 FCL.110.A.

GM1 FCL.135.A; FCL.135.H

DIFFERENCES AND FAMILIARISATION TRAINING

(a) Differences training requires the acquisition of additional knowledge and training on an appropriate training device or the aircraft.

(b) Familiarisation training requires the acquisition of additional knowledge.

AMC1 FCL.110.H LAPL(H) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE LAPL(H)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL(H) flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic autorotations, simulated engine failure and ground resonance recovery if relevant to type;

(vi) sideways and backwards flight and turns on the spot;

(vii) incipient vortex ring recognition and recovery;

(viii) touchdown autorotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(ix) steep turns;

(x) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(xi) limited power and confined area operations including selection of and operations to and from unprepared sites;

(xii) cross-country flying by using visual reference, dead reckoning and, where available and radio navigation aids;

(xiii) operations to and from aerodromes; compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the helicopter type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the helicopter:

(A) characteristics of the helicopter, external features;

(B) cockpit layout;

(C) systems;

(D) checklists, procedures, controls.

(ii) Exercise 1b: Emergency procedures:

(A) action if fire on the ground and in the air;

(B) engine, cabin and electrical system fire;

(C) systems failures;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and helicopter acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) seat, harness and flight controls adjustments;

(G) starting and warm-up checks clutch engagement and starting rotors;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing;

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience:

(A) to introduce the student to rotary wing flight;

(B) flight exercise.

(v) Exercise 4: Effects of controls:

(A) function of flight controls, primary and secondary effect;

(B) effect of air speed;

(C) effect of power changes (torque);

(D) effect of yaw (sideslip);

(E) effect of disc loading (bank and flare);

(F) effect on controls of selecting hydraulics on/off;

(G) effect of control friction;

(H) instruments;

(I) use of carburettor heat or anti-icing control.

(vi) Exercise 5: Power and attitude changes:

(A) relationship between cyclic control position, disc attitude, fuselage attitude and air speed;

(B) flapback;

(C) power required diagram in relation to air speed;

(D) power and air speed changes in level flight;

(E) use of instruments for precision;

(F) engine and air speed limitations.

(vii) Exercise 6a: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) control in pitch, including use of control friction or trim;

(C) maintaining direction and balance, (ball or yawstring use);

(D) setting power for selected air speeds and speed changes;

(E) use of instruments for precision.

(viii) Exercise 6b: Climbing:

(A) optimum climb speed, best angle or rate of climb from power required diagram;

(B) initiation, maintaining the normal and maximum rate of climb, levelling off;

(C) levelling off at selected altitudes or heights;

(D) use of instruments for precision.

(ix) Exercise 6c: Descending:

(A) optimum descent speed and best angle or rate of descent from power required diagram;

(B) initiation, maintaining and levelling off;

(C) levelling off at selected altitudes or heights;

(D) descent (including effect of power and air speed);

(E) use of instruments for precision.

(x) Exercise 6d: Turning:

(A) initiation and maintaining medium level turns;

(B) resuming straight flight;

(C) altitude, bank and coordination;

(D) climbing and descending turns and effect on rate of climb or descent;

(E) turns onto selected headings, use of gyro heading indicator and compass;

(F) use of instruments for precision.

(xi) Exercise 7: Basic autorotation:

(A) safety checks, verbal warning and look-out;

(B) entry, development and characteristics;

(C) control of air speed and RRPM, rotor and engine limitations;

(D) effect of AUM, IAS, disc loading, G-forces and density altitude

(E) re-engagement and go-around procedures (throttle over-ride or ERPM control);

(F) vortex condition during recovery;

(G) gentle and medium turns in autorotation;

(H) demonstration of variable flare simulated engine off landing.

(xii) Exercise 8a: Hovering:

(A) demonstrate hover IGE, importance of wind effect and attitude, ground cushion, stability in the hover, effects of over controlling;

(B) student holding cyclic stick only;

(C) student handling collective lever (and throttle) only;

(D) student handling collective lever, (throttle) and pedals;

(E) student handling all controls;

(F) demonstration of ground effect;

(G) demonstration of wind effect;

(H) demonstrate gentle forward running touchdown;

(I) specific hazards, for example snow, dust and litter.

(xiii) Exercise 8b: Hover taxiing and spot turns:

(A) revise hovering;

(B) precise ground speed and height control;

(C) effect of wind direction on helicopter attitude and control margin;

(D) control and coordination during spot turns;

(E) carefully introduce gentle forward running touchdown.

(xiv) Exercise 8c: Hovering and taxiing emergencies:

(A) revise hovering and gentle forward running touchdown, explain (demonstrate where applicable) effect of hydraulics failure in the hover;

(B) demonstrate simulated engine failure in the hover and hover taxi.

(C) demonstrate dangers of mishandling and over-pitching.

(xv) Exercise 9: Take-off and landing

(A) pre-take-off checks or drills;

(B) look-out;

(C) lifting to hover;

(D) after take-off checks;

(E) danger of horizontal movement near ground;

(F) danger of mishandling and overpitching;

(G) landing (without sideways or backwards movement);

(H) after landing checks or drills;

(I) take-off and landing crosswind and downwind.

(xvi) Exercise 10: Transitions from hover to climb and approach to hover:

(A) look-out;

(B) revise take-off and landing;

(C) ground effect, translational lift and its effects;

(D) flapback and its effects;

(E) effect of wind speed and direction during transitions from or to the hover;

(F) the constant angle approach;

(G) demonstration of variable flare simulated engine off landing.

(xvii) Exercise 11a: Circuit, approach and landing:

(A) revise transitions from hover to climb and approach to hover;

(B) circuit procedures, downwind and base leg;

(C) approach and landing with power;

(D) pre-landing checks;

(E) effect of wind on approach and IGE hover

(F) crosswind approach and landing;

(G) go-around;

(H) noise abatement procedures.

(viii) Exercise 11b: Steep and limited power approaches and landings:

(A) revise the constant angle approach;

(B) the steep approach (explain danger of high sink rate and low air speed);

(C) limited power approach (explain danger of high speed at touch down);

(D) use of the ground effect;

(E) variable flare simulated engine off landing.

(xix) Exercise 11c: Emergency procedures:

(A) abandoned take-off;

(B) missed approach and go-around;

(C) hydraulic off landing (if applicable);

(D) tail rotor control or tail rotor drive failure (briefing only);

(E) simulated emergencies in the circuit to include:

(F) hydraulics failure;

(G) simulated engine failure on take-off, crosswind, downwind and base leg;

(H) governor failure.

(xx) Exercise 12: First solo:

(A) instructor's briefing, observation of flight and debriefing;

(B) warn of change of attitude from reduced and laterally displaced weight;

(C) warn of low tail, low skid or wheel during hover and landing;

(D) warn of dangers of loss of RRPM and overpitching;

(E) pre-take-off checks;

(F) into wind take-off;

(G) procedures during and after take-off;

(H) normal circuit, approaches and landings;

(I) action if an emergency.

(xxi) Exercise 13: Sideways and backwards hover manoeuvring:

(A) manoeuvring sideways flight heading into wind;

(B) manoeuvring backwards flight heading into wind;

(C) combination of sideways and backwards manoeuvring;

(D) manoeuvring sideways and backwards, heading out of wind;

(E) stability and weather cocking;

(F) recovery from backwards manoeuvring, (pitch nose down);

(G) groundspeed limitations for sideways and backwards manoeuvring.

(xxii) Exercise 14: Spot turns:

(A) revise hovering into wind and downwind;

(B) turn on spot through 360º:

(a) around pilots position;

(b) around tail rotor;

(c) around helicopter geometric centre;

(d) square and safe visibility clearing turn.

(C) rotor RPM control, torque effect, cyclic limiting stops due to CG position and wind speed and direction.

(xxiii) Exercise 15: Hover OGE and vortex ring:

(A) establishing hover OGE;

(B) drift, height or power control;

(C) demonstration of incipient stage of vortex ring, recognition and recovery (from a safe altitude);

(D) loss of tail rotor effectiveness.

(xxiv) Exercise 16: Simulated EOL:

(A) the effect of weight, disc loading, density attitude and RRPM decay;

(B) revise basic autorotation entry;

(C) optimum use of cyclic and collective to control speed or RRPM;

(D) variable flare simulated EOL;

(E) demonstrate constant attitude simulated EOL;

(F) demonstrate simulated EOL from hover or hover taxi;

(G) demonstrate simulated EOL from transition and low level.

(xxv) Exercise 17: Advanced autorotation:

(A) over a selected point at various height and speed;

(B) revise basic autorotation: note ground distance covered;

(C) range autorotation;

(D) low speed autorotation;

(E) constant attitude autorotation (terminate at safe altitude);

(F) 'S' turns;

(G) turns through 180° and 360°;

(H) effects on angles of descent, IAS, RRPM and effect of AUM.

(xxvi) Exercise 18: Practice forced landings:

(A) procedure and choice of the forced landing area;

(B) forced landing checks and crash action;

(C) re-engagement and go-around procedures.

(xxvii) Exercise 19: Steep turns:

(A) steep (level) turns (30° bank);

(B) maximum rate turns (45° bank if possible);

(C) steep autorotative turns;

(D) faults in the turn: balance, attitude, bank and coordination;

(E) RRPM control and disc loading;

(F) vibration and control feedback;

(G) effect of wind at low level.

(xxviii) Exercise 20: Transitions:

(A) revise ground effect, translational lift and flapback;

(B) maintaining constant height, (20–30 ft AGL):

(C) transition from hover to minimum 50 knots IAS and back to hover;

(D) demonstrate effect of wind.

(xxix) Exercise 21: Quick stops:

(A) use of power and controls;

(B) effect of wind;

(C) quick stops into wind;

(D) quick stops from crosswind and downwind terminating into wind;

(E) danger of vortex ring;

(F) danger of high disc loading.

(xxx) Exercise 22a: Navigation:

(A) Flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation and use:

(1) choice of route;

(2) controlled airspace, danger and prohibited areas;

(3) safety altitudes and noise abatement considerations.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate landing sites.

(e) helicopter documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form (where appropriate).

(B) Departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of height or altitude and heading;

(d) revisions of ETA and heading:

(1) 10° line, double track, track error and closing angle;

(2) 1 in 60 rule;

(3) amending an ETA.

(e) log keeping;

(f) use of radio;

(g) minimum weather conditions for continuation of flight;

(h) in-flight decisions;

(i) transiting controlled or regulated airspace;

(j) uncertainty of position procedure;

(k) lost procedure.

(C) Arrival and aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of helicopter;

(g) refuelling;

(h) closing of flight plan, (if appropriate);

(i) post-flight administrative procedures.

(xxxi) Exercise 22b: Navigation problems at low heights and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and other aircraft);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) avoidance of noise sensitive areas;

(F) joining the circuit;

(G) bad weather circuit and landing;

(H) appropriate procedures and choice of landing area for precautionary landings.

(xxxii) Exercise 22c: Radio navigation (basics):

(A) Use of GNNS or VOR/NDB:

(a) selection of waypoints;

(b) to or from indications or orientation;

(c) error messages.

(B) Use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) Use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(xxxiii) Exercise 23: Advanced take-off, landings and transitions:

(A) landing and take-off out of wind (performance reduction);

(B) ground effect, translational lift and directional stability variation when out of wind;

(C) downwind transitions;

(D) vertical take-off over obstacles;

(E) reconnaissance of landing site;

(F) running landing;

(G) zero speed landing;

(H) crosswind and downwind landings;

(I) steep approach;

(J) go-around.

(xxxiv) Exercise 24: Sloping ground:

(A) limitations and assessing slope angle;

(B) wind and slope relationship: blade and control stops;

(C) effect of CG when on slope;

(D) ground effect on slope and power required;

(E) right skid up slope;

(F) left skid up slope;

(G) nose up slope;

(H) avoidance of dynamic roll over, dangers soft ground and sideways movement on touchdown;

(I) danger of striking main or tail rotor by harsh control movement near ground.

(xxxv) Exercise 25: Limited power:

(A) take-off power check;

(B) vertical take-off over obstacles;

(C) in-flight power check;

(D) running landing;

(E) zero speed landing;

(F) approach to low hover;

(G) approach to hover;

(H) approach to hover OGE;

(I) steep approach;

(J) go-around.

(xxxvi) Exercise 26: Confined areas:

(A) landing capability and performance assessment;

(B) locating landing site and assessing wind speed and direction;

(C) reconnaissance of landing site;

(D) select markers;

(E) select direction and type of approach;

(F) circuit;

(G) approach to committed point and go-around;

(H) approach;

(I) clearing turn;

(J) landing;

(K) power check and performance assessment in and OGE;

(L) normal take-off to best angle of climb speed;

(M) vertical take-off from hover.

AMC2 FCL.110.H LAPL(H) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.H(b) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(H), in accordance with AMC1 FCL.110.H.

AMC1 FCL.110.S LAPL(S) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.S(c) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(S), in accordance with AMC1 FCL.110.S and FCL.210.S.

AMC1 FCL.110.S; FCL.210.S

FLIGHT INSTRUCTION FOR THE LAPL(S) AND THE SPL

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL (S) and SPL flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including verifying mass and balance, aircraft inspection and servicing, airspace and weather briefing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at high angle of attack (critically low air speeds), recognition of, and recovery from, incipient and full stalls and spins;

(v) flight at critically high air speeds, recognition of, and recovery from spiral dive;

(vi) normal and crosswind take-offs in respect with the different launch methods;

(vii) normal and crosswind landings;

(viii) short field landings and outlandings: field selection, circuit and landing hazards and precautions;

(ix) cross-country flying using visual reference, dead reckoning and available navigation aids;

(x) soaring techniques as appropriate to site conditions;

(xi) emergency actions;

(xii) compliance with air traffic services procedures and communication procedures.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the sailplane type.

(2) At the discretion of the instructors some of the exercises may be combined and some other exercises may be done in several flights.

(3) At least the exercises 1 to 12 have to be completed before the first solo flight.

(4) Each of the exercises involves the need for the applicant to be aware of the needs for good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the sailplane:

(A) characteristics of the sailplane;

(B) cockpit layout: instruments and equipment;

(C) light controls: stick, pedals, airbrakes, flaps and trim;

(D) cable release and undercarriage;

(E) checklists, drills and controls.

(ii) Exercise 2: Procedures if emergencies:

(A) use of safety equipment (parachute);

(B) action if system failures;

(C) bail-out procedures.

(iii) Exercise 3: Preparation for flight:

(A) pre-flight briefings;

(B) required documents on board;

(C) equipment required for the intended flight;

(D) ground handling, movements, tow out, parking and security;

(E) pre-flight external and internal checks;

(F) verifying in-limits mass and balance;

(G) harness, seat or rudder panel adjustments;

(H) passenger handling;

(I) pre-launch checks.

(iv) Exercise 4: Initial air experience:

(A) area familiarisation;

(B) look-out procedures.

(v) Exercise 5: Effects of controls:

(A) look-out procedures;

(B) use of visual references;

(C) primary effects when laterally level and when banked;

(D) reference attitude and effect of elevator;

(E) relationship between attitude and speed;

(F) effects of:

(a) flaps (if available);

(b) airbrakes.

(vi) Exercise 6: Coordinated rolling to and from moderate angles of bank:

(A) look-out procedures;

(B) further effects of aileron (adverse yaw) and rudder (roll);

(C) coordination;

(D) rolling to and from moderate angles of bank and return to straight flight.

(vii) Exercise 7: Straight flying:

(A) look-out procedures;

(B) maintaining straight flight;

(C) flight at critically high air speeds;

(D) demonstration of inherent pitch stability;

(E) control in pitch, including use of trim;

(F) lateral level, direction and balance and trim;

(G) air speed: instrument monitoring and control.

(viii) Exercise 8: Turning:

(A) look-out procedures;

(B) demonstration and correction of adverse yaw;

(C) entry to turn (medium level turns);

(D) stabilising turns;

(E) exiting turns;

(F) faults in the turn (slipping and skidding);

(G) turns on to selected headings and use of compass;

(H) use of instruments (ball indicator or slip string) for precision.

(ix) Exercise 9a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds (high angle of attack) and to provide practice in maintaining the sailplane in balance while returning to normal attitude (speed).

(A) safety checks;

(B) introduction to characteristics of slow flight;

(C) controlled flight down to critically high angle of attack (slow air speed).

(x) Exercise 9b: Stalling:

(A) safety checks;

(B) pre-stall symptoms, recognition and recovery;

(C) stall symptoms, recognition and recovery;

(D) recovery when a wing drops;

(E) approach to stall in the approach and in the landing configurations;

(F) recognition and recovery from accelerated stalls.

(xi) Exercise 10: Spin recognition and spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45°);

(C) entry into fully developed spins (if suitable training aircraft available);

(D) recognition of full spins (if suitable training aircraft available);

(E) standard spin recovery (if suitable training aircraft available);

(F) instructor induced distractions during the spin entry (if suitable training aircraft available).

Note: consideration of manoeuvre limitations and the need to refer to the sailplane manual and mass and balance calculations. If no suitable training aircraft is available to demonstrate the fully developed spin, all the aspects related to these training items have to be covered by specific theoretical instruction.

(xii) Exercise 11: Take-off or launch methods:

At least one launch method must be taught containing all the subjects below.

(xiii) Exercise 11a: Winch launch:

(A) signals or communication before and during launch;

(B) use of the launching equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) optimum profile of winch launch and limitations;

(G) release procedures;

(H) launch failure procedures.

(xiv) Exercise 11b: Aero tow:

(A) signals or communication before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) on tow: straight flight, turning and slip stream;

(G) out of position in tow and recovery;

(H) descending on tow (towing aircraft and sailplane);

(I) release procedures;

(J) launch failure and abandonment.

(xv) Exercise 11c: Self-launch:

(A) engine extending and retraction procedures;

(B) engine starting and safety precautions;

(C) pre-take-off checks;

(D) noise abatement procedures;

(E) checks during and after take-off;

(F) into wind take-off;

(G) crosswind take-off;

(H) power failures and procedures;

(I) abandoned take-off;

(J) maximum performance (short field and obstacle clearance) take-off;

(K) short take-off and soft field procedure or techniques and performance calculations.

(xvi) Exercise 11d: Car launch:

(A) signals before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off;

(E) crosswind take-off;

(F) optimum launch profile and limitations;

(G) release procedures;

(H) launch failure procedures.

(xvii) Exercise 11e: Bungee launch:

(A) signals before and during launch;

(B) use of the launch equipment;

(C) pre-take-off checks;

(D) into wind take-off.

(xviii) Exercise 12: Circuit, approach and landing:

(A) procedures for rejoining the circuit;

(B) collision avoidance, look-out techniques and procedures;

(C) pre-landing checks: circuit procedures, downwind and base leg;

(D) effect of wind on approach and touchdown speeds;

(E) use of flaps (if applicable);

(F) visualisation of an aiming point;

(G) approach control and use of airbrakes;

(H) normal and crosswind approach and landing;

(I) short landing procedures or techniques.

(xix) Exercise 13: First solo:

(A) instructor's briefing including limitations;

(B) awareness of local area and restrictions;

(C) use of required equipment;

(D) observation of flight and debriefing by instructor.

(xx) Exercise 14: Advanced turning:

(A) steep turns (45°);

(B) stalling and spin avoidance in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xxi) Exercise 15: Soaring techniques:

At least one of the three soaring techniques must be taught containing all subjects below.

(xxii) Exercise 15a: Thermalling:

(A) look-out procedures;

(B) detection and recognition of thermals;

(C) use of audio soaring instruments;

(D) joining a thermal and giving way;

(E) flying in close proximity to other sailplanes;

(F) centring in thermals;

(G) leaving thermals.

(xxiii) Exercise 15b: Ridge flying:

(A) look-out procedures;

(B) practical application of ridge flying rules;

(C) optimisation of flight path;

(D) speed control.

(xxiv) Exercise 15C: Wave flying:

(A) look-out procedures;

(B) wave access techniques;

(C) speed limitations with increasing height;

(D) use of oxygen.

(xxv) Exercise 16: Out-landings:

(A) gliding range;

(B) restart procedures (only for self-launching and self-sustaining sailplanes);

(C) selection of landing area;

(D) circuit judgement and key positions;

(E) circuit and approach procedures;

(F) actions after landing.

(xxvi) Exercise 17: Cross-country flying:

If the required cross-country flight will be conducted as a solo cross-country flight, all the subjects below must be taught before.

(xxvii) Exercise 17a: Flight planning:

(A) weather forecast and actuals;

(B) NOTAMs and airspace considerations;

(C) map selection and preparation;

(D) route planning;

(E) radio frequencies (if applicable);

(F) pre-flight administrative procedure;

(G) flight plan where required;

(H) mass and performance;

(I) alternate aerodromes and landing areas;

(J) safety altitudes.

(xxviii) Exercise 17b: In-flight navigation:

(A) maintaining track and re-routing considerations;

(B) use of radio and phraseology (if applicable);

(C) in-flight planning;

(D) procedures for transiting regulated airspace or ATC liaison where required;

(E) uncertainty of position procedure;

(F) lost procedure;

(G) use of additional equipment where required;

(H) joining, arrival and circuit procedures at remote aerodrome.

(xix) Exercise 17c: Cross-country techniques:

(A) look-out procedures;

(B) maximising potential cross-country performance;

(C) risk reduction and threat reaction.

AMC1 FCL.135.S; FCL.205.S(a)

EXTENSION OF PRIVILEGES TO TMG: LAPL(S) AND SPL

(a) The aim of the flight training is to qualify LAPL(S) or SPL holders to exercise the privileges of the licence on a TMG.

(b) The ATO should issue a certificate of satisfactory completion of the training.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) Principles of flight:

(i) operating limitations (addition TMG);

(ii) propellers;

(iii) flight mechanics.

(2) Operational procedures for TMG:

(i) special operational procedures and hazards;

(ii) emergency procedures.

(3) Flight performance and planning:

(i) mass and balance considerations;

(ii) loading;

(iii) CG calculation;

(iv) load and trim sheet;

(v) performance of TMGs;

(vi) flight planning for VFR flights;

(vii) fuel planning;

(viii) pre-flight preparation;

(ix) ICAO flight plan;

(x) flight monitoring and in-flight re-planning.

(4) Aircraft general knowledge:

(i) system designs, loads, stresses, maintenance;

(ii) airframe;

(iii) landing gear, wheels, tyres, brakes;

(iv) fuel system;

(v) electrics;

(vi) piston engines;

(vii) propellers;

(viii) instrument and indication systems.

(5) Navigation:

(i) dead reckoning navigation (addition powered flying elements);

(ii) in-flight navigation (addition powered flying elements);

(iii) basic radio propagation theory;

(iv) radio aids (basics);

(v) radar (basics);

(vi) GNSS.

(d) Flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed.

(2) The flying exercises should cover the revision or explanation of the following exercises:

(i) Exercise 1: Familiarisation with the TMG:

(A) characteristics of the TMG;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1e: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) serviceability documents;

(B) equipment required, maps, etc.;

(C) external checks;

(D) internal checks;

(E) harness and seat or rudder panel adjustments;

(F) starting and warm-up checks;

(G) power checks;

(H) running down system checks and switching off the engine;

(I) parking, security and picketing (for example tie down);

(J) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures (if applicable).

(v) Exercise 3e: Emergencies: brake and steering failure.

(vi) Exercise 4: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance and trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(vii) Exercise 5: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(viii) Exercise 6: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(ix) Exercise 7: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (incorrect pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) slipping turns (on suitable types);

(G) turns onto selected headings, use of gyro heading indicator or compass;

(H) use of instruments for precision.

(x) Exercise 8a: Slow flight:

Note: the objective is to improve the pilot's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the TMG in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xi) Exercise 8b: Stalling:

(A) airmanship;

(B) safety checks;

(C) symptoms;

(D) recognition;

(E) clean stall and recovery without power and with power;

(F) recovery when a wing drops;

(G) approach to stall in the approach and in the landing configurations, with and without power, recovery at the incipient stage.

(xii) Exercise 9: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel (if applicable);

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure or techniques including performance calculations;

(G) noise abatement procedures.

(xiii) Exercise 10: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel (if applicable);

(D) effect of wind on approach and touchdown speeds;

(E) use of airbrakes, flaps, slats or spoilers;

(F) crosswind approach and landing;

(G) glide approach and landing (engine stopped);

(H) short landing and soft field procedures or techniques;

(I) flapless approach and landing (if applicable);

(J) wheel landing (tail wheel aeroplanes);

(K) missed approach and go-around;

(L) noise abatement procedures.

(xiv) Exercise 9/10e: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety it will be necessary for pilots trained on nose wheel TMGs to undergo dual conversion training before flying tail wheel TMGs, and vice versa.

(xv) Exercise 11: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xvi) Exercise 12: Stopping and restarting the engine:

(A) engine cooling procedures;

(B) switching off procedure in-flight;

(C) sailplane operating procedures;

(D) restarting procedure.

(xvii) Exercise 13: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine failure checks;

(G) use of radio;

(H) base leg;

(I) final approach;

(J) landing;

(K) actions after landing.

(xviii) Exercise 14: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xix) Exercise 15a: Navigation

(A) Flight planning

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;

(4) mass and performance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate aerodromes.

(e) TMG documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form.

(B) Departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(C) En-route:

(a) maintenance of altitude and heading;

(b) revisions of ETA and heading;

(c) log keeping;

(d) use of radio or compliance with ATC procedures;

(e) minimum weather conditions for continuation of flight;

(f) in-flight decisions;

(g) transiting controlled or regulated airspace;

(h) diversion procedures;

(i) uncertainty of position procedure;

(j) lost procedure.

(D) Arrival, aerodrome joining procedure:

(a) ATC liaison in regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking;

(f) security of TMG;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xx) Exercise 15b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxi) Exercise 15c: Radio navigation (basics):

(A) Use of GNSS or VOR/NDB;

(a) selection of waypoints;

(b) to or from indications or orientation;

(c) error messages.

(B) Use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(C) Use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar;

(1) transponders;

(2) code selection;

(3) interrogation and reply.

AMC1 FCL.110.B LAPL(B) — Experience requirements and crediting

CREDITING: PRE-ENTRY FLIGHT TEST

The pre-entry flight test referred to in FCL.110.B(b) should cover the total content of the syllabus of flight instruction for the issuance of the LAPL(B), in accordance with AMC1 FCL.110.B and FCL.210.B.

AMC1 FCL.110.B; FCL.210.B

FLIGHT INSTRUCTION FOR THE LAPL(B) AND FLIGHT INSTRUCTION FOR THE BPL

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The LAPL(B) or BPL flight instruction syllabus should take into account the principles of threat and error management and also cover:

(i) pre-flight operations, including load calculations, balloon inspection and servicing;

(ii) crew and passenger briefings;

(iii) inflation and crowd control;

(iv) control of the balloon by external visual reference;

(v) take-off in different wind conditions;

(vi) approach from low and high level;

(vii) landings in different surface wind conditions;

(viii) cross-country flying using visual reference and dead reckoning;

(ix) emergency operations, including simulated balloon equipment malfunctions;

(x) compliance with air traffic services procedures and communication procedures;

(xi) avoidance of nature protection areas, landowner relations.

(2) Before allowing the applicant to undertake his/her first solo flight, the FI should ensure that the applicant can operate the required systems and equipment.

(c) Syllabus of flight instruction (hot-air balloon)

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the balloon type.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the balloon:

(A) characteristics of the balloon;

(B) the components or systems;

(C) re-fuelling of the cylinders;

(D) instruments and equipment;

(E) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment;

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs

(b) airspace structure;

(c) sensitive areas (for example nature protection areas);

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) field selection;

(c) behaviour;

(d) adjacent fields.

(E) load calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefing;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope, basket and burner;

(C) burner test;

(D) use of restraint line;

(E) pre-inflation checks.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) cold inflation;

(C) use of the inflation fan;

(D) hot inflation.

(vi) Exercise 6: Take-off in different wind conditions:

(A) pre take-off checks and briefings;

(B) heating for controlled climb;

(C) 'hands off and hands on' procedure for ground crew;

(D) assessment of lift;

(E) use of quick release;

(F) assessment of wind and obstacles;

(G) take-off in wind without shelter obstacles;

(H) preparation for false lift.

(vii) Exercise 7: Climb to level flight:

(A) climbing with a predetermined rate of climb;

(B) look-out procedures;

(C) effect on envelope temperature;

(D) maximum rate of climb according to manufacturer's flight manual;

(E) levelling off at selected altitude.

(viii) Exercise 8: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) use of parachute and turning vents (if applicable).

(ix) Exercise 9: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) fast descent;

(C) look-out procedures;

(D) maximum rate of descent according to manufacturer's flight manual;

(E) use of parachute;

(F) parachute stall;

(G) cold descent;

(H) levelling off at selected altitude.

(x) Exercise 10: Emergencies – systems:

(A) pilot light failure;

(B) burner failure, valve leaks, flame out and re-light;

(C) gas leaks;

(D) envelope over temperature;

(E) envelope damage in-flight;

(F) parachute or rapid deflation system failure.

(xi) Exercise 10B: Other emergencies:

(A) fire extinguisher;

(B) fire on ground;

(C) fire in the air;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xii) Exercise 11: Navigation:

(A) maps selection;

(B) plotting expected track;

(C) marking positions and time;

(D) calculation of distance, speed and fuel consumption;

(E) ceiling limitations (ATC, weather and envelope temperature);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of fuel consumption and envelope temperature;

(I) ATC liaison (if applicable);

(J) communication with retrieve crew;

(K) use of GNSS (if applicable).

(xiii) Exercise 12: Fuel management:

(A) cylinder arrangement and burner systems;

(B) pilot light supply (vapour or liquid);

(C) use of master cylinders (if applicable);

(D) fuel requirement and expected fuel consumption;

(E) fuel state and pressure;

(F) fuel reserves;

(G) cylinder contents gauge and change procedure;

(H) use of cylinder manifolds.

(xiv) Exercise 13: Approach from low level:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) use of burner and parachute;

(E) look-out procedures;

(F) missed approach and fly on.

(xv) Exercise 14: Approach from high level:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) rate of descent;

(E) use of burner and parachute;

(F) look-out procedures;

(G) missed approach and fly on.

(xvi) Exercise 15: Operating at low level:

(A) use of burner, whisper burner and parachute;

(B) look-out procedures;

(C) avoidance of low level obstacles;

(D) avoidance of protection areas;

(E) landowner relations.

(xvii) Exercise 16: Landing in different wind conditions:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) turbulences (in the case of landings with high wind speed only);

(E) use of burner and pilot lights;

(F) use of parachute and turning vents (if applicable);

(G) look-out procedures;

(H) dragging and deflation;

(I) landowner relations;

(J) airmanship.

(xviii) Exercise 17: First solo:

(A) supervised flight preparation;

(B) instructor's briefing, observation of flight and de-briefing.

(d) Syllabus of flight instruction (gas balloon)

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the balloon type.

(2) Each of the exercises involves the need for the pilot-under-training to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1: Familiarisation with the balloon:

(A) characteristics of the balloon;

(B) the components or systems;

(C) instruments and equipment;

(D) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs;

(b) airspace structure;

(c) sensitive areas (for example nature protection areas);

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) behaviour;

(c) adjacent fields.

(E) load calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefings;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope and basket (balloon with net);

(C) rigging envelope and basket (netless balloon);

(D) ballast check.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) inflation procedure according to manufacturer's flight manual;

(C) avoiding electrostatic discharge.

(vi) Exercise 6: Take-off in different wind conditions:

(A) pre take-off checks and briefings;

(B) prepare for controlled climb;

(C) 'hands off and hands on' procedure for ground crew;

(D) assessment of wind and obstacles;

(E) preparation for false lift.

(vii) Exercise 7: Climb to level flight:

(A) climb with a predetermined rate of climb;

(B) look-out procedures;

(C) maximum rate of climb according to manufacturer's flight manual;

(D) levelling off at selected altitude.

(viii) Exercise 8: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) use of parachute or valve.

(ix) Exercise 9: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) fast descent;

(C) look-out procedures;

(D) maximum rate of descent according to manufacturer's flight manual;

(E) use of parachute or valve;

(F) levelling off at selected altitude.

(x) Exercise 10: Emergencies:

(A) closed appendix during take-off and climb;

(B) envelope damage in-flight;

(C) parachute or valve failure;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xi) Exercise 11: Navigation:

(A) map selection;

(B) plotting expected track;

(C) marking positions and time;

(D) calculation of distance, speed and ballast consumption;

(E) ceiling limitations (ATC, weather and ballast);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of ballast consumption;

(I) ATC liaison (if applicable);

(J) communication with retrieve crew;

(K) use of GNSS (if applicable).

(xii) Exercise 12: Ballast management:

(A) minimum ballast;

(B) arrangement and securing of ballast;

(C) ballast requirement and expected ballast consumption;

(D) ballast reserves.

(xiii) Exercise 13: Approach from low level:

(A) pre-landing checks;

(B) passenger pre-landing checks;

(C) selection of field;

(D) use of ballast and parachute or valve;

(E) use of trail rope (if applicable);

(F) look-out procedures;

(G) missed approach and fly on.

(xiv) Exercise 14: Approach from high level:

(A) pre-landing checks;

(B) passenger pre-landing checks;

(C) selection of field;

(D) rate of descent;

(E) use of ballast and parachute or valve;

(F) use of trail rope (if applicable);

(G) look-out procedures;

(H) missed approach and fly on.

(xv) Exercise 15: Operating at low level:

(A) use of ballast and parachute or valve;

(B) look-out procedures;

(C) avoidance of low level obstacle;

(D) avoidance of protection areas;

(E) landowner relations.

(xvi) Exercise 16: Landing in different wind conditions:

(A) pre-landing checks;

(B) passenger pre-landing briefing;

(C) selection of field;

(D) turbulences (in the case of landings with high wind speed only);

(E) use of ballast and parachute or valve;

(F) look-out procedures;

(G) use of rip panel;

(H) dragging;

(I) deflation;

(J) avoiding electrostatic discharge;

(K) landowner relations.

(xvii) Exercise 17: First solo:

Note: the exercises 1 to 16 have to be completed and the student must have achieved a safe and competent level before the first solo flight takes place.

(A) supervised flight preparation;

(B) instructor's briefing, observation of flight and de-briefing.

AMC1 FCL.130.B; FCL.220.B

FLIGHT INSTRUCTION FOR THE EXTENSION OF PRIVILEGES TO TETHERED FLIGHTS

(a) The aim of the flight instruction is to qualify LAPL(B) or BPL holders to perform tethered flights.

(b) The flying exercise should cover the following training items:

   (1) ground preparations;

   (2) weather suitability;

   (3) tether points:

      (i) upwind;

      (ii) downwind.

   (4) tether ropes (three point system);

   (5) maximum all-up-weight limitation;

   (6) crowd control;

   (7) pre take-off checks and briefings;

   (8) heating for controlled lift off;

   (9) 'hands off and hands on' procedure for ground crew;

   (10) assessment of lift;

   (11) assessment of wind and obstacles;

   (12) take-off and controlled climb (at least up to 60 ft – 20m).

AMC1 FCL.135.B; FCL.225.B

THEORETICAL KNOWLEDGE INSTRUCTION FOR THE EXTENSION TO ANOTHER BALLOON CLASS: LAPL(B) AND BPL

(a) The aim of the flight instruction is to qualify LAPL(B) or BPL holders to exercise the privileges on a different class of balloons.

(b) The following classes are recognised:

  (1) hot-air balloons;

  (2) gas balloons;

  (3) hot-air airships.

(c) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

(d) Theoretical knowledge

  The theoretical knowledge syllabus should cover the revision or explanation of:

  (1) principles of flight:

    (i) operating limitations;

    (ii) loading limitations.

  (2) operational procedures:

    (i) special operational procedures and hazards;

    (ii) emergency procedures.

  (3) flight performance and planning:

    (i) mass considerations;

    (ii) loading;

    (iii) performance (hot-air balloon, gas balloon or hot-air airship);

    (iv) flight planning;

    (v) fuel planning;

    (vi) flight monitoring.

  (4) aircraft general knowledge:

    (i) system designs, loads, stresses and maintenance;

    (ii) envelope;

    (iii) burner (only extension to hot-air balloon or airship);

    (iv) fuel cylinders (except gas balloon);

    (v) basket or gondola;

    (vi) lifting or burning gas;

    (vii) ballast (only gas balloon);

    (viii) engine (only hot-air airship);

    (ix) instruments and indication systems;

    (x) emergency equipment.

AMC2 FCL.135.B; FCL.225.B

FLIGHT INSTRUCTION FOR THE EXTENSION TO ANOTHER BALLOON CLASS: LAPL(B) AND BPL

(a) This additional syllabus of flight instruction should be used for the extension of privileges for LAPL(B) and BPL - hot-air balloon to hot-air airship.

(b) The prerequisite for the extension of privileges to hot-air airships is a valid BPL or LAPL for hot-air balloons because a hot-air airship with a failed engine must be handled in a similar manner as a hot-air balloon. The conversion training has to concentrate therefore on the added complication of the engine, its controls and the different operating limitations of a hot-air airship.

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed.

(2) The flying exercises should cover the revision or explanation of the following exercises:

(i) Exercise 1: Familiarisation with the hot-air airship:

(A) characteristics of the hot-air airship;

(B) the components or systems;

(C) instruments and equipment;

(D) use of checklist(s) and procedures.

(ii) Exercise 2: Preparation for flight:

(A) documentation and equipment;

(B) weather forecast and actuals;

(C) flight planning:

(a) NOTAMs;

(b) airspace structure;

(c) sensitive areas;

(d) expected track and distance;

(e) pre-flight picture;

(f) possible landing fields.

(D) launch field:

(a) permission;

(b) behaviour;

(c) field selection;

(d) adjacent fields.

(E) load and fuel calculations.

(iii) Exercise 3: Crew and passenger briefing:

(A) clothing;

(B) crew briefing;

(C) passenger briefing.

(iv) Exercise 4: Assembly and layout:

(A) crowd control;

(B) rigging envelope, gondola, burner and engine;

(C) burner test;

(D) pre-inflation checks.

(v) Exercise 5: Inflation:

(A) crowd control;

(B) cold inflation:

(a) use of restraint line;

(b) use of the inflation fan.

(C) hot inflation.

(vi) Exercise 6: Engine:

(A) identification of main parts and controls;

(B) familiarisation with operation and checking of the engine;

(C) engine checks before take-off.

(vii) Exercise 7: Pressurisation:

(A) pressurisation fan operation;

(B) super pressure and balance between pressure and temperature;

(C) pressure limitations.

(viii) Exercise 8: Take-off:

(A) before take-off checks and briefings;

(B) heating for controlled climb;

(C) procedure for ground crew;

(D) assessment of wind and obstacles.

(ix) Exercise 9: Climb to level flight:

(A) climbing with a predetermined rate of climb;

(B) effect on envelope temperature and pressure;

(C) maximum rate of climb according to manufacturer's flight manual;

(D) level off at selected altitude.

(x) Exercise 10: Level flight:

(A) maintaining level flight by:

(a) use of instruments only;

(b) use of visual references only;

(c) all available means.

(B) maintaining level flight at different air speeds by taking aerodynamic lift into account.

(xi) Exercise 11: Descent to level flight:

(A) descent with a predetermined rate of descent;

(B) maximum rate of descent according to manufacturer's flight manual;

(C) levelling off at selected altitude.

(xii) Exercise 12: Emergencies - systems:

(A) engine failure;

(B) pressurisation failure;

(C) rudder failure;

(D) pilot light failure;

(E) burner failure, valve leaks, flame out and re-light;

(F) gas leaks;

(G) envelope over temperature;

(H) envelope damage in-flight.

(xiii) Exercise 12B: Other emergencies:

(A) fire extinguishers;

(B) fire on ground;

(C) fire in the air;

(D) contact with electrical power lines;

(E) obstacle avoidance;

(F) escape drills, location and use of emergency equipment.

(xiv) Exercise 13: Navigation:

(A) map selection and preparation;

(B) plotting and steering expected track;

(C) marking positions and time;

(D) calculation of distance, speed and fuel consumption;

(E) ceiling limitations (ATC, weather and envelope temperature);

(F) planning ahead;

(G) monitoring of weather development and acting so;

(H) monitoring of fuel and envelope temperature or pressure;

(I) ATC liaison (if applicable);

(J) communication with ground crew;

(K) use of GNSS (if applicable).

(xv) Exercise 14: Fuel management:

(A) engine arrangement and tank system;

(B) cylinder arrangement and burner systems;

(C) pilot light supply (vapour or liquid);

(D) fuel requirement and expected fuel consumption for engine and burner;

(E) fuel state and pressure;

(F) fuel reserves;

(G) cylinder and petrol tank contents gauge.

(xvi) Exercise 15: Approach and go-around:

(A) pre-landing checks;

(B) selection of field into wind;

(C) use of burner and engine;

(D) look-out procedures;

(E) missed approach and go-around.

(xvii) Exercise 16: Approach with simulated engine failure:

(A) pre-landing checks;

(B) selection of field;

(C) use of burner;

(D) look-out procedures;

(E) missed approach and go-around.

(xviii) Exercise 17: Operating at low level:

(A) use of burner and engine;

(B) look-out procedures;

(C) avoidance of low level obstacles;

(D) avoidance of sensitive areas (nature protection areas) or landowner relations.

(xix) Exercise 18: Steering:

(A) assessment of wind;

(B) correcting for wind to steer a given course.

(xx) Exercise 19: Final landing:

(A) pre-landing checks;

(B) use of burner and engine;

(C) look-out;

(D) deflation;

(E) landowner relations.

AMC3 FCL.135.B; FCL.225.B

CONTENTS OF THE SKILL TEST FOR THE EXTENSION OF A LAPL(B) OR A BPL TO ANOTHER BALLOON CLASS (HOT-AIR AIRSHIP)

(a) The take-off site should be chosen by the applicant depending on the actual meteorological conditions, the area which has to be overflown and the possible options for suitable landing sites. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the balloon on which the test is being taken. During pre-flight preparation for the test the applicant should be required to perform crew and passenger briefings and demonstrate crowd control. The load calculation should be performed by the applicant in compliance with the operations manual or flight manual for the hot-air airship used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the hot-air airship within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the airship at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a LAPL(B) and BPL hot-air airship extension.

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of hot-air airship by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Hot-air airship inspection and servicing
c	Load calculation
d	Crowd control, crew and passenger briefings
e	Assembly and layout
f	Inflation and pre-take-off procedures
g	Take-off
h	ATC compliance (if applicable)
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance (if applicable)
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation and airspace structure
d	Plotting and steering expected track
e	Maintenance of altitude
f	Fuel management
g	Communication with ground crew
h	ATC compliance (if applicable)

SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach, missed approach and go-around
b	Pre-landing checks
c	Selection of landing field
d	Landing and deflation
e	ATC compliance (if applicable)
f	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with Sections 1 through 4	
a	Simulated fire on the ground and in the air
b	Simulated pilot light-, burner- and engine-failure
c	Approach with simulated engine failure, missed approach and go-around
d	Other abnormal and emergency procedures as outlined in the appropriate flight manual
e	Oral questions

SUBPART C — PRIVATE PILOT LICENCE (PPL), SAILPLANE PILOT LICENCE (SPL) and BALLOON PILOT LICENCE (BPL)

AMC1 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE PPL(A) AND PPL(H)
The following tables contain the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the PPL(A) and PPL(H). The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated to the licence and the activity. An approved course shall comprise at least 100 hours of theoretical knowledge instruction. This theoretical knowledge instruction provided by the ATO should include a certain element of formal classroom work but may include also such facilities as interactive video, slide or tape presentation, computer-based training and other media distance learning courses. The training organisation responsible for the training has to check if all the appropriate elements of the training course of theoretical knowledge instruction have been completed to a satisfactory standard before recommending the applicant for the examination.

The applicable items for each licence are marked with 'x'. An 'x' on the main title of a subject means that all the sub-divisions are applicable.

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
1.	**AIR LAW AND ATC PROCEDURES**				
	International law: conventions, agreements and organisations				
	The Convention on international civil aviation (Chicago) Doc. 7300/6				
	Part I Air Navigation: relevant parts of the following chapters: (a) general principles and application of the convention; (b) flight over territory of Contracting States; (c) nationality of aircraft; (d) measures to facilitate air navigation; (e) conditions to be fulfilled on aircraft; (f) international standards and recommended practices; (g) validity of endorsed certificates and licences; (h) notification of differences.	x		x	
	Part II The International Civil Aviation Organisation (ICAO): objectives and composition	x		x	
	Annex 8: Airworthiness of aircraft				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Foreword and definitions	x		x	
	Certificate of airworthiness	x		x	
	Annex 7: Aircraft nationality and registration marks				
	Foreword and definitions	x		x	
	Common- and registration marks	x		x	
	Certificate of registration and aircraft nationality	x		x	
	Annex 1: Personnel licensing				
	Definitions	x		x	
	Relevant parts of Annex 1 connected to Part-FCL and Part-Medical	x		x	
	Annex 2: Rules of the air				
	Essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight rules, signals and interception of civil aircraft	x		x	
	Procedures for air navigation: aircraft operations doc. 8168-ops/611, volume 1				
	Altimeter setting procedures (including IACO doc. 7030 – regional supplementary procedures)				
	Basic requirements (except tables), procedures applicable to operators and pilots (except tables)	x		x	
	Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – regional supplementary procedures)				
	Operation of transponders	x		x	
	Phraseology	x		x	
	Annex 11: Doc. 4444 air traffic management				
	Definitions	x		x	
	General provisions for air traffic services	x		x	
	Visual separation in the vicinity of aerodromes	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Procedures for aerodrome control services	x		x	
	Radar services	x		x	
	Flight information service and alerting service	x		x	
	Phraseologies	x		x	
	Procedures related to emergencies, communication failure and contingencies	x		x	
	Annex 15: Aeronautical information service				
	Introduction, essential definitions	x		x	
	AIP, NOTAM, AIRAC and AIC	x		x	
	Annex 14, volume 1 and 2: Aerodromes				
	Definitions	x		x	
	Aerodrome data: conditions of the movement area and related facilities	x		x	
	Visual aids for navigation: (a) indicators and signalling devices; (b) markings; (c) lights; (d) signs; (e) markers.	x		x	
	Visual aids for denoting obstacles: (a) marking of objects; (b) lighting of objects.	x		x	
	Visual aids for denoting restricted use of areas	x		x	
	Emergency and other services: (a) rescue and fire fighting; (b) apron management service.	x		x	
	Annex 12: Search and rescue				
	Essential definitions	x		x	
	Operating procedures: (a) procedures for PIC at the scene of an accident; (b) procedures for PIC intercepting a distress transmission; (c) search and rescue signals.	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Search and rescue signals: (a) signals with surface craft; (b) ground or air visual signal code; (c) air or ground signals.	x		x	
	Annex 17: Security				
	General: aims and objectives	x		x	
	Annex 13: Aircraft accident investigation				
	Essential definitions Applicability	x x		x x	
	National law				
	National law and differences to relevant ICAO Annexes and relevant EU regulations.	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
2.	**HUMAN PERFORMANCE**				
	Human factors: basic concepts				
	Human factors in aviation				
	Becoming a competent pilot	x		x	
	Basic aviation physiology and health maintenance				
	The atmosphere: (a) composition; (b) gas laws.	x		x	
	Respiratory and circulatory systems: (a) oxygen requirement of tissues; (b) functional anatomy; (c) main forms of hypoxia (hypoxic and anaemic): (1) sources, effects and counter-measures of carbon monoxide; (2) counter measures and hypoxia; (3) symptoms of hypoxia. (d) hyperventilation; (e) the effects of accelerations on the circulatory system; (f) hypertension and coronary heart disease.	x		x	
	Man and environment				
	Central, peripheral and autonomic nervous systems	x		x	
	Vision: (a) functional anatomy; (b) visual field, foveal and peripheral vision; (c) binocular and monocular vision; (d) monocular vision cues; (e) night vision; (f) visual scanning and detection techniques and importance of 'look-out'; (g) defective vision.	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Hearing: (a) descriptive and functional anatomy; (b) flight related hazards to hearing; (c) hearing loss.	x		x	
	Equilibrium: (a) functional anatomy; (b) motion and acceleration; (c) motion sickness.	x		x	
	Integration of sensory inputs: (a) spatial disorientation: forms, recognition and avoidance;	x		x	
	(b) illusions: forms, recognition and avoidance: (1) physical origin; (2) physiological origin; (3) psychological origin. (c) approach and landing problems.				
	Health and hygiene				
	Personal hygiene: personal fitness	x		x	
	Body rhythm and sleep: (a) rhythm disturbances; (b) symptoms, effects and management.	x		x	
	Problem areas for pilots: (a) common minor ailments including cold, influenza and gastro-intestinal upset; (b) entrapped gases and barotrauma, (scuba diving); (c) obesity; (d) food hygiene; (e) infectious diseases; (f) nutrition; (g) various toxic gases and materials.	x		x	
	Intoxication:	x		x	
	(a) prescribed medication; (b) tobacco; (c) alcohol and drugs;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(d) caffeine; (e) self-medication.				
	Basic aviation psychology				
	Human information processing				
	Attention and vigilance: (a) selectivity of attention; (b) divided attention.	x		x	
	Perception: (A) perceptual illusions; (B) subjectivity of perception; (C) processes of perception.	x		x	
	Memory: (a) sensory memory; (b) working or short term memory; (c) long term memory to include motor memory (skills).	x		x	
	Human error and reliability				
	Reliability of human behaviour	x		x	
	Error generation: social environment (group, organisation)	x		x	
	Decision making				
	Decision-making concepts:	x		x	
	(a) structure (phases);				
	(b) limits; (c) risk assessment; (d) practical application.				
	Avoiding and managing errors: cockpit management				
	Safety awareness: (a) risk area awareness; (b) situational awareness.	x		x	
	Communication: verbal and non-verbal communication	x		x	
	Human behaviour				
	Personality and attitudes: (a) development;	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) environmental influences.				
	Identification of hazardous attitudes (error proneness)	x		x	
	Human overload and underload				
	Arousal	x		x	
	Stress: (a) definition(s); (b) anxiety and stress; (c) effects of stress.	x		x	
	Fatigue and stress management: (a) types, causes and symptoms of fatigue; (b) effects of fatigue; (c) coping strategies; (d) management techniques; (e) health and fitness programmes;	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
3.	**METEOROLOGY**				
	The atmosphere				
	Composition, extent and vertical division				
	Structure of the atmosphere	x		x	
	Troposphere	x		x	
	Air temperature				
	Definition and units	x		x	
	Vertical distribution of temperature	x		x	
	Transfer of heat	x		x	
	Lapse rates, stability and instability	x		x	
	Development of inversions and types of inversions	x		x	
	Temperature near the earth's surface, surface effects, diurnal and seasonal variation, effect of clouds and effect of wind	x		x	
	Atmospheric pressure				
	Barometric pressure and isobars	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Pressure variation with height	x		x	
	Reduction of pressure to mean sea level	x		x	
	Relationship between surface pressure centres and pressure centres aloft	x		x	
	Air density				
	Relationship between pressure, temperature and density	x		x	
	ISA				
	ICAO standard atmosphere	x		x	
	Altimetry				
	Terminology and definitions	x		x	
	Altimeter and altimeter settings	x		x	
	Calculations	x		x	
	Effect of accelerated airflow due to topography	x		x	
	Wind				
	Definition and measurement of wind				
	Definition and measurement	x		x	
	Primary cause of wind				
	Primary cause of wind, pressure gradient, coriolis force and gradient wind	x		x	
	Variation of wind in the friction layer	x		x	
	Effects of convergence and divergence	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
4.	**COMMUNICATIONS**				
	VFR COMMUNICATIONS				
	Definitions				
	Meanings and significance of associated terms	x		x	
	ATS abbreviations	x		x	
	Q-code groups commonly used in RTF air-ground communications	x		x	
	Categories of messages	x		x	
	General operating procedures				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Transmission of letters	x		x	
	Transmission of numbers (including level information)	x		x	
	Transmission of time	x		x	
	Transmission technique	x		x	
	Standard words and phrases (relevant RTF phraseology included)	x		x	
	R/T call signs for aeronautical stations including use of abbreviated call signs	x		x	
	R/T call signs for aircraft including use of abbreviated call signs	x		x	
	Transfer of communication	x		x	
	Test procedures including readability scale	x		x	
	Read back and acknowledgement requirements	x		x	
	Relevant weather information terms (VFR)				
	Aerodrome weather	x		x	
	Weather broadcast	x		x	
	Action required to be taken in case of communication failure	x		x	
	Distress and urgency procedures				
	Distress (definition, frequencies, watch of distress frequencies, distress signal and distress message)	x		x	
	Urgency (definition, frequencies, urgency signal and urgency message)	x		x	
	General principles of VHF propagation and allocation of frequencies	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
5.	**PRINCIPLES OF FLIGHT**				
5.1.	**PRINCIPLES OF FLIGHT: AEROPLANE**				
	Subsonic aerodynamics				
	Basics concepts, laws and definitions				
	Laws and definitions: (a) conversion of units;	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) Newton´s laws; (c) Bernoulli's equation and venture; (d) static pressure, dynamic pressure and total pressure; (e) density; (f) IAS and TAS.				
	Basics about airflow: (a) streamline; (b) two-dimensional airflow; (c) three-dimensional airflow.	x	x		
	Aerodynamic forces on surfaces: (a) resulting airforce; (b) lift; (c) drag; (d) angle of attack.	x	x		
	Shape of an aerofoil section: (a) thickness to chord ratio; (b) chord line; (c) camber line; (d) camber; (e) angle of attack.	x	x		
	The wing shape: (a) aspect ratio; (b) root chord; (c) tip chord; (d) tapered wings; (e) wing planform.	x	x		
	The two-dimensional airflow about an aerofoil				
	Streamline pattern	x	x		
	Stagnation point	x	x		
	Pressure distribution	x	x		
	Centre of pressure	x	x		
	Influence of angle of attack	x	x		
	Flow separation at high angles of attack	x	x		
	The lift – α graph	x	x		
	The coefficients				
	The lift coefficient C_l: the lift formula	x	x		
	The drag coefficient C_d: the drag formula	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	The three-dimensional airflow round a wing and a fuselage				
	Streamline pattern: (a) span-wise flow and causes; (b) tip vortices and angle of attack; (c) upwash and downwash due to tip vortices; (d) wake turbulence behind an aeroplane (causes, distribution and duration of the phenomenon).	x	x		
	Induced drag: (a) influence of tip vortices on the angle of attack; (b) the induced local α; (c) influence of induced angle of attack on the direction of the lift vector; (d) induced drag and angle of attack.	x	x		
	Drag				
	The parasite drag: (a) pressure drag; (b) interference drag; (c) friction drag.	x	x		
	The parasite drag and speed	x	x		
	The induced drag and speed	x	x		
	The total drag	x	x		
	The ground effect				
	Effect on take off and landing characteristics of an aeroplane	x	x		
	The stall				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Flow separation at increasing angles of attack: (a) the boundary layer: (1) laminar layer; (2) turbulent layer; (3) transition. (b) separation point; (c) influence of angle of attack; (d) influence on: (1) pressure distribution; (2) location of centre of pressure; (3) C_L; (4) C_D; (5) pitch moments. (e) buffet; (f) use of controls.	x	x		
	The stall speed: (a) in the lift formula; (b) 1g stall speed; (c) influence of: (1) the centre of gravity; (2) power setting; (3) altitude (IAS); (4) wing loading; (5) load factor n: (i) definition; (ii) turns; (iii) forces.	x	x		
	The initial stall in span-wise direction: (a) influence of planform; (b) geometric twist (wash out); (c) use of ailerons.	x	x		
	Stall warning: (a) importance of stall warning; (b) speed margin; (c) buffet; (d) stall strip; (e) flapper switch; (f) recovery from stall.	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Special phenomena of stall: (a) the power-on stall; (b) climbing and descending turns; (c) t-tailed aeroplane; (d) avoidance of spins: (1) spin development; (2) spin recognition; (3) spin recovery. (e) ice (in stagnation point and on surface): (1) absence of stall warning; (2) abnormal behaviour of the aircraft during stall.	x	x		
	C_L augmentation				
	Trailing edge flaps and the reasons for use in take-off and landing: (a) influence on C_L - α-graph; (b) different types of flaps; (c) flap asymmetry; (d) influence on pitch movement.	x	x		
	Leading edge devices and the reasons for use in take-off and landing	x	x		
	The boundary layer				
	Different types: (a) laminar; (b) turbulent.	x	x		
	Special circumstances				
	Ice and other contamination: (a) ice in stagnation point; (b) ice on the surface (frost, snow and clear ice); (c) rain; (d) contamination of the leading edge; (e) effects on stall; (f) effects on loss of controllability; (g) effects on control surface moment; (h) influence on high lift devices during take-off, landing and low speeds.	x	x		
	Stability				
	Condition of equilibrium in steady horizontal flight				
	Precondition for static stability	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Equilibrium: (a) lift and weight; (b) drag and thrust.	x	x		
	Methods of achieving balance				
	Wing and empennage (tail and canard)	x	x		
	Control surfaces	x	x		
	Ballast or weight trim	x	x		
	Static and dynamic longitudinal stability				
	Basics and definitions: (a) static stability, positive, neutral and negative; (b) precondition for dynamic stability; (c) dynamic stability, positive, neutral and negative.	x	x		
	Location of centre of gravity: (a) aft limit and minimum stability margin; (b) forward position; (c) effects on static and dynamic stability.	x	x		
	Dynamic lateral or directional stability				
	Spiral dive and corrective actions	x	x		
	Control				
	General				
	Basics, the three planes and three axis	x	x		
	Angle of attack change	x	x		
	Pitch control				
	Elevator	x	x		
	Downwash effects	x	x		
	Location of centre of gravity	x	x		
	Yaw control				
	Pedal or rudder	x	x		
	Roll control				
	Ailerons: function in different phases of flight	x	x		
	Adverse yaw	x	x		
	Means to avoid adverse yaw: (a) frise ailerons; (b) differential ailerons deflection.	x	x		
	Means to reduce control forces				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Aerodynamic balance: (a) balance tab and anti-balance tab; (b) servo tab.	x	x		
	Mass balance				
	Reasons to balance: means	x	x		
	Trimming				
	Reasons to trim	x	x		
	Trim tabs	x	x		
	Limitations				
	Operating limitations				
	Flutter	x	x		
	V_{fe}	x	x		
	V_{no}, V_{ne}	x	x		
	Manoeuvring envelope				
	Manoeuvring load diagram: (a) load factor; (b) accelerated stall speed; (c) V_a; (d) manoeuvring limit load factor or certification category.	x	x		
	Contribution of mass	x	x		
	Gust envelope				
	Gust load diagram	x	x		
	Factors contributing to gust loads	x	x		
	Propellers				
	Conversion of engine torque to thrust				
	Meaning of pitch	x	x		
	Blade twist	x	x		
	Effects of ice on propeller	x	x		
	Engine failure or engine stop				
	Windmilling drag	x	x		
	Moments due to propeller operation				
	Torque reaction	x	x		
	Asymmetric slipstream effect	x	x		
	Asymmetric blade effect	x	x		

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Flight mechanics				
	Forces acting on an aeroplane				
	Straight horizontal steady flight	x	x		
	Straight steady climb	x	x		
	Straight steady descent	x	x		
	Straight steady glide	x	x		
	Steady coordinated turn: (a) bank angle; (b) load factor; (c) turn radius; (d) rate one turn.	x	x		
5.2.	**PRINCIPLES OF FLIGHT: HELICOPTER**				
	Subsonic aerodynamics				
	Basic concepts, laws and definitions			x	x
	Conversion of units			x	x
	Definitions and basic concepts about air:			x	x
	(a) the atmosphere and International Standard Atmosphere; (b) density; (c) influence of pressure and temperature on density.				
	Newton's laws: (a) Newton's second law: Momentum equation; (b) Newton's third law: action and reaction.			x	x
	Basic concepts about airflow: (a) steady airflow and unsteady airflow; (b) Bernoulli's equation; (c) static pressure, dynamic pressure, total pressure and stagnation point;			x	x
	(d) TAS and IAS; (e) two-dimensional airflow and three-dimensional airflow; (f) viscosity and boundary layer.				
	Two-dimensional airflow			x	x
	Aerofoil section geometry: (a) aerofoil section;			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) chord line, thickness and thickness to chord ratio of a section; (c) camber line and camber; (d) symmetrical and asymmetrical aerofoils sections.				
	Aerodynamic forces on aerofoil elements: (a) angle of attack; (b) pressure distribution; (c) lift and lift coefficient (d) relation lift coefficient: angle of attack; (e) profile drag and drag coefficient; (f) relation drag coefficient: angle of attack; (g) resulting force, centre of pressure and pitching moment.			x	x
	Stall: (a) boundary layer and reasons for stalling; (b) variation of lift and drag as a function of angle of attack; (c) displacement of the centre of pressure and pitching moment.			x	x
	Disturbances due to profile contamination: (a) ice contamination; (b) ice on the surface (frost, snow and clear ice).			x	x
	The three-dimensional airflow round a wing and a fuselage			x	x
	The wing:			x	x
	(a) planform, rectangular and tapered wings;				
	(b) wing twist.				
	Airflow pattern and influence on lift:			x	x
	(a) span wise flow on upper and lower surface; (b) tip vortices; (c) span-wise lift distribution.				
	Induced drag: causes and vortices			x	x
	The airflow round a fuselage: (a) components of a fuselage; (b) parasite drag;			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(c) variation with speed.				
	Transonic aerodynamics and compressibility effects				
	Airflow velocities			x	x
	Airflow speeds: (a) speed of sound; (b) subsonic, high subsonic and supersonic flows.			x	x
	Shock waves: (a) compressibility and shock waves; (b) the reasons for their formation at upstream high subsonic airflow; (c) their effect on lift and drag.			x	x
	Influence of wing planform: sweep-angle			x	x
	Rotorcraft types			x	x
	Rotorcraft			x	x
	Rotorcraft types: (a) autogyro; (b) helicopter.			x	x
	Helicopters			x	x
	Helicopters configurations: the single main rotor helicopter			x	x
	The helicopter, characteristics and associated terminology: (a) general lay-out, fuselage, engine and gearbox; (b) tail rotor, fenestron and NOTAR;			x	x
	(c) engines (reciprocating and turbo shaft engines); (d) power transmission;				
	(e) rotor shaft axis, rotor hub and rotor blades; (f) rotor disc and rotor disc area; (g) teetering rotor (two blades) and rotors with more than two blades;				
	(h) skids and wheels; (i) helicopter axes and fuselage centre line;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(j) roll axis, pitch axis and normal or yaw axis; (k) gross mass, gross weight and disc loading.				
	Main rotor aerodynamics			x	x
	Hover flight outside ground effect			x	x
	Airflow through the rotor discs and round the blades: (a) circumferential velocity of the blade sections; (b) induced airflow, through the disc and downstream; (c) downward fuselage drag; (d) equilibrium of rotor thrust, weight and fuselage drag; (e) rotor disc induced power; (f) relative airflow to the blade; (g) pitch angle and angle of attack of a blade section; (h) lift and profile drag on the blade element; (i) resulting lift and thrust on the blade and rotor thrust; (j) collective pitch angle changes and necessity of blade feathering; (k) required total main rotor-torque and rotor-power; (l) influence of the air density.			x	x
	Anti-torque force and tail rotor: (a) force of tail rotor as a function of main rotor-torque; (b) anti-torque rotor power; (c) necessity of blade feathering of tail rotor blades and yaw pedals.			x	x
	Maximum hover altitude OGE: (a) total power required and power available; (b) maximum hover altitude as a function of pressure altitude and OAT.			x	x
	Vertical climb			x	x
	Relative airflow and angles of attack:			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) climb velocity V_C, induced and relative velocity and angle of attack; (b) collective pitch angle and blade feathering.				
	Power and vertical speed: (a) induced power, climb power and profile power;			x	x
	(b) total main rotor power and main rotor torque;				
	(c) tail rotor power;				
	(d) total power requirement in vertical flight.				
	Forward flight			x	x
	Airflow and forces in uniform inflow distribution: (a) assumption of uniform inflow distribution on rotor disc; (b) advancing blade (90°) and retreating blade (270°); (c) airflow velocity relative to the blade sections, area of reverse flow; (d) lift on the advancing and retreating blades at constant pitch angles; (e) necessity of cyclic pitch changes; (f) compressibility effects on the advancing blade tip and speed limitations; (g) high angle of attack on the retreating blade, blade stall and speed limitations; (h) thrust on rotor disc and tilt of thrust vector; (i) vertical component of the thrust vector and gross weight equilibrium; (j) horizontal component of the thrust vector and drag equilibrium.			x	x
	The flare (power flight):			x	x
	(a) thrust reversal and increase in rotor thrust; (b) increase of rotor RPM on non governed rotor.				
	Power and maximum speed: (a) induced power as a function of helicopter speed;			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) rotor profile power as a function of helicopter speed; (c) fuselage drag and parasite power as a function of forward speed; (d) tail rotor power and power ancillary equipment; (e) total power requirement as a function of forward speed; (f) influence of helicopter mass, air density and drag of additional external equipment;				
	(g) translational lift and influence on power required.				
	Hover and forward flight in ground effect			x	x
	Airflow in ground effect and downwash: rotor power decrease as a function of rotor height above the ground at constant helicopter mass			x	x
	Vertical descent			x	x
	Vertical descent, power on:			x	x
	(a) airflow through the rotor, low and moderate descent speeds; (b) vortex ring state, settling with power and consequences.				
	Autorotation: (a) collective lever position after failure; (b) up flow through the rotor, auto-rotation and anti-autorotation rings; (c) tail rotor thrust and yaw control; (d) control of rotor RPM with collective lever; (e) landing after increase of rotor thrust by pulling collective and reduction in vertical speed.			x	x
	Forward flight: Autorotation			x	x
	Airflow through the rotor disc: (a) descent speed and up flow through the disc; (b) the flare, increase in rotor thrust, reduction of vertical speed and ground speed.			x	x
	Flight and landing:			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(a) turning; (b) flare; (c) autorotative landing; (d) height or velocity avoidance graph and dead man's curve.				
	Main rotor mechanics			x	x
	Flapping of the blade in hover			x	x
	Forces and stresses on the blade: (a) centrifugal force on the blade and attachments; (b) limits of rotor RPM; (c) lift on the blade and bending stresses on a rigid attachment; (d) the flapping hinge of the articulated rotor and flapping hinge offset; (e) the flapping of the hinge less rotor and flexible element.			x	x
	Coning angle in hover:			x	x
	(a) lift and centrifugal force in hover and blade weight negligible (b) flapping, tip path plane and disc area.				
	Flapping angles of the blade in forward flight			x	x
	Forces on the blade in forward flight without cyclic feathering: (a) aerodynamic forces on the advancing and retreating blades without cyclic feathering;			x	x
	(b) periodic forces and stresses, fatigue and flapping hinge; (c) phase lag between the force and the flapping angle (about 90°); (d) flapping motion of the hinged blades and tilting of the cone and flap back of rotor;				
	(e) rotor disc attitude and thrust vector tilt.				
	Cyclic pitch (feathering) in helicopter mode, forward flight: (a) necessity of forward rotor disc tilt and thrust vector tilt;			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(b) flapping and tip path plane, virtual rotation axis or no flapping axis and plane of rotation; (c) shaft axis and hub plane; (d) cyclic pitch change (feathering) and rotor thrust vector tilt; (e) collective pitch change, collective lever, swash plate, pitch link and pitch horn; (f) cyclic stick, rotating swash plate and pitch link movement and phase angle.				
	Blade lag motion			x	x
	Forces on the blade in the disc plane (tip path plane) in forward flight: (a) forces due to the Coriolis effect because of the flapping; (b) alternating stresses and the need of the drag or lag hinge. The drag or lag hinge: (a) the drag hinge in the fully articulated rotor; (b) the lag flexure in the hinge less rotor; (c) drag dampers.			x x	x x
	Ground resonance: (a) blade lag motion and movement of the centre of gravity of the blades and the rotor; (b) oscillating force on the fuselage; (c) fuselage, undercarriage and resonance.			x	x
	Rotor systems			x	x
	See-saw or teetering rotor			x	x
	Fully articulated rotor: (a) three hinges arrangement; (b) bearings and elastomeric hinges.			x	x
	Hinge less rotor and bearing less rotor			x	x
	Blade sailing: (a) low rotor RPM and effect of adverse wind; (b) minimising the danger;			x	x
	(c) droop stops.				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Vibrations due to main rotor: (a) origins of the vibrations: in plane and vertical; (b) blade tracking and balancing.			x	x
	Tail rotors			x	x
	Conventional tail rotor			x	x
	Rotor description: (a) two-blades tail rotors with teetering hinge; (b) rotors with more than two blades; (c) feathering bearings and flapping hinges; (d) dangers to people and to the tail rotor, rotor height and safety.			x	x
	Aerodynamics: (a) induced airflow and tail rotor thrust; (b) thrust control by feathering, tail rotor drift and roll; (c) effect of tail rotor failure and vortex ring.			x	x
	The fenestron: technical lay-out			x	x
	The NOTAR: technical lay-out			x	x
	Vibrations: high frequency vibrations due to the tail rotors			x	x
	Equilibrium, stability and control			x	x
	Equilibrium and helicopter attitudes			x	x
	Hover: (a) forces and equilibrium conditions; (b) helicopter pitching moment and pitch angle; (c) helicopter rolling moment and roll angle.			x	x
	Forward flight: (a) forces and equilibrium conditions; (b) helicopter moments and angles;			x	x
	(c) effect of speed on fuselage attitude.				
	Control			x	x
	Control power			x	x
	(a) fully articulated rotor; (b) hinge less rotor;				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	(c) teetering rotor.				
	Static and dynamic roll over			x	x
	Helicopter performances Engine performances Piston engines:			 x x	 x x
	(a) power available; (b) effects of density altitude.				
	Turbine engines: (a) power available; (b) effects of ambient pressure and temperature.			x	x
	Helicopter performances			x	x
	Hover and vertical flight: (a) power required and power available; (b) OGE and IGE maximum hover height; (c) influence of AUM, pressure, temperature and density.			x	x
	Forward flight: (a) maximum speed; (b) maximum rate of climb speed; (c) maximum angle of climb speed; (d) range and endurance; (e) influence of AUM, pressure, temperature and density.			x	x
	Manoeuvring: (a) load factor; (b) bank angle and number of g's; (c) manoeuvring limit load factor.			x	x
	Special conditions: (a) operating with limited power; (b) over pitch and over torque.			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
6.	**OPERATIONAL PROCEDURES**				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	General				
	Operation of aircraft: ICAO Annex 6, General requirements				
	Definitions	x	x	x	x
	Applicability	x	x	x	x
	Special operational procedures and hazards (general aspects)	x	x	x	x
	Noise abatement				
	Noise abatement procedures	x	x	x	x
	Influence of the flight procedure (departure, cruise and approach)	x	x	x	x
	Runway incursion awareness (meaning of surface markings and signals)	x	x	x	x
	Fire or smoke				
	Carburettor fire	x	x	x	x
	Engine fire	x	x	x	x
	Fire in the cabin and cockpit, (choice of extinguishing agents according to fire classification and use of the extinguishers)	x	x	x	x
	Smoke in the cockpit and (effects and action to be taken) and smoke in the cockpit and cabin (effects and actions taken)	x	x	x	x
	Windshear and microburst				
	Effects and recognition during departure and approach	x	x	x	x
	Actions to avoid and actions taken during encounter	x	x	x	x
	Wake turbulence				
	Cause	x	x	x	x
	List of relevant parameters	x	x	x	x
	Actions taken when crossing traffic, during take-off and landing	x	x	x	x
	Emergency and precautionary landings				
	Definition	x	x	x	x
	Cause	x	x	x	x
	Passenger information	x	x	x	x
	Evacuation	x	x	x	x
	Action after landing	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Contaminated runways				
	Kinds of contamination	x	x		
	Estimated surface friction and friction coefficient	x	x		
	Rotor downwash			x	x
	Operation influence by meteorological conditions (helicopter)				
	White out, sand or dust			x	x
	Strong winds			x	x
	Mountain environment			x	x
	Emergency procedures				
	Influence by technical problems				
	Engine failure			x	x
	Fire in cabin, cockpit or engine			x	x
	Tail, rotor or directional control failure			x	x
	Ground resonance			x	x
	Blade stall			x	x
	Settling with power (vortex ring)			x	x
	Overpitch			x	x
	Overspeed: rotor or engine			x	x
	Dynamic rollover			x	x
	Mast bumping			x	x

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
7.	**FLIGHT PERFORMANCE AND PLANNING**				
7.1.	**MASS AND BALANCE: AEROPLANES OR HELICOPTERS**				
	Purpose of mass and balance considerations				
	Mass limitations				
	Importance in regard to structural limitations	x	x	x	x
	Importance in regard to performance limitations	x	x	x	x

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
	CG limitations				
	Importance in regard to stability and controllability	x	x	x	x
	Importance in regard to performance	x	x	x	x
	Loading				
	Terminology				
	Mass terms	x	x	x	x
	Load terms (including fuel terms)	x	x	x	x
	Mass limits				
	Structural limitations	x	x	x	x
	Performance limitations	x	x	x	x
	Baggage compartment limitations	x	x	x	x
	Mass calculations				
	Maximum masses for take-off and landing	x	x	x	x
	Use of standard masses for passengers, baggage and crew	x	x	x	x
	Fundamentals of CG calculations				
	Definition of centre of gravity	x	x	x	x
	Conditions of equilibrium (balance of forces and balance of moments)	x	x	x	x
	Basic calculations of CG	x	x	x	x
	Mass and balance details of aircraft				
	Contents of mass and balance documentation				
	Datum and moment arm	x	x	x	x
	CG position as distance from datum	x	x	x	x
	Extraction of basic mass and balance data from aircraft documentation				
	BEM	x	x	x	x
	CG position or moment at BEM	x	x	x	x
	Deviations from standard configuration	x	x	x	x
	Determination of CG position				
	Methods				
	Arithmetic method	x	x	x	x
	Graphic method	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Load and trim sheet				
	General considerations	x	x	x	x
	Load sheet and CG envelope for light aeroplanes and for helicopters	x	x	x	x
7.2.	**PERFORMANCE: AEROPLANES**				
	Introduction				
	Performance classes	x	x		
	Stages of flight	x	x		
	Effect of aeroplane mass, wind, altitude, runway slope and runway conditions	x	x		
	Gradients	x	x		
	SE aeroplanes				
	Definitions of terms and speeds	x	x		
	Take-off and landing performance				
	Use of aeroplane flight manual data	x	x		
	Climb and cruise performance				
	Use of aeroplane flight data	x	x		
	Effect of density altitude and aeroplane mass	x	x		
	Endurance and the effects of the different recommended power or thrust settings	x	x		
	Still air range with various power or thrust settings	x	x		
7.3.	**FLIGHT PLANNING AND FLIGHT MONITORING**				
	Flight planning for VFR flights				
	VFR navigation plan				
	Routes, airfields, heights and altitudes from VFR charts	x	x	x	x
	Courses and distances from VFR charts	x	x	x	x
	Aerodrome charts and aerodrome directory	x	x	x	x
	Communications and radio navigation planning data	x	x	x	x
	Completion of navigation plan	x	x	x	x
	Fuel planning				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	General knowledge	x	x	x	x
	Pre-flight calculation of fuel required				
	Calculation of extra fuel	x	x	x	x
	Completion of the fuel section of the navigation plan (fuel log) and calculation of total fuel	x	x	x	x
	Pre-flight preparation				
	AIP and NOTAM briefing				
	Ground facilities and services	x	x	x	x
	Departure, destination and alternate aerodromes	x	x	x	x
	Airway routings and airspace structure	x	x	x	x
	Meteorological briefing				
	Extraction and analysis of relevant data from meteorological documents	x	x	x	x
	ICAO flight plan (ATS flight plan)				
	Individual flight plan				
	Format of flight plan	x	x	x	x
	Completion of the flight plan	x	x	x	x
	Submission of the flight plan	x	x	x	x
	Flight monitoring and in-flight re-planning				
	Flight monitoring				
	Monitoring of track and time	x	x	x	x
	In-flight fuel management	x	x	x	x
	In-flight re-planning in case of deviation from planned data	x	x	x	x
7.4.	**PERFORMANCE: HELICOPTERS**				
	General				
	Introduction				
	Stages of flight			x	x
	Effect on performance of atmospheric, airport or heliport and helicopter conditions			x	x
	Applicability of airworthiness requirements			x	x
	Definitions and terminology			x	x

		Aeroplane	Helicopter		
		PPL	Bridge course	PPL	Bridge course
	Performance: SE helicopters				
	Definitions of terms (a) masses; (b) velocities: v_x, $v_{y;}$			x	x
	(c) velocity of best range and of maximum endurance; (d) power limitations; (e) altitudes.				
	Take-off, cruise and landing performance **Use and interpretation of diagrams and tables:** (a) Take-off: (1) take-off run and distance available; (2) take-off and initial climb; (3) effects of mass, wind and density altitude; (4) effects of ground surface and gradient. (b) Landing: (1) effects of mass, wind, density altitude and approach speed; (2) effects of ground surface and gradient. (c) In-flight: (1) relationship between power required and power available; (2) performance diagram; (3) effects of configuration, mass, temperature and altitude; (4) reduction of performance during climbing turns; (5) autorotation; (6) adverse effects (icing, rain and condition of the airframe).			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
8.	**AIRCRAFT GENERAL KNOWLEDGE**				
8.1.	**AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**				
	System design, loads, stresses, maintenance				
	Loads and combination loadings applied to an aircraft's structure	x	x	x	x
	Airframe				
	Wings, tail surfaces and control surfaces				
	Design and constructions	x	x		
	Structural components and materials	x	x		
	Stresses	x	x		
	Structural limitations	x	x		
	Fuselage, doors, floor, wind-screen and windows				
	Design and constructions	x	x	x	x
	Structural components and materials	x	x	x	x
	Stresses	x	x	x	x
	Structural limitations	x	x	x	x
	Flight and control surfaces				
	Design and constructions			x	x
	Structural components and materials			x	x
	Stresses and aero elastic vibrations			x	x
	Structural limitations			x	x
	Hydraulics				
	Hydromechanics: basic principles	x	x	x	x
	Hydraulic systems	x	x	x	x
	Hydraulic fluids: types and characteristics, limitations	x	x	x	x
	System components: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Landing gear, wheels, tyres and brakes				
	Landing gear				
	Types and materials	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Nose wheel steering: design and operation	x	x		
	Brakes				
	Types and materials	x	x	x	x
	System components: design, operation, indications and warnings	x	x	x	x
	Wheels and tyres				
	Types and operational limitations	x	x	x	x
	Helicopter equipments			x	x
	Flight controls				
	Mechanical or powered	x	x	x	x
	Control systems and mechanical	x	x	x	x
	System components: design, operation, indications and warnings, degraded modes of operation and jamming	x	x	x	x
	Secondary flight controls				
	System components: design, operation, degraded modes of operation, indications and warnings	x	x		
	Anti-icing systems				
	Types and operation (pitot and windshield)	x	x	x	x
	Fuel system				
	Piston engine				
	System components: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Turbine engine				
	System components: design, operation, degraded modes of operation, indications and warnings			x	x
	Electrics				
	Electrics: general and definitions				
	Direct current: voltage, current, resistance, conductivity, Ohm's law, power and work	x	x	x	x
	Alternating current: voltage, current, amplitude, phase, frequency and resistance	x	x	x	x
	Circuits: series and parallel	x	x	x	x
	Magnetic field: effects in an electrical circuit	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Batteries				
	Types, characteristics and limitations	x	x	x	x
	Battery chargers, characteristics and limitations	x	x	x	x
	Static electricity: general				
	Basic principles	x	x	x	x
	Static dischargers	x	x	x	x
	Protection against interference	x	x	x	x
	Lightning effects	x	x	x	x
	Generation: production, distribution and use				
	DC generation: types, design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	AC generation: types, design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Electric components				
	Basic elements: basic principles of switches, circuit-breakers and relays	x	x	x	x
	Distribution				
	General: (a) bus bar, common earth and priority; (b) AC and DC comparison.	x	x	x	x
	Piston engines				
	General				
	Types of internal combustion engine: basic principles and definitions	x	x	x	x
	Engine: design, operation, components and materials	x	x	x	x
	Fuel				
	Types, grades, characteristics and limitations	x	x	x	x
	Alternate fuel: characteristics and limitations	x	x	x	x
	Carburettor or injection system				
	Carburettor: design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Injection: design, operation, degraded modes of operation, indications and warnings	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Icing	x	x	x	x
	Air cooling systems				
	Design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Lubrication systems				
	Lubricants: types, characteristics and limitations	x	x	x	x
	Design, operation, degraded modes of operation, indications and warnings	x	x	x	x
	Ignition circuits				
	Design, operation, degraded modes of operation	x	x	x	x
	Mixture				
	Definition, characteristic mixtures, control instruments, associated control levers and indications	x	x	x	x
	Propellers				
	Definitions and general: (a) aerodynamic parameters; (b) types; (c) operating modes.	x	x		
	Constant speed propeller: design, operation and system components	x	x		
	Propeller handling: associated control levers, degraded modes of operation, indications and warnings	x	x		
	Performance and engine handling				
	Performance: influence of engine parameters, influence of atmospheric conditions, limitations and power augmentation systems	x	x	x	x
	Engine handling: power and mixture settings during various flight phases and operational limitations	x	x	x	x
	Turbine engines				
	Definitions			x	x
	Coupled turbine engine: design, operation, components and materials			x	x
	Free turbine engine: design, operation, components and materials			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Fuel				
	Types, characteristics and limitations			x	x
	Main engine components				
	Compressor: (a) types, design, operation, components and materials; (b) stresses and limitations; (c) stall, surge and means of prevention.			x	x
	Combustion chamber: (a) types, design, operation, components and materials; (b) stresses and limitations; (c) emission problems.			x	x
	Turbine: (a) types, design, operation, components and materials; (b) stresses, creep and limitations.			x	x
	Exhaust: (a) design, operation and materials; (b) noise reduction.			x	x
	Fuel control units: types, operation and sensors			x	x
	Helicopter air intake: different types, design, operation, materials and optional equipments			x	x
	Additional components and systems				
	Helicopter additional components and systems: lubrication system, ignition circuit, starter, accessory gearbox, free wheel units: design, operation and components			x	x
	Performance aspects				
	Torque, performance aspects, engine handling and limitations: (a) engine ratings; (b) engine performance and limitations; (c) engine handling.			x	x
	Protection and detection systems				
	Fire detection systems				
	Operation and indications			x	X
	Miscellaneous systems				
	Rotor design			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Rotor heads				
	Main rotor				
	Types			x	x
	Structural components and materials, stresses and structural limitations			x	x
	Design and construction			x	x
	Adjustment			x	x
	Tail rotor				
	Types			x	x
	Structural components and materials, stresses and structural limitations			x	x
	Design and construction			x	x
	Adjustment			x	x
	Transmission				
	Main gear box				
	Different types, design, operation and limitations			x	x
	Rotor brake				
	Different types, design, operation and limitations			x	x
	Auxiliary systems			x	x
	Drive shaft and associated installation			x	x
	Intermediate and tail gear box				
	Different types, design, operation and limitations			x	x
	Blades				
	Main rotor blade				
	Design and construction			x	x
	Structural components and materials			x	x
	Stresses			x	x
	Structural limitations			x	x
	Adjustment			x	x
	Tip shape			x	x
	Tail rotor blade				
	Design and construction			x	x
	Structural components and materials			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Stresses			x	x
	Structural limitations			x	x
	Adjustment			x	x
8.2.	**INSTRUMENTATION**				
	Instrument and indication systems				
	Pressure gauge				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Temperature sensing				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Fuel gauge				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Flow meter				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Position transmitter				
	Different types, design, operation, characteristics and accuracy	x	x	x	x
	Torque meter				
	Design, operation, characteristics and accuracy			x	x
	Tachometer				
	Design, operation, characteristics and accuracy	x	x	x	x
	Measurement of aerodynamic parameters				
	Pressure measurement				
	Static pressure, dynamic pressure, density and definitions	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Temperature measurement: aeroplane				
	Design, operation, errors and accuracy	x	x		
	Displays	x	x		
	Temperature measurement: helicopter				
	Design, operation, errors and accuracy			x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Displays			x	x
	Altimeter				
	Standard atmosphere	x	x	x	x
	The different barometric references (QNH, QFE and 1013.25)	x	x	x	x
	Height, indicated altitude, true altitude, pressure altitude and density altitude	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Vertical speed indicator				
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Air speed indicator				
	The different speeds IAS, CAS, TAS: definition, usage and relationships	x	x	x	x
	Design, operation, errors and accuracy	x	x	x	x
	Displays	x	x	x	x
	Magnetism: direct reading compass				
	Earth magnetic field	x	x	x	x
	Direct reading compass				
	Design, operation, data processing, accuracy and deviation	x	x	x	x
	Turning and acceleration errors	x	x	x	x
	Gyroscopic instruments				
	Gyroscope: basic principles				
	Definitions and design	x	x	x	x
	Fundamental properties	x	x	x	x
	Drifts	x	x	x	x
	Turn and bank indicator				
	Design, operation and errors	x	x	x	x
	Attitude indicator				
	Design, operation, errors and accuracy	x	x	x	x
	Directional gyroscope				
	Design, operation, errors and accuracy	x	x	x	x
	Communication systems				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Transmission modes: VHF, HF and SATCOM				
	Principles, bandwidth, operational limitations and use	x	x	x	x
	Voice communication				
	Definitions, general and applications	x	x	x	x
	Alerting systems and proximity systems				
	Flight warning systems				
	Design, operation, indications and alarms	x	x	x	x
	Stall warning				
	Design, operation, indications and alarms	x	x		
	Radio-altimeter				
	Design, operation, errors, accuracy and indications			x	x
	Rotor or engine over speed alert system				
	Design, operation, displays and alarms			x	x
	Integrated instruments: electronic displays				
	Display units				
	Design, different technologies and limitations	x	x	x	x

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
9.	**NAVIGATION**				
9.1.	**GENERAL NAVIGATION**				
	Basics of navigation				
	The solar system				
	Seasonal and apparent movements of the sun	x		x	
	The earth				
	Great circle, small circle and rhumb line	x		x	
	Latitude and difference of latitude	x		x	
	Longitude and difference of longitude	x		x	
	Use of latitude and longitude co-ordinates to locate any specific position	x		x	
	Time and time conversions				

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Apparent time	x		x	
	UTC	x		x	
	LMT	x		x	
	Standard times	x		x	
	Dateline	x		x	
	Definition of sunrise, sunset and civil twilight	x		x	
	Directions				
	True north, magnetic north and compass north	x		x	
	Compass deviation	x		x	
	Magnetic poles, isogonals, relationship between true and magnetic	x		x	
	Distance				
	Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres and ft	x		x	
	Conversion from one unit to another	x		x	
	Relationship between nautical miles and minutes of latitude and minutes of longitude	x		x	
	Magnetism and compasses				
	General principles				
	Terrestrial magnetism	x		x	
	Resolution of the earth's total magnetic force into vertical and horizontal components	x		x	
	Variation-annual change	x		x	
	Aircraft magnetism				
	The resulting magnetic fields	x		x	
	Keeping magnetic materials clear of the compass	x		x	
	Charts				
	General properties of miscellaneous types of projections				
	Direct Mercator	x		x	
	Lambert conformal conic	x		x	
	The representation of meridians, parallels, great circles and rhumb lines				
	Direct Mercator	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Lambert conformal conic	x		x	
	The use of current aeronautical charts				
	Plotting positions	x		x	
	Methods of indicating scale and relief (ICAO topographical chart)	x		x	
	Conventional signs	x		x	
	Measuring tracks and distances	x		x	
	Plotting bearings and distances	x		x	
	DR navigation				
	Basis of DR				
	Track	x		x	
	Heading (compass, magnetic and true)	x		x	
	Wind velocity	x		x	
	Air speed (IAS, CAS and TAS)	x		x	
	Groundspeed	x		x	
	ETA	x		x	
	Drift and wind correction angle	x		x	
	DR position fix	x		x	
	Use of the navigational computer				
	Speed	x		x	
	Time	x		x	
	Distance	x		x	
	Fuel consumption	x		x	
	Conversions	x		x	
	Air speed	x		x	
	Wind velocity	x		x	
	True altitude	x		x	
	The triangle of velocities				
	Heading	x		x	
	Ground speed	x		x	
	Wind velocity	x		x	
	Track and drift angle	x		x	
	Measurement of DR elements				
	Calculation of altitude	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Determination of appropriate speed	x		x	
	In-flight navigation				
	Use of visual observations and application to in-flight navigation	x		x	
	Navigation in cruising flight, use of fixes to revise navigation data				
	Ground speed revision	x		x	
	Off-track corrections	x		x	
	Calculation of wind speed and direction	x		x	
	ETA revisions	x		x	
	Flight log	x		x	
9.2.	**RADIO NAVIGATION**				
	Basic radio propagation theory				
	Antennas				
	Characteristics	x		x	
	Wave propagation				
	Propagation with the frequency bands	x		x	
	Radio aids				
	Ground DF				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	NDB/ADF				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	VOR				
	Principles	x		x	
	Presentation and interpretation	x		x	

		Aeroplane		Helicopter	
		PPL	Bridge course	PPL	Bridge course
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	DME				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	Radar				
	Ground radar				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Coverage	x		x	
	Range	x		x	
	Errors and accuracy	x		x	
	Factors affecting range and accuracy	x		x	
	Secondary surveillance radar and transponder				
	Principles	x		x	
	Presentation and interpretation	x		x	
	Modes and codes	x		x	
	GNSS				
	GPS, GLONASS OR GALILEO				
	Principles	x		x	
	Operation	x		x	
	Errors and accuracy	x		x	
	Factors affecting accuracy	x		x	

AMC2 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE PPL(AS)

The following table contains the syllabi for the courses of theoretical knowledge, as well as for the theoretical knowledge examinations for the PPL(As). The training and examination should cover aspects related to non-technical skills in an integrated manner, taking into account the particular risks associated to the licence and the activity.

		PPL
1.	**AIR LAW AND ATC PROCEDURES**	
	International law: conventions, agreements and organisations	x
	Airworthiness of aircraft	x
	Aircraft nationality and registration marks	x
	Personnel licensing	x
	Rules of the air	x
	Procedures for air navigation services: aircraft operations	x
	Air traffic services and air traffic management	x
	Aeronautical information service	x
	Aerodromes	x
	Search and rescue	x
	Security	x
	Aircraft accident and incident investigation	x
	National law	x

		PPL
2.	**HUMAN PERFORMANCE**	
	Human factors: basic concepts	x
	Basic aviation physiology and health maintenance	x
	Basic aviation psychology	x

		PPL
3.	**METEOROLOGY**	
	The atmosphere	x
	Wind	x
	Thermodynamics	x
	Clouds and fog	x

	Precipitation	x
	Air masses and fronts	x
	Pressure systems	x
	Climatology	x
	Flight hazards	x
	Meteorological information	x

		PPL
4.	**COMMUNICATIONS**	
	VFR COMMUNICATIONS	
	Definitions	x
	General operating procedures	x
	Relevant weather information terms (VFR)	x
	Action required to be taken in case of communication failure	x
	Distress and urgency procedures	x
	General principles of VHF propagation and allocation of frequencies	x

		PPL
5.	**PRINCIPLES OF FLIGHT**	
	Basics of aerostatics	x
	Basics of subsonic aerodynamics	x
	Aerodynamics of airships	x
	Stability	x
	Controllability	x
	Limitations	x
	Propellers	x
	Basics of airship flight mechanics	x

		PPL
6.	**OPERATIONAL PROCEDURES**	
	General requirements	x
	Special operational procedures and hazards (general aspects)	x
	Emergency procedures	x

		PPL
7.	**FLIGHT PERFORMANCE AND PLANNING**	
7.1	**MASS AND BALANCE**	
	Purpose of mass and balance considerations	x
	Loading	x
	Fundamentals of CG calculations	x
	Mass and balance details of aircraft	x
	Determination of CG position	x
	Passenger, cargo and ballast handling	x
7.2	**PERFORMANCE**	
	Airworthiness requirements	x
	Basics of airship performance	x
	Definitions and terms	x
	Stages of flight	x
	Use of flight manual	x
7.3	**FLIGHT PLANNING AND FLIGHT MONITORING**	
	Flight planning for VFR flights	x
	Fuel planning	x
	Pre-flight preparation	x
	ATS flight plan	x
	Flight monitoring and in-flight re-planning	x

		PPL
8.	**AIRCRAFT GENERAL KNOWLEDGE**	
8.1	**ENVELOPE, AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**	
	Design, materials, loads and stresses	x
	Envelope and airbags	x
	Framework	x
	Gondola	x
	Flight controls	x
	Landing gear	x
	Hydraulics and pneumatics	x
	Heating and air conditioning	x
	Fuel system	x
	Piston engines (propellers)	x
	Turbine engines (basics)	x

	Electrics	x
	Fire protection and detection systems	x
	Maintenance	x
8.2	**INSTRUMENTATION**	
	Sensors and instruments	x
	Measurement of air data and gas parameters	x
	Magnetism: direct reading compass and flux valve	x
	Gyroscopic instruments	x
	Communication systems	x
	Alerting systems	x
	Integrated instruments: electronic displays	x
	Flight management system (general basics)	x
	Digital circuits and computers	x

		PPL
9.	**NAVIGATION**	
9.1.	**GENERAL NAVIGATION**	
	Basics of navigation	x
	Magnetism and compasses	x
	Charts	x
	DR navigation	x
	In-flight navigation	x
9.2.	**RADIO NAVIGATION**	
	Basic radio propagation theory	x
	Radio aids	x
	Radar	x
	GNSS	x

AMC3 FCL.210; FCL.215

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE BPL AND SPL

The syllabi for the theoretical knowledge instruction and examination for the LAPL(B) and LAPL(S) in AMC1 FCL.115 and FCL.120 should be used for the BPL and SPL, respectively.

AMC1 FCL.215; FCL.235

THEORETICAL KNOWLEDGE EXAMINATION AND SKILL TEST FOR THE PPL

(a) Theoretical knowledge examination

(1) The examinations should comprise a total of 120 multiple-choice questions covering all the subjects.

(2) Communication practical classroom testing may be conducted.

(3) The period of 18 months mentioned in FCL.025(b)(2) should be counted from the end of the calendar month when the applicant first attempted an examination.

(b) Skill test

Further training may be required following any failed skill test or part thereof. There should be no limit to the number of skill tests that may be attempted.

(c) Conduct of the test

(1) If the applicant chooses to terminate a skill test for reasons considered inadequate by the FE, the applicant should retake the entire skill test. If the test is terminated for reasons considered adequate by the FE, only those sections not completed should be tested in a further flight.

(2) Any manoeuvre or procedure of the test may be repeated once by the applicant. The FE may stop the test at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest.

(3) An applicant should be required to fly the aircraft from a position where the PIC functions can be performed and to carry out the test as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

AMC1 FCL.235 Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A PPL(A)

(a) The route to be flown for the navigation test should be chosen by the FE. The route may end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test should have a duration that allows the pilot to demonstrate his/her ability to complete a route with at least three identified waypoints and may, as agreed between the applicant and FE, be flown as a separate test.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the authorised checklist for the aeroplane on which the test is being taken. During pre-flight preparation for the test the applicant should be required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the aeroplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the aeroplane used:

(1) height:

(i) normal flight	± 150 ft
(ii) with simulated engine failure	± 200 ft (if ME aeroplane is used)

(2) heading or tracking of radio aids:

(i) normal flight	± 10 °
(ii) with simulated engine failure	± 15 ° (if ME aeroplane is used)

(3) speed:

(i) take-off and approach	+15/−5 knots
(ii) all other flight regimes	± 15 knots

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(A) on SE and ME aeroplanes or on TMGs.

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE	
Use of checklist, airmanship, control of aeroplane by external visual reference, anti/de-icing procedures, etc. apply in all sections.	
a	Pre-flight documentation, NOTAM and weather briefing
b	Mass and balance and performance calculation
c	Aeroplane inspection and servicing
d	Engine starting and after starting procedures
e	Taxiing and aerodrome procedures, pre-take-off procedures
f	Take-off and after take-off checks
g	Aerodrome departure procedures
h	ATC compliance and R/T procedures

SECTION 2 GENERAL AIRWORK	
a	ATC compliance and R/T procedures
b	Straight and level flight, with speed changes
c	Climbing: i. best rate of climb; ii. climbing turns; iii. levelling off.
d	Medium (30 ° bank) turns
e	Steep (45 ° bank) turns (including recognition and recovery from a spiral dive)
f	Flight at critically low air speed with and without flaps
g	Stalling: i. clean stall and recover with power; ii. approach to stall descending turn with bank angle 20°, approach configuration; iii. approach to stall in landing configuration.
h	Descending: i. with and without power; ii. descending turns (steep gliding turns); iii. levelling off.
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed
c	Orientation, timing and revision of ETAs and log keeping
d	Diversion to alternate aerodrome (planning and implementation)
e	Use of radio navigation aids
f	Basic instrument flying check (180 ° turn in simulated IMC)
g	Flight management (checks, fuel systems and carburettor icing, etc.)
h	ATC compliance and R/T procedures

SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures
b	* Precision landing (short field landing), crosswind, if suitable conditions available
c	* Flapless landing
d	* Approach to landing with idle power (SE only)
e	Touch and go
f	Go-around from low height
g	ATC compliance and R/T procedures
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (SE only)
b	* Simulated forced landing (SE only)
c	Simulated precautionary landing (SE only)
d	Simulated emergencies
e	Oral questions

SECTION 6 SIMULATED ASYMMETRIC FLIGHT AND RELEVANT CLASS OR TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in an FFS)
b	Asymmetric approach and go-around
c	Asymmetric approach and full stop landing
d	Engine shutdown and restart
e	ATC compliance, R/T procedures or airmanship
f	As determined by the FE: any relevant items of the class or type rating skill test to include, if applicable: i. aeroplane systems including handling of auto pilot; ii. operation of pressurisation system; iii. use of de-icing and anti-icing system.
g	Oral questions

* These items may be combined, at the discretion of the FE.

AMC2 FCL.235 Skill test

CONTENTS OF THE SKILL TEST FOR THE ISSUE OF A PPL(H)

(a) The area and route to be flown should be chosen by the FE and all low level and hover work should be at an adequate aerodrome or site. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The navigation section of the test, as set out in this AMC should consist of at least three legs, each leg of a minimum duration of 10 minutes. The skill test may be conducted in two flights.

(b) An applicant should indicate to the FE the checks and duties carried out, including the identification of radio facilities. Checks should be completed in accordance with the authorised checklist or pilot operating handbook for the helicopter on which the test is being taken. During pre-flight preparation for the test the applicant is required to determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the helicopter used.

FLIGHT TEST TOLERANCE

(c) The applicant should demonstrate the ability to:

(1) operate the helicopter within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgement and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the helicopter at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the helicopter used.

(1) height:

(I) normal forward flight	± 150 ft
(ii) with simulated major emergency	± 200 ft
(iii) hovering IGE flight	± 2 ft

(2) heading or tracking of radio aids:

(i) normal flight	± 10 °
(ii) with simulated major emergency	± 15 °

(3) speed:

(i) take-off approach	– 10 knots/+15 knots
(ii) all other flight regimes	± 15 knots

(4) ground drift:

(i) take-off hover IGE	± 3 ft
(ii) landing	no sideways or backwards movement

CONTENT OF THE SKILL TEST

(e) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(H) on SE or ME helicopters.

SECTION 1 PRE-FLIGHT OR POST-FLIGHT CHECKS AND PROCEDURES	
Use of checklist, airmanship, control of helicopter by external visual reference, anti-icing procedures, etc. apply in all sections	
a	Helicopter knowledge, (for example technical log, fuel, mass and balance, performance), flight planning, NOTAM and weather briefing
b	Pre-flight inspection or action, location of parts and purpose
c	Cockpit inspection and starting procedure
d	Communication and navigation equipment checks, selecting and setting frequencies
e	Pre-take-off procedure, R/T procedure and ATC compliance
f	Parking, shutdown and post-flight procedure
SECTION 2 HOVER MANOEUVRES, ADVANCED HANDLING AND CONFINED AREAS	
a	Take-off and landing (lift-off and touch down)
b	Taxi and hover taxi
c	Stationary hover with head, cross or tail wind
d	Stationary hover turns, 360 ° left and right (spot turns)
e	Forward, sideways and backwards hover manoeuvring
f	Simulated engine failure from the hover
g	Quick stops into and downwind
h	Sloping ground or unprepared sites landings and take-offs

i	Take-offs (various profiles)
j	Crosswind and downwind take-off (if practicable)
k	Take-off at maximum take-off mass (actual or simulated)
l	Approaches (various profiles)
m	Limited power take-off and landing
n	Autorotations, (FE to select two items from: basic, range, low speed and 360 ° turns)
o	Autorotative landing
p	Practice forced landing with power recovery
q	Power checks, reconnaissance technique, approach and departure technique
SECTION 3 NAVIGATION - EN ROUTE PROCEDURES	
a	Navigation and orientation at various altitudes or heights and map reading
b	Altitude or height, speed, heading control, observation of airspace and altimeter setting
c	Monitoring of flight progress, flight log, fuel usage, endurance, ETA, assessment of track error and re-establishment of correct track and instrument monitoring
d	Observation of weather conditions and diversion planning
e	Use of navigation aids (where available)
f	ATC liaison with due observance of regulations, etc.
SECTION 4 FLIGHT PROCEDURES AND MANOEUVRES	
a	Level flight, control of heading, altitude or height and speed
b	Climbing and descending turns to specified headings
c	Level turns with up to 30 ° bank, 180 ° to 360 ° left and right
d	Level turns 180 ° left and right by sole reference to instruments
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES (SIMULATED WHERE APPROPRIATE)	
Note (1) Where the test is conducted on an ME helicopter, a simulated engine failure drill, including an SE approach and landing should be included in the test.	

Note (2) The FE should select four items from the following:	
a	Engine malfunctions, including governor failure, carburettor or engine icing and oil system, as appropriate
b	Fuel system malfunction
c	Electrical system malfunction
d	Hydraulic system malfunction, including approach and landing without hydraulics, as applicable
e	Main rotor or anti-torque system malfunction (FFS or discussion only)
f	Fire drills, including smoke control and removal, as applicable
g	Other abnormal and emergency procedures as outlined in an appropriate flight manual and with reference to Appendix 9 C to Part-FCL, sections 3 and 4, including for ME helicopters: (a) Simulated engine failure at take-off: (1) rejected take-off at or before TDP or safe forced landing at or before DPATO; (2) shortly after TDP or DPATO. (b) Landing with simulated engine failure: (1) landing or go-around following engine failure before LDP or DPBL; (2) following engine failure after LDP or safe forced landing after DPBL.

AMC3 FCL.235 Skill test

CONTENT OF THE SKILL TEST FOR THE ISSUE OF THE PPL(AS)

(a) The area and route to be flown is chosen by the FE. Routes used for section 3 may end at the aerodrome of departure or at another aerodrome and one destination should be a controlled aerodrome. The skill test may be conducted in two flights. The total duration of the flight(s) should be at least 60 minutes.

(b) The applicant should demonstrate the ability to:

(1) operate the airship within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgement and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the airship at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

Flight test tolerances

(c) The following limits should apply, corrected to make allowance for turbulent conditions and the handling qualities and performance of the airship used.

(1) height:

(i) normal flight ±200 ft

(ii) simulated major emergency ±300 ft

(2) tracking on radio aids: ±15 °

(3) heading:

(i) normal flight ±15 °

(ii) simulated major emergency ±20 °

CONTENT OF THE TEST

(d) The skill test contents and sections set out in this AMC should be used for the skill test for the issue of a PPL(As).

(e) Items in sections 5 and 6 may be performed in an FNPT (As) or a FS (As).

SECTION 1 PRE-FLIGHT OPERATIONS AND DEPARTURE
Use of airship checklists, airmanship, control of airship by external visual reference, anti-icing procedures, and principles of threat and error management, etc. apply in all sections

a	Pre-flight, including: flight planning, documentation, mass and balance, NOTAM and weather briefing
b	Airship inspection and servicing
c	Off-mast procedure, ground manoeuvring and take-off
d	Performance considerations and trim
e	Aerodrome and traffic pattern operations
f	Departure procedure, altimeter setting, collision avoidance (look-out)
g	ATC compliance and R/T procedures
SECTION 2 GENERAL AIRWORK	
a	Control of the airship by external visual reference, including straight and level, climb, descent and look-out
b	Flight close to pressure height
c	Turns
d	Steep descents and climbs
e	Flight by reference solely to instruments, including: i. Level flight, control of heading, altitude and air speed; ii. Climbing and descending turns; iii. Recoveries from unusual attitudes.
f	ATC compliance and R/T procedures
SECTION 3 EN-ROUTE PROCEDURES	
a	Flight plan, dead reckoning and map reading
b	Maintenance of altitude, heading and speed and collision avoidance (look-out procedures)
c	Orientation, timing and revision of ETAs and log keeping
d	Observation of weather conditions and diversion to alternate aerodrome (planning and implementation)
e	Use of radio navigation aids
f	Flight management (checks, fuel systems, etc.)
g	ATC compliance and R/T procedures
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Aerodrome arrival procedures, altimeter setting, checks and look-out

b	ATC compliance and R/T procedures
c	Go-around action
d	Normal landing
e	Short field landing
f	Post-flight actions
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated engine failure after take-off (at a safe altitude) and fire drill
b	Equipment malfunctions
c	Forced landing (simulated)
d	ATC compliance and R/T procedures
e	Oral questions
SECTION 6 RELEVANT TYPE ITEMS	
This section may be combined with sections 1 through 5	
a	Simulated engine failure during take-off (at a safe altitude unless carried out in a FFS)
b	Approach and go-around with failed engine(s)
c	Approach and full stop landing with failed engine(s)
d	Malfunctions in the envelope pressure system
e	ATC compliance, R/T procedures and airmanship
f	As determined by the FE: any relevant items of the type rating skill test to include, if applicable: i. Airship systems; ii. Operation of envelope pressure system.
g	Oral questions

AMC1 FCL.210.A PPL(A) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(A)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The PPL(A) flight instruction syllabus takes into account the principles of threat and error management and also covers:

(i) pre-flight operations, including mass and balance determination, aircraft inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the aircraft by external visual reference;

(iv) flight at critically low air speeds, recognition of, and recovery from, incipient and full stalls;

(v) flight at critically high air speeds, recognition of, and recovery from, spiral dive;

(vi) normal and crosswind take-offs and landings;

(vii) maximum performance (short field and obstacle clearance) take-offs, short-field landings;

(viii) flight by reference solely to instruments, including the completion of a level 180 ° turn;

(ix) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(x) emergency operations, including simulated aeroplane equipment malfunctions;

(xi) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(A) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the aeroplane.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the aeroplane:

(A) characteristics of the aeroplane;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and aeroplane acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) harness, seat or rudder panel adjustments;

(G) starting and warm-up checks;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing (for example tie down);

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects when laterally level and when banked;

(B) further effects of aileron and rudder;

(C) effects of:

(a) air speed;

(b) slipstream;

(c) power;

(d) trimming controls;

(e) flaps;

(f) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5a: Taxiing:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) control of direction and turning;

(E) turning in confined spaces;

(F) parking area procedure and precautions;

(G) effects of wind and use of flying controls;

(H) effects of ground surface;

(I) freedom of rudder movement;

(J) marshalling signals;

(K) instrument checks;

(L) air traffic control procedures.

(vii) Exercise 5b: Emergencies: brake and steering failure.

(viii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) flight at critically high air speeds;

(C) demonstration of inherent stability;

(D) control in pitch, including use of trim;

(E) lateral level, direction and balance and trim;

(F) at selected air speeds (use of power);

(G) during speed and configuration changes;

(H) use of instruments for precision.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) en-route climb (cruise climb);

(D) climbing with flap down;

(E) recovery to normal climb;

(F) maximum angle of climb;

(G) use of instruments for precision.

(x) Exercise 8: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) glide, powered and cruise descent (including effect of power and air speed);

(D) side slipping (on suitable types);

(E) use of instruments for precision flight.

(xi) Exercise 9: Turning:

(A) entry and maintaining medium level turns;

(B) resuming straight flight;

(C) faults in the turn (for example in correct pitch, bank and balance);

(D) climbing turns;

(E) descending turns;

(F) faults in the turns (slipping and skidding on suitable types);

(G) turns onto selected headings, use of gyro heading indicator and compass;

(H) use of instruments for precision.

(xii) Exercise 10a: Slow flight:

Note: the objective is to improve the student's ability to recognise inadvertent flight at critically low speeds and provide practice in maintaining the aeroplane in balance while returning to normal air speed.

(A) safety checks;

(B) introduction to slow flight;

(C) controlled flight down to critically slow air speed;

(D) application of full power with correct attitude and balance to achieve normal climb speed.

(xiii) Exercise 10b: Stalling:

(A) safety checks;

(B) symptoms;

(C) recognition;

(D) clean stall and recovery without power and with power;

(E) recovery when a wing drops;

(F) approach to stall in the approach and in the landing configurations, with and without power and recovery at the incipient stage.

(xiv) Exercise 11: Spin avoidance:

(A) safety checks;

(B) stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45 °);

(C) instructor induced distractions during the stall.

Note 1: at least two hours of stall awareness and spin avoidance flight training should be completed during the course.

Note 2: consideration of manoeuvre limitations and the need to refer to the aeroplane manual and mass and balance calculations.

(xv) Exercise 12: Take-off and climb to downwind position:

(A) pre-take-off checks;

(B) into wind take-off;

(C) safeguarding the nose wheel;

(D) crosswind take-off;

(E) drills during and after take-off;

(F) short take-off and soft field procedure/techniques including performance calculations;

(G) noise abatement procedures.

(xvi) Exercise 13: Circuit, approach and landing:

(A) circuit procedures, downwind and base leg;

(B) powered approach and landing;

(C) safeguarding the nose wheel;

(D) effect of wind on approach and touchdown speeds and use of flaps;

(E) crosswind approach and landing;

(F) glide approach and landing;

(G) short landing and soft field procedures or techniques;

(H) flapless approach and landing;

(I) wheel landing (tail wheel aeroplanes);

(J) missed approach and go-around;

(K) noise abatement procedures.

(xvii) Exercise 12/13: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) mislanding and go-around;

(D) missed approach.

Note: in the interests of safety it will be necessary for pilots trained on nose wheel aeroplanes to undergo dual conversion training before flying tail wheel aeroplanes, and vice-versa.

(xviii) Exercise 14: First solo:

(A) instructor's briefing, observation of flight and de-briefing;

Note: during flights immediately following the solo circuit consolidation the following should be revised:

(B) procedures for leaving and rejoining the circuit;

(C) the local area, restrictions, map reading;

(D) use of radio aids for homing;

(E) turns using magnetic compass, compass errors.

(xix) Exercise 15: Advanced turning:

(A) steep turns (45 °), level and descending;

(B) stalling in the turn and recovery;

(C) recoveries from unusual attitudes, including spiral dives.

(xx) Exercise 16: Forced landing without power:

(A) forced landing procedure;

(B) choice of landing area, provision for change of plan;

(C) gliding distance;

(D) descent plan;

(E) key positions;

(F) engine cooling;

(G) engine failure checks;

(H) use of radio;

(I) base leg;

(J) final approach;

(K) landing;

(L) actions after landing.

(xxi) Exercise 17: Precautionary landing:

(A) full procedure away from aerodrome to break-off height;

(B) occasions necessitating;

(C) in-flight conditions;

(D) landing area selection:

(a) normal aerodrome;

(b) disused aerodrome;

(c) ordinary field.

(E) circuit and approach;

(F) actions after landing.

(xxii) Exercise 18a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) controlled airspace;

(3) danger, prohibited and restricted areas;

(4) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance;
(4) mass and performance.
(d) flight information:
(1) NOTAMs etc.;
(2) radio frequencies;
(3) selection of alternate aerodromes.
(e) aeroplane documentation;
(f) notification of the flight:
(1) pre-flight administrative procedures;
(2) flight plan form.
(B) departure:
(a) organisation of cockpit workload;
(b) departure procedures:
(1) altimeter settings;
(2) ATC liaison in controlled or regulated airspace;
(3) setting heading procedure;
(4) noting of ETAs.
(c) maintenance of altitude and heading;
(d) revisions of ETA and heading;
(e) log keeping;
(f) use of radio;
(g) use of navaids;
(h) minimum weather conditions for continuation of flight;
(i) in-flight decisions;
(j) transiting controlled or regulated airspace;
(k) diversion procedures;
(l) uncertainty of position procedure;
(m) lost procedure.
(C) arrival and aerodrome joining procedure:
(a) ATC liaison in controlled or regulated airspace;
(b) altimeter setting;
(c) entering the traffic pattern;
(d) circuit procedures;
(e) parking;
(f) security of aeroplane;
(g) refuelling;
(h) closing of flight plan, if appropriate;
(i) post-flight administrative procedures.

(xxiii) Exercise 18b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and terrain);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) vertical situational awareness (avoidance of controlled flight into terrain);

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xxiv) Exercise 18c: Radio navigation:

(A) use of GNSS:

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF omni range:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP, frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME:

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xxv) Exercise 19: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation; attitude instrument flight;

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level at various air speeds and configurations;

(b) climbing and descending;

(c) standard rate turns, climbing and descending, onto selected headings;

(d) recoveries from climbing and descending turns.

(d) BITD

(1) A BITD may be used for flight training for:

(i) flight by reference solely to instruments;

(ii) navigation using radio navigation aids;

(iii) basic instrument flight.

(2) The use of the BITD should be subject to the following:

(i) the training should be complemented by exercises on an aeroplane;

(ii) the record of the parameters of the flight must be available;

(iii) A FI(A) or STI(A) should conduct the instruction.

AMC1 FCL.210.H PPL(H) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(H)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Ground instruction

Enhanced ground instruction in weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conducting a precautionary landing.

(c) Flight instruction

(1) The PPL(H) flight instruction syllabus should take into account the principles of threat and error management and cover:

(i) pre-flight operations, including mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic autorotations, simulated engine failure, ground resonance recovery if relevant to type;

(vi) sideways and backwards flight, turns on the spot;

(vii) incipient vortex ring recognition and recovery;

(viii) touchdown autorotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(ix) steep turns;

(x) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(xi) limited power and confined area operations, including selection of and operations to and from unprepared sites;

(xii) flight by sole reference to basic flight instruments, including completion of a level 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud (this training may be conducted by an FI(H));

(xiii) cross-country flying by using visual reference, DR, GNNS and, where available, radio navigation aids; simulation of deteriorating weather conditions and actions to divert or conduct precautionary landing;

(xiv) operations to, from and transiting controlled aerodromes; compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(H) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(3) Wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

(d) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the helicopter.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the helicopter:

(A) characteristics of the helicopter, external features;

(B) cockpit layout;

(C) systems;

(D) checklists, procedures and controls.

(ii) Exercise 1b: Emergency procedures:

(A) action if fire on the ground and in the air;

(B) engine, cabin and electrical system fire;

(C) systems failures;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and helicopter acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) external checks;

(E) internal checks;

(F) seat, harness and flight controls adjustments;

(G) starting and warm-up checks clutch engagement and starting rotors;

(H) power checks;

(I) running down system checks and switching off the engine;

(J) parking, security and picketing;

(K) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience:

(A) to introduce the student to rotary wing flight;

(B) flight exercise.

(v) Exercise 4: Effects of controls:

(A) function of flight controls, primary and secondary effect;

(B) effects of:

(a) air speed;

(b) power changes (torque);

(c) yaw (sideslip);

(d) disc loading (bank and flare);

(e) controls of selecting hydraulics on/off;

(f) control friction.

(C) instruments;

(D) use of carburettor heat or anti-icing control.

(vi) Exercise 5: Power and attitude changes:

(A) relationship between cyclic control position, disc attitude, fuselage attitude and air speed;

(B) flapback;

(C) power required diagram in relation to air speed;

(D) power and air speed changes in level flight;

(E) use of instruments for precision;

(F) engine and air speed limitations.

(vii) Exercise 6: Straight and level:

(A) at normal cruising power, attaining and maintaining straight and level flight;

(B) control in pitch, including use of control friction or trim;

(C) maintaining direction and balance, (ball or yawstring use);

(D) setting power for selected air speeds and speed changes;

(E) use of instruments for precision.

(viii) Exercise 7: Climbing:

(A) optimum climb speed, best angle or rate of climb from power required diagram;

(B) initiation, maintaining the normal and maximum rate of climb, levelling off;

(C) levelling off at selected altitudes or heights;

(D) use of instruments for precision.

(ix) Exercise 8: Descending:

(A) optimum descent speed, best angle or rate of descent from power required diagram;

(B) initiation, maintaining and levelling off;

(C) levelling off at selected altitudes or heights;

(D) descent (including effect of power and air speed);

(E) use of instruments for precision.

(x) Exercise 9: Turning:

(A) initiation and maintaining medium level turns;

(B) resuming straight flight;

(C) altitude, bank and co-ordination;

(D) climbing and descending turns and effect on rate of climb or descent;

(E) turns onto selected headings, use of gyro heading indicator and compass;

(F) use of instruments for precision.

(xi) Exercise 10: Basic autorotation:

(A) safety checks, verbal warning and look-out;

(B) entry, development and characteristics;

(C) control of air speed and RRPM, rotor and engine limitations;

(D) effect of AUM, IAS, disc loading, G forces and density altitude;

(E) re-engagement and go-around procedures (throttle over-ride or ERPM control);

(F) vortex condition during recovery;

(G) gentle and medium turns in autorotation;

(H) demonstration of variable flare simulated engine off landing.

(xii) Exercise 11a: Hovering:

(A) demonstrate hover IGE, importance of wind effect and attitude, ground cushion, stability in the hover and effects of over controlling;

(B) student holding cyclic stick only;

(C) student handling collective lever (and throttle) only;

(D) student handling collective lever, (throttle) and pedals;

(E) student handling all controls;

(F) demonstration of ground effect;

(G) demonstration of wind effect;

(H) demonstrate gentle forward running touchdown;

(I) specific hazards for example snow, dust and litter.

(xiii) Exercise 11b: Hover taxiing and spot turns:

(A) revise hovering;

(B) precise ground speed and height control;

(C) effect of wind direction on helicopter attitude and control margin;

(D) control and co-ordination during spot turns;

(E) carefully introduce gentle forward running touchdown.

(xiv) Exercise 11c: Hovering and taxiing emergencies:

(A) revise hovering and gentle forward running touchdown, explain (demonstrate where applicable) effect of hydraulics failure in the hover;

(B) demonstrate simulated engine failure in the hover and hover taxi;

(C) demonstrate dangers of mishandling and over-pitching.

(xv) Exercise 12: Take-off and landing:

(A) pre-take-off checks or drills;

(B) look-out;

(C) lifting to hover;

(D) after take-off checks;

(E) danger of horizontal movement near ground;

(F) danger of mishandling and overpitching;

(G) landing (without sideways or backwards movement);

(H) after landing checks or drills;

(I) take-off and landing crosswind and downwind.

(xvi) Exercise 13: Transitions from hover to climb and approach to hover:

(A) look-out;

(B) revise take-off and landing;

(C) ground effect, translational lift and its effects;

(D) flapback and its effects;

(E) effect of wind speed and direction during transitions from or to the hover;

(F) the constant angle approach;

(G) demonstration of variable flare simulated engine off landing.

(xvii) Exercise 14a: Circuit, approach and landing:

(A) revise transitions from hover to climb and approach to hover;

(B) circuit procedures, downwind and base leg;

(C) approach and landing with power;

(D) pre-landing checks;

(E) effect of wind on approach and IGE hover;

(F) crosswind approach and landing;

(G) go-around;

(H) noise abatement procedures.

(xviii) Exercise 14b: Steep and limited power approaches and landings:

(A) revise the constant angle approach;

(B) the steep approach (explain danger of high sink rate and low air speed)

(C) limited power approach (explain danger of high speed at touch down);

(D) use of the ground effect;

(E) variable flare simulated engine off landing.

(xix) Exercise 14c: Emergency procedures:

(A) abandoned take-off;

(B) missed approach and go-around;

(C) hydraulic off landing (if applicable);

(D) tail rotor control or tail rotor drive failure (briefing only)

(E) simulated emergencies in the circuit to include:

(a) hydraulics failure;

(b) simulated engine failure on take-off, crosswind, downwind and base leg;

(c) governor failure.

(xx) Exercise 15: First solo:

(A) instructor's briefing, observation of flight and debriefing;

(B) warn of change of attitude from reduced and laterally displaced weight;

(C) warn of low tail, low skid or wheel during hover, landing;

(D) warn of dangers of loss of RRPM and overpitching;

(E) pre-take-off checks;

(F) into wind take-off;

(G) procedures during and after take-off;

(H) normal circuit, approaches and landings;

(I) action if an emergency.

(xxi) Exercise 16: Sideways and backwards hover manoeuvring:

(A) manoeuvring sideways flight heading into wind;

(B) manoeuvring backwards flight heading into wind;

(C) combination of sideways and backwards manoeuvring;

(D) manoeuvring sideways and backwards and heading out of wind;

(E) stability and weather cocking;

(F) recovery from backwards manoeuvring (pitch nose down);

(G) limitations for sideways and backwards manoeuvring.

(xxii) Exercise 17: Spot turns:

(A) revise hovering into wind and downwind;

(B) turn on spot through 360º:

(a) around pilots position;

(b) around tail rotor;

(c) around helicopter geometric centre;

(d) square and safe visibility clearing turn.

(C) rotor RPM control, torque effect, cyclic limiting stops due to CG position and wind speed and direction.

(xxiii) Exercise 18: Hover OGE and vortex ring:

(A) establishing hover OGE;

(B) drift, height or power control;

(C) demonstration of incipient stage of vortex ring, recognition and recovery (from a safe altitude);

(D) loss of tail rotor effectiveness.

(xxiv) Exercise 19: Simulated EOL:

(A) the effect of weight, disc loading, density attitude and RRPM decay;

(B) revise basic autorotation entry;

(C) optimum use of cyclic and collective to control speed or RRPM;

(D) variable flare simulated EOL;

(E) demonstrate constant attitude simulated EOL;

(F) demonstrate simulated EOL from hover or hover taxi;

(G) demonstrate simulated EOL from transition and low level.

(xxv) Exercise 20: Advanced autorotation:

(A) over a selected point at various height and speed;

(B) revise basic autorotation: note ground distance covered;

(C) range autorotation;

(D) low speed autorotation;

(E) constant attitude autorotation (terminate at safe altitude);

(F) 'S' turns;

(G) turns through 180 ° and 360 °;

(H) effects on angles of descent, IAS, RRPM and effect of AUM.

(xxvi) Exercise 21: Practice forced landings:

(A) procedure and choice of the forced landing area;

(B) forced landing checks and crash action;

(C) re-engagement and go-around procedures.

(xxvii) Exercise 22: Steep turns:

(A) steep (level) turns (30 ° bank);

(B) maximum rate turns (45 ° bank if possible);

(C) steep autorotative turns;

(D) faults in the turn: balance, attitude, bank and co-ordination;

(E) RRPM control and disc loading;

(F) vibration and control feedback;

(G) effect of wind at low level.

(xxviii) Exercise 23: Transitions:

(A) revise ground effect, translational lift and flapback;

(B) maintaining constant height, (20-30 ft AGL);

(C) transition from hover to minimum 50 knots IAS and back to hover;

(D) demonstrate effect of wind.

(xxix) Exercise 24: Quick stops:

(A) use of power and controls;

(B) effect of wind;

(C) quick stops into wind;

(D) quick stops from crosswind and downwind terminating into wind;

(E) danger of vortex ring;

(F) danger of high disc loading.

(xxx) Exercise 25a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation and use;

(1) choice of route:

(2) controlled airspace, danger and prohibited areas;

(3) safety altitudes and noise abatement considerations.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;

(2) fuel consumption;

(3) mass and balance.

(d) flight information:

(1) NOTAMs, etc.;

(2) radio frequencies;

(3) selection of alternate landing sites.

(e) helicopter documentation;

(f) notification of the flight:

(1) pre-flight administrative procedures;

(2) flight plan form (where appropriate).

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:

(1) altimeter settings;

(2) ATC liaison in controlled or regulated airspace;

(3) setting heading procedure;

(4) noting of ETAs.

(c) maintenance of height or altitude and heading;

(d) revisions of ETA and heading:

(1) 10 ° line, double track and track error and closing angle;

(2) 1 in 60 rule;

(3) amending an ETA.

(e) log keeping;

(f) use of radio;

(g) use of navaids (if fitted);

(h) minimum weather conditions for continuation of flight;

(i) in-flight decisions;

(j) transiting controlled or regulated airspace;

(k) uncertainty of position procedure;

(l) lost procedure.

(C) arrival and aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures.

(e) parking;

(f) security of helicopter;

(g) refuelling;

(h) closing of flight plan (if appropriate);

(i) post-flight administrative procedures.

(xxxi) Exercise 25b: Navigation problems at low heights and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles and other aircraft);

(C) difficulties of map reading;

(D) effects of wind and turbulence;

(E) avoidance of noise sensitive areas;

(F) actions in the event of encountering DVE;

(G) decision to divert or conduct precautionary landing;

(H) bad weather circuit and landing;

(I) appropriate procedures and choice of landing area;

(J) precautionary landing.

(xxxii) Exercise 25c: Radio navigation:

(A) use of GNSS:

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages;

(d) hazards of over-reliance on the use of GNSS in the continuation of flight in DVE.

(B) use of VHF omni range:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs:

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) RTF procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilots responsibilities;

(d) secondary surveillance radar (if transponder fitted):

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME:

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xxxiii) Exercise 26: Advanced take-off, landings and transitions:

(A) landing and take-off out of wind (performance reduction);

(B) ground effect, translational lift and directional stability variation when out of wind;

(C) downwind transitions;

(D) vertical take-off over obstacles;

(E) running take-off;

(F) cushion creep take-off;

(G) reconnaissance of landing site;

(H) running landing;

(I) zero speed landing;

(J) crosswind and downwind landings;

(K) steep approach;

(L) go-around.

(xxxiv) Exercise 27: Sloping ground:

(A) limitations and assessing slope angle;

(B) wind and slope relationship: blade and control stops;

(C) effect of CG when on slope;

(D) ground effect on slope and power required;

(E) right skid up slope;

(F) left skid up slope;

(G) nose up slope;

(H) avoidance of dynamic roll over, dangers of soft ground and sideways movement on touchdown;

(I) danger of striking main or tail rotor by harsh control movement near ground.

(xxxv) Exercise 28: Limited power:

(A) take-off power check;

(B) vertical take-off over obstacles;

(C) in-flight power check;

(D) running landing;

(E) zero speed landing;

(F) approach to low hover;

(G) approach to hover;

(H) approach to hover OGE;

(I) steep approach;

(J) go-around.

(xxxvi) Exercise 29: Confined areas:

(A) landing capability and performance assessment;

(B) locating landing site and assessing wind speed and direction;

(C) reconnaissance of landing site;

(D) select markers;

(E) select direction and type of approach;

(F) circuit;

(G) approach to committed point and go-around;

(H) approach;

(I) clearing turn;

(J) landing;

(K) power check and performance assessment in and out of ground effect;

(L) normal take-off to best angle of climb speed;

(M) vertical take-off from hover.

(xxxvii) Exercise 30: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation:

(a) attitude instrument flight;

(b) instrument scan.

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level at various air speeds and configurations;

(b) climbing and descending;

(c) standard rate turns, climbing and descending, onto selected headings.

(E) recoveries from climbing and descending turns;

(F) recoveries from unusual attitudes.

(xxxviii) Exercise 31a: Night flying (if night rating required):

(A) pre-flight inspection using torch, pan lights, etc.;

(B) take-off (no sideways or backwards manoeuvring);

(C) hover taxi (higher and slower than by day);

(D) transition to climb;

(E) level flight;

(F) approach and transition to hover;

(G) landing;

(H) autorotation;

(I) practice forced landing (with flares if appropriate: simulated);

(J) night emergencies (for example failure of lights, etc.).

(xxxix) Exercise 31b: Night cross-country (if night rating required):

(A) navigation principles as for day cross-country;

(B) map marking (highlighting built-up areas with thicker lines, etc.).

AMC1 FCL.210.As PPL(As) — Experience requirements and crediting

FLIGHT INSTRUCTION FOR THE PPL(AS)

(a) Entry to training

Before being accepted for training an applicant should be informed that the appropriate medical certificate must be obtained before solo flying is permitted.

(b) Flight instruction

(1) The PPL(As) flight instruction syllabus should take into account the principles of threat and error management and cover:

(i) pre-flight operations, including mass and balance determination, airship inspection and servicing;

(ii) ground manoeuvring, masting and unmasting procedures;

(iii) aerodrome and traffic pattern operations, collision avoidance precautions and procedures;

(iv) control of the airship by external visual reference;

(v) take-offs and landings;

(vi) flight by reference solely to instruments, including the completion of a level 180 ° turn;

(vii) cross-country flying using visual reference, dead reckoning and radio navigation aids;

(viii) emergency operations, including simulated airship equipment malfunctions;

(ix) operations to, from and transiting controlled aerodromes, compliance with air traffic services procedures, communication procedures and phraseology.

(2) Before allowing the applicant for a PPL(As) to undertake his/her first solo flight, the FI should ensure that the applicant can use R/T communication.

(c) Syllabus of flight instruction

(1) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide; therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(i) the applicant's progress and ability;

(ii) the weather conditions affecting the flight;

(iii) the flight time available;

(iv) instructional technique considerations;

(v) the local operating environment;

(vi) applicability of the exercises to the airship.

(2) Each of the exercises involves the need for the applicant to be aware of the needs of good airmanship and look-out, which should be emphasised at all times.

(i) Exercise 1a: Familiarisation with the airship:

(A) characteristics of the airship;

(B) cockpit layout;

(C) systems;

(D) checklists, drills and controls.

(ii) Exercise 1b: Emergency drills:

(A) action if fire on the ground and in the air;

(B) engine cabin and electrical system fire;

(C) systems failure;

(D) escape drills, location and use of emergency equipment and exits.

(iii) Exercise 2: Preparation for and action after flight:

(A) flight authorisation and airship acceptance;

(B) serviceability documents;

(C) equipment required, maps, etc.;

(D) mass and balance;

(E) external checks;

(F) ground crew briefing;

(G) internal checks;

(H) harness, seat or rudder panel adjustments;

(I) starting and warm-up checks;

(J) power checks;

(K) running down system checks and switching off the engine;

(L) parking, security and masting;

(M) completion of authorisation sheet and serviceability documents.

(iv) Exercise 3: Air experience: flight exercise.

(v) Exercise 4: Effects of controls:

(A) primary effects;

(B) further effects;

(C) effects of:

(a) air speed;

(b) power;

(c) trimming controls;

(d) other controls, as applicable.

(D) operation of:

(a) mixture control;

(b) carburettor heat;

(c) cabin heating or ventilation.

(vi) Exercise 5: Ground manoeuvring:

(A) pre-taxi checks;

(B) starting, control of speed and stopping;

(C) engine handling;

(D) masting procedures;

(E) control of direction and turning;

(F) effects of wind;

(G) effects of ground surface;

(H) marshalling signals;

(I) instrument checks;

(J) air traffic control procedures;

(K) emergencies.

(vii) Exercise 6a: Take-off procedures:

(A) pre-take-off checks;

(B) take-off with different static heaviness;

(C) drills during and after take-off;

(D) noise abatement procedures.

(viii) Exercise 6b: Emergencies:

(A) abandoned take-off;

(B) engine failure after take-off;

(C) malfunctions of thrust vector control;

(D) aerodynamic control failures;

(E) electrical and system failures.

(ix) Exercise 7: Climbing:

(A) entry, maintaining the normal and max rate climb and levelling off;

(B) levelling off at selected altitudes;

(C) maximum angle of climb;

(D) maximum rate of climb.

(x) Exercise 8: Straight and level:

(A) attaining and maintaining straight and level flight;

(B) flight at or close to pressure height;

(C) control in pitch, including use of trim;

(D) at selected air speeds (use of power);

(E) during speed changes;

(F) use of instruments for precision.

(xi) Exercise 9: Descending:

(A) entry, maintaining and levelling off;

(B) levelling off at selected altitudes;

(C) maximum rate of descent;

(D) maximum angle of descent;

(E) use of instruments for precision flight.

(xii) Exercise 10: Turning:

(A) entry and maintaining level turns;

(B) resuming straight flight;

(C) faults in the turn;

(D) climbing turns;

(E) descending turns;

(F) turns onto selected headings, use of gyro heading indicator and compass;

(G) use of instruments for precision.

(xiii) Exercise 11: Hovering: hovering manoeuvres (as applicable);

(xiv) Exercise 12a: Approach and landing:

(A) effect of wind on approach and touchdown speeds;

(B) landing with different static heaviness;

(C) missed approach and go-around procedures;

(D) noise abatement procedures.

(xv) Exercise 12b: Emergencies:

(A) aborted approach or go-around;

(B) malfunction of thrust vector control;

(C) envelope emergencies;

(D) fire emergencies;

(E) aerodynamic control failures;

(F) electrical and system failures.

(xvi) Exercise 13: Precautionary landing:

(A) occasions necessitating;

(B) in-flight conditions;

(C) landing area selection;

(D) circuit and approach;

(E) actions after landing;

(xvii) Exercise 14a: Navigation:

(A) flight planning:

(a) weather forecast and actuals;

(b) map selection and preparation:

(1) choice of route;

(2) airspace structure;

(3) sensitive areas;

(4) safety altitudes.

(c) calculations:

(1) magnetic heading(s) and time(s) en-route;
(2) fuel consumption;
(3) mass and balance;
(4) performance.

(d) flight information:
(1) NOTAMs etc.;
(2) radio frequencies;
(3) selection of alternate aerodromes.

(e) airship documentation;

(f) notification of the flight:
(1) pre-flight administrative procedures;
(2) flight plan form.

(B) departure:

(a) organisation of cockpit workload;

(b) departure procedures:
(1) altimeter settings;
(2) ATC liaison in controlled or regulated airspace;
(3) setting heading procedure;
(4) noting of ETAs.

(c) maintenance of altitude and heading;

(d) revisions of ETA and heading;

(e) log keeping;

(f) use of radio;

(g) use of navaids;

(h) minimum weather conditions for continuation of flight;

(i) in-flight decisions;

(j) transiting controlled or regulated airspace;

(k) diversion procedures;

(l) uncertainty of position procedure;

(m) lost procedure.

(C) arrival, aerodrome joining procedure:

(a) ATC liaison in controlled or regulated airspace;

(b) altimeter setting;

(c) entering the traffic pattern;

(d) circuit procedures;

(e) parking or on masting;

(f) security of airship;

(g) refuelling;

(h) closing of flight plan, if appropriate;

(i) post-flight administrative procedures.

(xviii) Exercise 14b: Navigation problems at lower levels and in reduced visibility:

(A) actions before descending;

(B) hazards (for example obstacles, and terrain);

(C) difficulties of map reading;

(D) effects of winds, turbulence and precipitation;

(E) vertical situational awareness;

(F) avoidance of noise sensitive areas;

(G) joining the circuit;

(H) bad weather circuit and landing.

(xix) Exercise 14c: Radio navigation:

(A) use of GNSS

(a) selection of waypoints;

(b) to or from indications and orientation;

(c) error messages.

(B) use of VHF omni range (if applicable):

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) OBS;

(d) to or from indications and orientation;

(e) CDI;

(f) determination of radial;

(g) intercepting and maintaining a radial;

(h) VOR passage;

(i) obtaining a fix from two VORs.

(C) use of ADF equipment: NDBs (if applicable):

(a) availability, AIP and frequencies;

(b) selection and identification;

(c) orientation relative to the beacon;

(d) homing.

(D) use of VHF/DF:

(a) availability, AIP and frequencies;

(b) R/T procedures and ATC liaison;

(c) obtaining a QDM and homing.

(E) use of en-route or terminal radar:

(a) availability and AIP;

(b) procedures and ATC liaison;

(c) pilot's responsibilities;

(d) secondary surveillance radar:

(1) transponders;

(2) code selection;

(3) interrogation and reply.

(F) use of DME (if applicable);

(a) station selection and identification;

(b) modes of operation: distance, groundspeed and time to run.

(xx) Exercise 15: Basic instrument flight:

(A) physiological sensations;

(B) instrument appreciation: attitude instrument flight;

(C) instrument limitations;

(D) basic manoeuvres:

(a) straight and level;

(b) climbing and descending;

(c) turns, climbing and descending, onto selected headings;

(d) recoveries from climbing and descending turns.

(d) BITD

(1) A BITD may be used for flight training for:

(i) flight by reference solely to instruments;

(ii) navigation using radio navigation aids;

(iii) basic instrument flight.

(2) The use of the BITD should be subject to the following:

(i) the training should be complemented by exercises on an airship;

(ii) the record of the parameters of the flight must be available; and an FI(As) should conduct the instruction.

AMC1 FCL.205.S(b) SPL — Privileges and conditions

CONTENTS OF THE PROFICIENCY CHECK FOR THE EXTENSION OF SPL PRIVILEGES TO EXERCISE COMMERCIAL PRIVILEGES ON A SAILPLANE

(a) The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the authorised checklist for the sailplane on which the test is being taken.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the sailplane within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the sailplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

CONTENT OF THE SKILL TEST

(d) The applicant should demonstrate his/her skill in at least the winch or aerotow method of launching.

SECTION 1 PRE-FLIGHT OPERATIONS AND TAKE-OFF	
Use of checklist, airmanship, control of sailplane by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight sailplane (daily) inspection, documentation, NOTAM and weather briefing
b	Verifying in-limits mass and balance and performance calculation
c	Passenger briefing
d	Sailplane servicing compliance
e	Pre-take-off checks
SECTION 2 LAUNCH METHOD Note: at least for one of the three launch methods all the mentioned items are fully exercised during the skill test.	
SECTION 2 (a) WINCH OR CAR LAUNCH	
a	Signals before and during launch, including messages to winch driver
b	Initial roll and take-off climb
c	Adequate profile of winch launch

d	Launch failures (simulated)
e	Situational awareness
SECTION 2 (b) AEROTOW LAUNCH	
a	Signals before and during launch, including signals to or communications with tow plane pilot for any problems
b	Initial roll and take-off climb
c	Launch abandonment (simulation only or 'talk-through')
d	Correct positioning during straight flight and turns
e	Out of position and recovery
f	Correct release from tow
g	Lookout and airmanship through whole launch phase
SECTION 2 (c) SELF LAUNCH (TMGs excluded)	
a	ATC compliance
b	Aerodrome departure procedures
c	Initial roll and take-off climb
d	Simulated engine failure after take-off
e	Engine shut down and stowage
f	Lookout and airmanship through whole launch phase
SECTION 3 GENERAL AIRWORK	
a	Maintain straight flight: attitude and speed control
b	Steep (45 ° bank) turns, look-out procedures and collision avoidance
c	Turning on to selected headings visually and with use of compass
d	Flight at high angle of attack (critically low air speed)
e	Clean stall and recovery
f	Spin avoidance and recovery
g	Local area navigation and awareness
SECTION 4 CIRCUIT, APPROACH AND LANDING	
a	Aerodrome circuit joining procedure
b	Collision avoidance: look-out procedures
c	Pre-landing checks
d	Circuit, approach control and landing
e	Precision landing (simulation of out-landing: short field)
f	Cross wind landing if suitable conditions available

AMC1 FCL.205.B(b) BPL — Privileges and conditions

CONTENTS OF THE PROFICIENCY CHECK FOR EXTENSION OF BPL PRIVILEGES TO EXERCISE COMMERCIAL PRIVILEGES ON A BALLOON

(a) The take-off site should be chosen by the applicant depending on the actual meteorological conditions, the area which has to be overflown and the possible options for suitable landing sites. The applicant should be responsible for the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The proficiency check may be conducted in two flights. The total duration of the flight(s) should be at least 60 minutes.

(b) An applicant should indicate to the FE the checks and duties carried out. Checks should be completed in accordance with the flight manual or the authorised checklist for the balloon on which the test is being taken. During pre-flight preparation for the test the applicant should be required to perform crew and passenger briefings and demonstrate crowd control. The load calculation should be performed by the applicant in compliance with the operations manual or flight manual for the balloon used.

Flight Test Tolerance

(c) The applicant should demonstrate the ability to:

(1) operate the balloon within its limitations;

(2) complete all manoeuvres with smoothness and accuracy;

(3) exercise good judgment and airmanship;

(4) apply aeronautical knowledge;

(5) maintain control of the balloon at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(d) The following limits are for general guidance. The FE should make allowance for turbulent conditions and the handling qualities and performance of the hot-air balloon used:

Height

(1)	normal flight	± 100 ft
(2)	with simulated emergency	± 150 ft

CONTENT OF THE SKILL TEST

(e) The contents and sections of the proficiency check set out in this AMC should be used for the extension of BPL privileges to exercise commercial privileges on a hot-air balloon.

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.

a	Pre-flight documentation, flight planning, NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control and crew briefing
e	Passenger briefing
f	Assembly and layout
g	Inflation and pre-take-off procedures
h	Take-off
i	ATC compliance
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight
b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC compliance
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation, airspace structure
d	Maintenance of altitude
e	Fuel management
f	Communication with retrieve crew
g	ATC compliance or R/T communication
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level and missed approach and fly on
b	Approach from high level and missed approach and fly on
c	Passenger pre-landing briefing
d	Pre-landing checks

e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance or R/T communication
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 6	
a	Simulated fire on the ground and in the air
b	Simulated pilot light and burner failures
c	Simulated passenger health problems
d	Other abnormal and emergency procedures as outlined in the appropriate flight manual
e	Oral questions

(f) The contents and sections of the proficiency check set out in this AMC should be used for the extension of BPL privileges to exercise commercial privileges on a gas balloon.

SECTION 1 PRE-FLIGHT OPERATIONS, INFLATION AND TAKE-OFF	
Use of checklist, airmanship, control of balloon by external visual reference, look-out procedures, etc. apply in all sections.	
a	Pre-flight documentation, flight planning and NOTAM and weather briefing
b	Balloon inspection and servicing
c	Load calculation
d	Crowd control and crew briefings
e	Passenger briefing
f	Assembly and layout
g	Inflation and pre-take-off procedures
h	Take-off
i	ATC liaison: compliance
SECTION 2 GENERAL AIRWORK	
a	Climb to level flight

b	Level flight
c	Descent to level flight
d	Operating at low level
e	ATC liaison: compliance
SECTION 3 EN-ROUTE PROCEDURES	
a	Dead reckoning and map reading
b	Marking positions and time
c	Orientation, airspace structure
d	Maintenance of altitude
e	Ballast management
f	Communication with retrieve crew
g	ATC compliance or R/T communication
SECTION 4 APPROACH AND LANDING PROCEDURES	
a	Approach from low level and missed approach and fly on
b	Approach from high level and missed approach and fly on
c	Passenger pre-landing briefing
d	Pre-landing checks
e	Selection of landing field
f	Landing, dragging and deflation
g	ATC compliance or R/T communication
h	Actions after flight
SECTION 5 ABNORMAL AND EMERGENCY PROCEDURES	
This section may be combined with sections 1 through 4	
a	Simulated closed appendix during take-off and climb
b	Simulated parachute or valve failure
c	Simulated passenger health problems
d	Other abnormal and emergency procedures as outlined in the appropriate flight manual
e	Oral questions

AMC1 FCL.225.B BPL — Extension of privileges to another balloon class or group

(a) The aim of the flight training is to qualify BPL holders to exercise the privileges on a different class or group of balloons.

(b) The following classes should be recognised:

(1) hot-air balloons;

(2) gas balloons;

(3) hot-air airships.

(c) The following groups should be recognised:

(1) group A:

(i) hot-air balloons and hot-air airships with a maximum envelope capacity of 3 400m³;

(ii) gas balloons with a maximum envelope capacity of 1 260m³.

(2) group B:

(i) hot-air balloons and hot-air airship with an envelope capacity between 3 401m³ and 6 000m³;

(ii) gas balloons with an envelope capacity of more than 1 260m³.

(3) group C:

hot-air balloons and hot-air airship with an envelope capacity between 6 001m³ and 10 500m³.

(4) group D:

hot-air balloons and hot-air airships with an envelope capacity of more than 10 500m³.

(d) An extension to group B is also valid for group A. The extension for the group C is also valid for the groups A and B. An extension to group D will include the privilege for the other three groups.

(e) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

SUBPART D — COMMERCIAL PILOT LICENCE — CPL

AMC1 FCL.310; FCL.515 (b); FCL.615 (b)

Acceptable Means of Compliance and Guidance Material to Part-FCL (Learning Objectives (LOs)) — Amendment 2

Learning Objectives (LOs)

Table of contents

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LOs FOR ATPL, CPL AND IR

GENERAL

The detailed theoretical knowledge syllabus outlines the topics that should be taught and examined in order to meet the theoretical knowledge requirements appropriate to ATPL, MPL, CPL and IR.

For each topic in the detailed theoretical knowledge syllabus, one or more LOs are set out in the chapters as shown below.

Reference	***Subject***	***Chapter***
010	***Air law and ATC procedures***	A.
020	***Aircraft general knowledge***	
021	*Airframe and systems, electrics, power plant and emergency equipment*	B.
022	*Instrumentation*	C.
030	***Flight performance and planning***	
031	*Mass and balance*	D.
032	*Performance (Aeroplane)*	E.
033	*Flight planning and monitoring*	F.
034	*Performance (Helicopter)*	G.
040	***Human performance and limitations***	H.
050	***Meteorology***	I.
060	***Navigation***	
061	*General navigation*	J.
062	*Radio navigation*	K.
070	***Operational procedures***	L.
080	***Principles of flight***	
081	*Principles of flight (Aeroplane)*	M.
082	*Principles of flight (Helicopter)*	N.
090	***Communications***	
091	*VFR communications*	O.
092	*IFR communications*	P.

The applicable LOs for each licence or the instrument rating are marked with an ‘x’.

The LOs define the theoretical knowledge that a student should have assimilated upon successful completion of an approved theoretical knowledge course prior to undertaking the theoretical knowledge examinations. They refer to measurable statements of the skills and knowledge that a student should be able to demonstrate following a defined element of training.

The LOs are intended to be used by an approved training organisation (ATO) when developing the Part-FCL theoretical knowledge elements of the appropriate course. It should be noted, however, that the LOs do not provide a ready-made ground-training syllabus for individual ATOs, and should not be seen by organisations as a substitute for thorough course design. Adherence to the LOs should become part of the ATO's compliance monitoring scheme as required by ORA.GEN.200(a)(6). Any consequential changes to the organisation's documentation should not result in an approval process in accordance with ORA.GEN.130(a). In any case, the ATO should remain responsible for ensuring that the respective theoretical knowledge training courses are carried out while taking into account the LOs provided in this AMC.

TRAINING AIMS

After completion of the training, a student should be able to apply the acquired knowledge and skills to:

— understand the capabilities and limitations of the equipment used;

— identify sources of information and analyse information relevant to the operation;

— identify hazards, assess risks and manage threats;

— apply solutions to common problems including errors.

Specific examples of the application of knowledge and skills will be provided in the respective appendix to a subject, if needed.

INTERPRETATION

The abbreviations used are ICAO abbreviations listed in ICAO Doc 8400 'ICAO Abbreviations and Codes', or those listed in GM1 FCL.010.

Where an LO refers to a definition, e.g. 'Define the following terms' or 'Define and understand' or 'Explain the definitions in ...', candidates are also expected to be able to recognise a given definition.

Below is a table showing the short references to legislation and standards:

Reference	**Legislation/Standard**
The Basic Regulation	Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 (as amended)
The Aircrew Regulation	Commission Regulation (EU) No 1178/2011 of 3 November 2011 (as amended)
Part-FCL	Annex I to Commission Regulation (EU) No 1178/ 2011 of 3 November 2011 (as amended)
Part-MED	Annex IV to Commission Regulation (EU) No 1178/ 2011 of 3 November 2011 (as amended)
CS-23, CS-25, CS-27, CS-29, CS-E and CS-Definitions	Refer to the CS parts in Book 1 of the correspondingly numbered EASA Certification Specifications
AMC-23, AMC-25, etc.	Refer to the AMC parts in Book 2 of the correspondingly numbered EASA Certification Specifications
Single European Sky Regulations	Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation)

	Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation) Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation) Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
Passenger Rights Regulation	Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91
RTCA/EUROCAE	*Refers to correspondingly numbered documents* Radio Technical Commission for Aeronautics/European Organisation for Civil Aviation Equipment
ITU Radio Regulation	International Telecommunication Union Radio Regulation
NASA TM-85652	National Aeronautics and Space Administration — Technical Memorandum 85652

'Applicable operational requirements' means Annexes I, II, III, IV and V to Commission Regulation (EU) No 965/2012 of 5 October 2012 (as amended).

The Jeppesen Student Pilots' Training Route Manual (SPTRM), otherwise known as the 'Training Route Manual' (TRM), contains planning data plus aerodrome and approach charts that may be used in theoretical knowledge training courses.

Specimen data manuals, CAP 697 for Aeroplanes and CAP 758 for Helicopters, may be used in training courses and for reference during theoretical knowledge examinations. Where the competent authority does not permit the use of these manuals during examinations, alternative data manuals shall be provided to support the relevant questions. Definitions that are included in these data manuals are explained in the relevant manual.

Some numerical data, e.g. speeds, altitudes/levels and masses, used in questions for theoretical knowledge examinations may not be representative for helicopter operations but the data is satisfactory for the calculations required.

A. SUBJECT 010 — AIR LAW

(1) The subjects 'Air law' and 'ATC procedures' are primarily based on ICAO documentation and European Union regulations.

(2) National law should not be taken into account for theoretical-examination purposes; it should remain relevant though during practical training and operational flying.

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 00 00 00	**AIR LAW**						
010 01 00 00	**INTERNATIONAL LAW: CONVENTIONS, AGREEMENTS AND ORGANISATIONS**						
010 01 01 00	**The Convention on International Civil Aviation (Chicago) — ICAO DOC 7300**						
LO	Explain the historical background that led to the establishment of the Convention on International Civil Aviation, Chicago, 7 December 1944.	x	x	x	x	x	
010 01 01 01	**Part I — Air navigation**						
LO	Be familiar with the general contents of relevant parts of the following chapters: — general principles and application of the Convention; — flight over territory of Contracting States; — nationality of aircraft; — measures to facilitate air navigation; — conditions to be fulfilled with respect to aircraft; — international standards and recommended practices (SARPs), especially notification of differences and validity of endorsed certificates and licences.	x	x	x	x	x	
LO	General principles Describe the application of the following terms in civil aviation: — sovereignty; — territory, high seas, according to the UN Convention on the High Seas.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the following terms and explain how they apply to international air traffic: — right of non-scheduled flight (including the two technical freedoms of the air); scheduled air services; cabotage; landing at customs airports; applicability of air regulations; rules of the air; search of aircraft.	x	x	x	x	x	
LO	Describe the duties of Contracting States in relation to: documents carried on board of the aircraft: • certificate of registration; • certificates of airworthiness; • licences of personnel; • recognition of certificates and licences; cargo restrictions; photographic apparatus.	x	x	x	x	x	
010 01 01 02	**Part II — The International Civil Aviation Organization (ICAO)**						
LO	Describe the objectives of ICAO.	x	x	x	x	x	
LO	Explain the organisation and duties of the ICAO Assembly, Council and Air Navigation Commission (ANC).	x	x	x	x	x	
LO	Explain the organisation and duties of the ICAO Headquarters and Regional Offices.	x	x	x	x	x	
LO	Describe the worldwide ICAO regions.	x	x	x	x	x	
LO	Be familiar with the hierarchy of the ICAO publications (SARPs, Docs): annexes to the Convention; documents.	x	x	x	x	x	
010 01 02 00	**Other conventions and agreements**						
010 01 02 01	**The International Air Services Transit Agreement (ICAO Doc 7500)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the two technical freedoms of the air.	x	x	x	x	x	
010 01 02 02	**The International Air Transport Agreement**						
LO	Explain the three commercial freedoms of the air.	x	x	x	x	x	
LO	Describe the legal situation within the EU with regard to the Freedoms of the Air.	x	x	x	x	x	
010 01 02 03	**Suppression of unlawful acts against the safety of civil aviation; the Conventions of Tokyo, Den Haag and Montreal**						
LO	Explain the facts that led to the Conventions and Supplements concerning unlawful acts against the safety of civil aviation.	x	x	x	x	x	
LO	Explain the content of the Convention on Unlawful Acts Committed on Board Aircraft. (Doc 8364 — Convention on Offences and Certain Other Acts Committed on Board Aircraft, Tokyo, 14 September 1963)	x	x	x	x	x	
LO	Explain the content of the Convention on Suppression of Unlawful Seizure of Aircraft. (Doc 8920 — Convention for the Suppression of Unlawful Seizure of Aircraft, Den Haag, 16 December 1970, and Protocol for the Suppression of Unlawful Acts against the Safety of Civil Aviation, Montreal, 23 September 1971)	x	x	x	x	x	
LO	Explain the content of the Convention on Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation in accordance with Doc 8966 — Convention for the Suppression of Unlawful Acts against the Safety of Civil	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Aviation, done at Montreal on 23 September 1971, and signed at Montreal on 24 February 1988).						
LO	Describe the measures and actions to be taken by the PIC of an aircraft in order to suppress unlawful acts against the safety of the aircraft. (Doc 9518 — Protocol supplementary to the Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation, done at Montreal on 23 September 1971, and signed at Montreal on 24 February 1988)	x	x	x	x	x	
010 01 02 04	**Bilateral agreements**						
LO	Explain the reason for the existence of bilateral agreements for scheduled air transport (Digest of Bilateral Air Transport Agreements, ICAO Doc 9511).	x		x	x		
010 01 02 05	**International private law**						
LO	Explain the Conventions and Protocols designed to cover liability towards persons and goods in accordance with the Warsaw System based on the Convention for the Unification of Certain Rules Relating to International Carriage by Air, Warsaw, 2 October 1929.	x	x	x	x	x	
LO	Explain the legal significance of the issue of a passenger ticket and/or of baggage/cargo documents.	x	x	x	x	x	
LO	Describe the consequences for an airline and/or the PIC when a passenger ticket is not issued.	x	x	x	x	x	
LO	Explain that the liability towards persons and goods may be unlimited on the basis	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	of the Montreal Convention of 28 May 1999.						
LO	Explain the consequences of the EU Regulation about passenger rights in case of delay, cancellation or denied boarding.	x	x	x	x	x	
LO	Explain the liability limit in relation to destruction, loss, damage or delay of baggage.	x	x	x	x	x	
010 01 02 06	**Operators' and pilots' liabilities towards persons and goods on the ground in case of damage and injury caused by the operation of the aircraft**						
LO	• Explain the Conventions and Protocols designed to cover liability towards persons and goods on the ground based on the International Convention for rules relating to Damage Caused by aircraft, signed at Rome on 29 May 1933 and on 7 October 1952, and at Montreal on 23 September 1978.	x	x	x	x	x	
010 01 02 07	**The Convention of Rome (1933) and other documents related to rights in aircraft.**						
LO	Understand the rules relating to international recognition of rights in aircraft and the rules relating to precautionary arrest of aircraft.	x	x	x	x	x	
010 01 03 00	**World organisations**						
010 01 03 01	**The International Air Transport Association (IATA)**						
LO	Describe the general organisation and objectives of IATA.	x		x	x		
010 01 04 00	**European organisations**						
010 01 04 01	**European Aviation Safety Agency (EASA)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the general organisation and objectives of EASA.	x	x	x	x	x	
LO	Describe the role of EASA in European civil aviation.	x	x	x	x	x	
LO	Describe the role of the National Aviation Authorities (NAAs) in relation to EASA.	x	x	x	x	x	
LO	Give an overview of the EASA Regulations' structure.	x	x	x	x	x	
LO	Describe the relationship between EASA, ICAO and other organisations.	x	x	x	x	x	
010 01 04 02	**EUROCONTROL**						
LO	Describe the objectives of the Convention relating to the Cooperation for the Safety of Air Navigation (EUROCONTROL) and the Single European Sky (SES) Regulations.	x	x	x	x	x	
010 01 04 03	**European Civil Aviation Conference (ECAC)**						
LO	Give a brief summary of the European Civil Aviation Conference (ECAC).	x	x	x	x	x	
010 02 00 00	**AIRWORTHINESS OF AIRCRAFT**						
010 02 01 00	**ICAO Annex 8 and the related Certification Specifications**						
LO	Explain the definitions of ICAO Annex 8.	x	x	x	x	x	
LO	Explain how the Airworthiness Standards of ICAO Annex 8 and the Certification Specifications (CSs) are related to each other.	x	x	x	x	x	
LO	State which aircraft the Standards of ICAO Annex 8 and the CSs shall apply to.	x	x	x	x	x	
010 02 02 00	**Certificate of Airworthiness (CofA)**						
LO	State the issuing authority of a CofA.	x	x	x	x	x	
LO	State the necessity to have a CofA.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the various elements that are required for a CofA.	x	x	x	x	x	
LO	State who shall determine an aircraft's continuing airworthiness.	x	x	x	x	x	
LO	Describe how a Certificate of Airworthiness can be renewed or may remain valid.	x	x	x	x	x	
010 03 00 00	**AIRCRAFT NATIONALITY AND REGISTRATION MARKS**						
010 03 01 00	**Definitions of ICAO Annex 7**						
LO	Recall the definitions of the following terms: — aircraft; — heavier-than-air aircraft; — State of Registry.	x	x	x	x	x	
010 03 02 00	**Aircraft nationality, common and registration marks to be used**						
LO	State the location of nationality and common and registration marks.	x		x			
LO	Explain the combination of nationality and registration marks (sequence, use of hyphen).	x	x	x	x	x	
LO	State who is responsible for assigning registration marks.	x	x	x	x	x	
010 04 00 00	**PERSONNEL LICENSING**						
010 04 01 00	**ICAO Annex 1**						
010 04 01 01	**Differences between ICAO Annex 1 and the Aircrew Regulation**						
LO	Describe the relationship and differences between ICAO Annex 1 and the Aircrew Regulation.	x	x	x	x	x	x
010 04 02 00	**Part-FCL**						
010 04 02 01	**Definitions**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the following: category of aircraft, cross-country, dual instruction time, flight time, SPIC, instrument time, instrument flight time, instrument ground time, MCC, multi-pilot aircraft, night, private pilot, proficiency check, renewal, revalidation, skill test, solo flight time, type of aircraft.	x	x	x	x	x	x
010 04 02 02	**Content and structure**						
LO	• Explain the structure of Part FCL.	x	x	x	x	x	x
LO	• Understand the difference between Part-FCL and AMC/GM to Part-FCL.	x	x	x	x	x	x
LO	• Explain the requirements to act as a flight crew member of a civil aircraft registered in a Member State.	x	x	x	x	x	x
LO	• State to what extent Member States will accept certificates issued by other Member States.	x	x	x	x	x	x
LO	• List the two factors that are relevant to the exercise of the privileges of a licence.	x	x	x	x	x	x
LO	• State the circumstances in which a language-proficiency endorsement is required.	x	x	x	x	x	x
LO	• List the restrictions for licence holders with an age of 60 years or more.	x	x	x	x	x	
LO	• Explain the term 'competent authority'.	x	x	x	x	x	x
LO	• Describe the obligation to carry and present documents (e.g. a flight crew licence) under Part-FCL.	x	x	x	x	x	x
010 04 02 03	**Commercial Pilot Licence (CPL)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirements for the issue of a CPL.	x	x	x	x	x	
LO	State the privileges of a CPL.	x	x	x	x	x	
010 04 02 04	**Airline Transport Pilot Licence (ATPL) and Multi-crew Pilot Licence (MPL)**						
LO	State the requirements for the issue of an ATPL and MPL.	x		x	x		
LO	State the privileges of an ATPL and MPL.	x		x	x		
010 04 02 05	**Ratings**						
LO	Explain the requirements for class ratings, their validity and privileges.	x	x				
LO	Explain the requirements for type ratings, their validity and privileges.	x	x	x	x	x	
LO	Explain the requirements for instrument ratings, their validity and privileges.	x		x			x
010 04 03 00	**Part-MED**						
LO	Describe the relevant content of Part-MED — Medical Requirements (administrative parts and requirements related to licensing only).	x	x	x	x	x	x
LO	State the requirements for a medical certificate.	x	x	x	x	x	x
LO	Name the kind of medical certificate required when exercising the privileges of a CPL or ATPL.	x	x	x	x	x	
LO	State the actions to be taken in case of a decrease in medical fitness.	x	x	x	x	x	x
010 05 00 00	**RULES OF THE AIR**						
010 05 01 00	**Definitions of ICAO Annex 2**						
LO	Explain the definitions of ICAO Annex 2.	x	x	x	x	x	x
010 05 02 00	**Applicability of the Rules of the Air**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the territorial application of the ICAO Rules of the Air.	x	x	x	x	x	
LO	Explain the compliance with the Rules of the Air.	x	x	x	x	x	
LO	State who on board an aircraft is primarily responsible for the operation of the aircraft in accordance with the Rules of the Air.	x	x	x	x	x	
LO	Indicate under what circumstances departure from the Rules of the Air may be allowed.	x	x	x	x	x	
LO	Explain the duties of the PIC concerning pre-flight actions in case of an IFR flight.	x		x			x
LO	State who has the final authority as to the disposition of the aircraft.	x	x	x	x	x	
LO	Explain the problematic in the use of psychoactive substances by flight crew members.	x	x	x	x	x	x
010 05 03 00	**General rules**						
LO	Describe the rules for the avoidance of collisions.	x	x	x	x	x	
LO	Describe the lights to be displayed by aircraft.	x	x	x	x	x	
LO	Understand marshalling signals.	x	x	x	x	x	
LO	State the basic requirements for minimum height for the flight over congested areas of cities, towns or settlements, or over an open-air assembly of persons.	x	x	x	x	x	
LO	Define when the cruising levels shall be expressed in terms of flight levels (FL).	x	x	x	x	x	
LO	Define under what circumstances cruising levels shall be expressed in terms of altitudes.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the limitation for proximity to other aircraft and the right-of-way rules, including holding at runway-holding positions and lighted stop bars.	x	x	x	x	x	
LO	Describe the meaning of light signals displayed to and by the aircraft.	x	x	x	x	x	
LO	Describe the requirements when carrying out simulated instrument flights.	x		x			x
LO	Indicate the basic rules for an aircraft operating on and in the vicinity of an aerodrome (AD).	x	x	x	x	x	
LO	Explain the requirements for the submission of an ATS flight plan.	x	x	x	x	x	
LO	Explain why a time check has to be obtained before the flight.	x	x	x	x	x	x
LO	Explain the actions to be taken in case of flight-plan change or delay.	x	x	x	x	x	x
LO	State the actions to be taken in case of inadvertent changes to track, true airspeed (TAS) and time estimate affecting the current flight plan.	x	x	x	x	x	x
LO	Explain the procedures for closing a flight plan.	x	x	x	x	x	
LO	State for which flights an air traffic control clearance shall be obtained.	x	x	x	x	x	
LO	State how a pilot may request an air traffic control clearance.	x	x	x	x	x	
LO	State the action to be taken if an air traffic control clearance is not satisfactory to a pilot-in-command.	x	x	x	x	x	
LO	Describe the required actions to be carried out if the continuation of a controlled VFR flight in VMC is not practicable anymore.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the provisions for transmitting a position report to the appropriate ATS unit including time of transmission and normal content of the message.	x	x	x	x	x	x
LO	Describe the necessary action when an aircraft experiences a COM failure.	x	x	x	x	x	x
LO	State what information an aircraft being subjected to unlawful interference shall give to the appropriate ATS unit.	x	x	x	x	x	x
010 05 04 00	**Visual Flight Rules (VFRs)**						
LO	Describe the Visual Flight Rules as contained in Chapter 4 of ICAO Annex 2.	x	x	x	x	x	
010 05 05 00	**Instrument Flight Rules (IFRs)**						
LO	Describe the Instrument Flight Rules as contained in Chapter 5 of ICAO Annex 2.	x		x			x
010 05 06 00	**Interception of civil aircraft**						
LO	List the possible reasons for intercepting a civil aircraft.	x	x	x	x	x	
LO	State what primary action should be carried out by an intercepted aircraft.	x	x	x	x	x	
LO	State which frequency should primarily be tried in order to contact an intercepting aircraft.	x	x	x	x	x	
LO	State on which mode and code a transponder on board the intercepted aircraft should be operated.	x	x	x	x	x	
LO	Recall the interception signals and phrases.	x	x	x	x	x	
010 06 00 00	**PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS-OPS)**						
010 06 01 00	**Foreword and introduction**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Translate the term 'PANS-OPS' into plain language.	x		x			x
LO	State the general aim of PANS-OPS Flight Procedures (ICAO Doc 8168, Volume I).	x		x			x
010 06 02 00	**Definitions and abbreviations**						
LO	Recall all definitions included in ICAO Doc 8168, Volume I, Part I, Chapter 1.	x		x			x
LO	Interpret all abbreviations as shown in ICAO Doc 8168, Volume I, Part I, Chapter 2.	x		x			x
010 06 03 00	**Departure procedures**						
010 06 03 01	**General criteria (assuming all engines operating)**						
LO	Name the factors dictating the design of instrument-departure procedures.	x		x			x
LO	Explain in which situations the criteria for omnidirectional departures are applied.	x		x			x
010 06 03 02	**Standard instrument departures (SIDs)**						
LO	Define the terms 'straight departure' and 'turning departure'.	x		x			x
LO	State the responsibility of the operator when unable to utilise the published departure procedures.	x		x			x
010 06 03 03	**Omnidirectional departures**						
LO	Explain when the 'omnidirectional method' is used for departure.	x		x			x
LO	Describe the solutions when an omnidirectional procedure is not possible.	x		x			x
010 06 03 04	**Published information**						
LO	State the conditions for the publication of a SID and/or RNAV route.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe how omnidirectional departures are expressed in the appropriate publication.	x		x			x
010 06 03 05	**Area Navigation (RNAV) departure procedures and RNP-based departures**						
LO	Explain the relationship between RNAV/RNP-based departure procedures and those for approaches.	x		x			x
010 06 04 00	**Approach procedures**						
010 06 04 01	**General criteria**						
LO	General criteria (except the table 'Speeds for procedure calculations') of the approach procedure design: instrument approach areas; accuracy of fixes; fixes formed by intersections; intersection fix-tolerance factors; other fix-tolerance factors; approach area splays; descent gradient.	x		x			x
LO	Name the five possible segments of an instrument approach procedure.	x		x			x
LO	Give reasons for establishing aircraft categories for the approach.	x		x			x
LO	State the maximum angle between the final approach track and the extended RWY centre line to still consider a non-precision-approach as being a 'straight-in approach'.	x		x			x
LO	State the minimum obstacle clearance provided by the minimum sector altitudes (MSAs) established for an aerodrome.	x		x			x
LO	Describe the point of origin, shape, size and subdivisions of the area used for MSAs.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that a pilot shall apply wind corrections when carrying out an instrument-approach procedure.	x		x			x
LO	Name the most significant performance factor influencing the conduct of instrument-approach procedures.	x		x			x
LO	Explain why a pilot should not descend below OCA/Hs which are established for: precision-approach procedures; non-precision-approach procedures; visual (circling) procedures.	x		x			x
LO	Describe in general terms the relevant factors for the calculation of operational minima.	x		x			x
LO	Translate the following acronyms into plain language: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H.	x		x			x
LO	Explain the relationship between the terms: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H.	x		x			x
010 06 04 02	**Approach-procedure design**						
LO	Describe how the vertical cross section for each of the five approach segments is broken down into the various areas.	x		x			x
LO	State within which area of the cross section the Minimum Obstacle Clearance (MOC) is provided for the whole width of the area.	x		x			x
LO	Define the terms ‘IAF’, ‘IF’, ‘FAF’, ‘MAPt’ and ‘TP’.	x		x			x
LO	Name the area within which the plotted point of an intersection fix may lie.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain by which factors the dimensions of an intersection fix are determined.	x		x			x
LO	State the accuracy of facilities providing track (VOR, ILS, NDB).	x		x			x
LO	Describe the 'other fix-tolerance factors': surveillance radar (Terminal Area Radar (TAR)), En Route Surveillance Radar (RSR), DME, 75 MHz marker beacon, fixes overhead a station (VOR, NDB).	x		x			x
LO	Describe the basic information relating to approach-area splays.	x		x			x
LO	State the optimum descent gradient (preferred for a precision approach) in degrees and per cent.	x		x			x
010 06 04 03	**Arrival and approach segments**						
LO	Name the five standard segments of an instrument APP procedure and state the beginning and end for each of them.	x		x			x
LO	Describe where an ARR route normally ends.	x		x			x
LO	State whether or not omnidirectional or sector arrivals can be provided.	x		x			x
LO	Explain the main task of the initial APP segment.	x		x			x
LO	Describe the maximum angle of interception between the initial APP segment and the intermediate APP segment (provided at the intermediate fix) for a precision approach and a non-precision approach.	x		x			x
LO	Describe the main task of the intermediate APP segment.	x		x			x
LO	State the main task of the final APP segment.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the two possible aims of a final APP.	x		x			x
LO	Explain the term 'final approach point' in case of an ILS approach.	x		x			x
LO	State what happens if an ILS GP becomes inoperative during the APP.	x		x			x
010 06 04 04	**Missed approach**						
LO	Name the three phases of a missed-approach procedure and describe their geometric limits.	x		x			x
LO	Describe the main task of a missed-approach procedure.	x		x			x
LO	State at which height/altitude the missed approach is assured to be initiated.	x		x			x
LO	Define the term 'missed approach point (MAPt)'.	x		x			x
LO	Describe how an MAPt may be established in an approach procedure.	x		x			x
LO	State the pilot's reaction if, upon reaching the MAPt, the required visual reference is not established.	x		x			x
LO	Describe what a pilot is expected to do in the event a missed approach is initiated prior to arriving at the MAPt.	x		x			x
LO	State whether the pilot is obliged to cross the MAPt at the height/altitude required by the procedure or whether they are allowed to cross the MAPt at an altitude/height greater than that required by the procedure.	x		x			x
010 06 04 05	**Visual manoeuvring (circling) in the vicinity of the aerodrome**						
LO	Describe what is meant by 'visual manoeuvring (circling)'.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe how a prominent obstacle in the visual manoeuvring (circling) area outside the final-approach and missed-approach area has to be considered for the visual circling.	x		x			x
LO	State for which category of aircraft the obstacle-clearance altitude/ height within an established visual-manoeuvring (circling) area is determined.	x		x			x
LO	Describe how an MDA/H is specified for visual manoeuvring (circling) if the OCA/H is known.	x		x			x
LO	State the conditions to be fulfilled before descending below MDA/H in a visual-manoeuvring (circling) approach.	x		x			x
LO	Describe why there can be no single procedure designed that will cater for conducting a circling approach in every situation.	x		x			x
LO	State how the pilot is expected to behave after initial visual contact during a visual manoeuvring (circling).	x		x			x
LO	Describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach.	x		x			x
010 06 04 06	**Area Navigation (RNAV) approach procedures based on VOR/DME**						
LO	Describe the provisions that must be fulfilled before carrying out VOR/DME RNAV approaches.	x		x			x
LO	Explain the disadvantages of the VOR/DME RNAV system.	x		x			x
LO	List the factors the navigational accuracy of the VOR/DME RNAV system depends on.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State whether the VOR/DME/RNAV approach is a precision or a non-precision procedure.	x		x			x
010 06 04 07	**Use of FMS/RNAV equipment to follow conventional non-precision approach procedures**						
LO	State the provisions for flying the conventional non-precision approach procedures using FMS/RNAV equipment.	x		x			x
010 06 05 00	**Holding procedures**						
010 06 05 01	**Entry and holding**						
LO	Explain why deviations from the in-flight procedures of a holding established in accordance with Doc 8168 are dangerous.	x		x			x
LO	State that if for any reasons a pilot is unable to conform to the procedures for normal conditions laid down for any particular holding pattern, they should advise ATC as early as possible.	x		x			x
LO	Describe how right-turn holdings can be transferred to left-turn holding patterns.	x		x			x
LO	Describe the shape and terminology associated with the holding pattern.	x		x			x
LO	State the bank angle and rate of turn to be used whilst flying in a holding pattern.	x		x			x
LO	Explain why pilots in a holding pattern should attempt to maintain tracks and how this can be achieved.	x		x			x
LO	Describe where outbound timing begins in a holding pattern.	x		x			x
LO	State where the outbound leg in a holding terminates if the outbound leg is based on DME.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the three heading-entry sectors for entries into a holding pattern.	x		x			x
LO	Define the terms ‘parallel entry’, ‘offset entry’ and ‘direct entry’.	x		x			x
LO	Determine the correct entry procedure for a given holding pattern.	x		x			x
LO	State the still air time for flying the outbound entry heading with or without DME.	x		x			x
LO	Describe what the pilot is expected to do when clearance is received specifying the time of departure from the holding point.	x		x			x
010 06 05 02	**Obstacle clearance (except table)**						
LO	Describe the layout of the basic holding area, entry area and buffer area of a holding pattern.	x		x			x
LO	State which obstacle clearance is provided by a minimum permissible holding level referring to the holding area, the buffer area (general only) and over high terrain or in mountainous areas.	x		x			x
010 06 06 00	**Altimeter-setting procedures**						
010 06 06 01	**Basic requirements and procedures**						
LO	Describe the two main objectives of altimeter settings.	x	x	x	x	x	x
LO	Define the terms ‘QNH’ and ‘QFE’.	x	x	x	x	x	x
LO	Describe the different terms for altitude or flight levels respectively which are the references during climb or descent to change the altimeter setting from QNH to 1013.2 hPa and vice versa.	x	x	x	x	x	x
LO	Define the term ‘Flight Level (FL)’.	x	x	x	x	x	x

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State where flight level zero shall be located.	x	x	x	x	x	x
LO	State the interval by which consecutive flight levels shall be separated.	x	x	x	x	x	x
LO	Describe how flight levels are numbered.	x	x	x	x	x	x
LO	Define the term 'Transition Altitude'.	x	x	x	x	x	x
LO	State how Transition Altitudes shall normally be specified.	x	x	x	x	x	x
LO	Explain how the height of the Transition Altitude is calculated and expressed in practice.	x	x	x	x	x	x
LO	State where Transition Altitudes shall be published.	x	x	x	x	x	x
LO	Define the term 'Transition Level'.	x	x	x	x	x	x
LO	State when the Transition Level is normally passed on to the aircraft.	x	x	x	x	x	x
LO	State how the vertical position of the aircraft shall be expressed at or below the Transition Altitude and Transition Level.	x	x	x	x	x	x
LO	Define the term 'Transition Layer'.	x	x	x	x	x	x
LO	Describe when the vertical position of an aircraft passing through the transition layer shall be expressed in terms of flight levels and when in terms of altitude.	x	x	x	x	x	x
LO	State when the QNH altimeter setting shall be made available to departing aircraft.	x	x	x	x	x	x
LO	Explain when the vertical separation of an aircraft during en route flight shall be assessed in terms of altitude and when in terms of flight levels.	x	x	x	x	x	x
LO	Explain when, in air–ground communications during an en route flight, the vertical position of an aircraft	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	shall be expressed in terms of altitude and when in terms of flight levels.						
LO	Describe why QNH altimeter-setting reports should be provided from sufficient locations.	x	x	x	x	x	x
LO	State how a QNH altimeter setting shall be made available to aircraft approaching a controlled aerodrome for landing.	x	x	x	x	x	x
LO	State under which circumstances the vertical position of an aircraft above the transition level may be referenced to altitudes.	x	x	x	x	x	x
010 06 06 02	**Procedures for operators and pilots**						
LO	State the three requirements that selected altitudes or selected flight levels should have.	x	x	x	x	x	x
LO	Describe a pre-flight operational test in case of QNH setting and in case of QFE setting including indication (error) tolerances referred to the different test ranges.	x	x	x	x	x	x
LO	State on which setting at least one altimeter shall be set prior to take-off.	x	x	x	x	x	x
LO	State where during the climb the altimeter setting shall be changed from QNH to 1013.2 hPa.	x	x	x	x	x	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the transition level.	x	x	x	x	x	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the actual QNH altimeter setting.	x	x	x	x	x	x
LO	State where the altimeter settings shall be changed from 1013.2 hPa to QNH during descent for landing.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 06 07 00	**Simultaneous operation on parallel or near-parallel instrument runways**						
LO	Describe the difference between independent and dependent parallel approaches.	x	x	x	x	x	x
LO	Describe the following different operations: simultaneous instrument departures; segregated parallel approaches/departures; semi-mixed and mixed operations.	x	x	x	x	x	x
LO	Know about 'NOZ' and 'NTZ'.	x	x	x	x	x	x
LO	Name the aircraft equipment requirements for conducting parallel instrument approaches.	x	x	x	x	x	x
LO	State under which circumstances parallel instrument approaches may be conducted.	x	x	x	x	x	x
LO	State the radar requirements for simultaneous, independent, parallel instrument approaches and how weather conditions effect these.	x	x	x	x	x	x
LO	State the maximum angle of interception for an ILS localiser CRS or MLS final APP track in case of simultaneous, independent, parallel instrument approaches.	x	x	x	x	x	x
LO	Describe the special conditions for tracks on missed approach procedures and departures in case of simultaneous, parallel operations.	x	x	x	x	x	x
010 06 08 00	**Secondary surveillance radar (transponder) operating procedures**						
010 06 08 01	**Operation of transponders**						
LO	State when and where the pilot shall operate the transponder.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the modes and codes that the pilot shall operate in the absence of any ATC directions or regional air navigation agreements.	x	x	x	x	x	x
LO	Indicate when the pilot shall operate Mode C.	x	x	x	x	x	x
LO	State when the pilot shall 'SQUAWK IDENT'.	x	x	x	x	x	x
LO	State the transponder mode and code to indicate: a state of emergency; a communication failure; unlawful interference.	x	x	x	x	x	x
LO	Describe the consequences of a transponder failure in flight.	x	x	x	x	x	x
LO	State the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at the given aerodrome is possible.	x	x	x	x	x	x
010 06 08 02	**Operation of ACAS equipment**						
LO	Describe the main reason for using ACAS.	x	x	x	x	x	x
LO	Indicate whether the 'use of ACAS indications' described in Doc 8168 is absolutely mandatory.	x	x	x	x	x	x
LO	Explain the pilots' reaction required to allow ACAS to fulfil its role of assisting pilots in the avoidance of potential collisions.	x	x	x	x	x	x
LO	Explain why pilots shall not manoeuvre their aircraft in response to Traffic Advisories only.	x	x	x	x	x	x
LO	Explain the significance of Traffic Advisories in view of possible Resolution Advisories.	x	x	x	x	x	x
LO	State why a pilot should follow Resolution Advisories immediately.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the reasons which may force a pilot to disregard a Resolution Advisory.	x	x	x	x	x	x
LO	Decide how a pilot shall react if there is a conflict between Resolution Advisories in case of an ACAS/ACAS coordinated encounter Resolution Advisories.	x	x	x	x	x	x
LO	Explain the importance of instructing ATC immediately that a Resolution Advisory has been followed.	x	x	x	x	x	x
LO	Explain the duties of a pilot as far as ATC is concerned when a Resolution Advisory situation is resolved.	x	x	x	x	x	x
010 07 00 00	**AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT**						
010 07 01 00	**ICAO Annex 11 — Air Traffic Services**						
010 07 01 01	**Definitions**						
LO	Recall the definitions given in ICAO Annex 11.	x	x	x	x	x	x
010 07 01 02	**General**						
LO	Name the objectives of Air Traffic Services (ATS).	x	x	x	x	x	x
LO	Describe the three basic types of Air Traffic Services.	x	x	x	x	x	x
LO	Describe the three basic types of Air Traffic Control services (ATC).	x	x	x	x	x	x
LO	Indicate when aerodrome control towers shall provide an accurate time check to pilots.	x	x	x	x	x	x
LO	State on which frequencies a pilot can expect ATS to contact them in case of an emergency.	x	x	x	x	x	x
LO	Understand the procedure for the transfer of an aircraft from one ATC unit to another.	x	x	x	x	x	
010 07 01 03	**Airspace**						
LO	Describe the purpose for establishing FIRs including UIRs.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Understand the various rules and services that apply to the various classes of airspace.	x	x	x	x	x	x
LO	Explain which airspace shall be included in an FIR or UIR.	x	x	x	x	x	x
LO	State the designation for those portions of the airspace where flight information service (FIS) and alerting service shall be provided.	x	x	x	x	x	x
LO	State the designations for those portions of the airspace where ATC service shall be provided.	x	x	x	x	x	x
LO	Indicate whether or not CTAs and CTRs designated within an FIR shall form part of that FIR.	x	x	x	x	x	x
LO	Name the lower limit of a CTA as far as ICAO standards are concerned.	x	x	x	x	x	x
LO	State whether or not the lower limit of a CTA has to be established uniformly.	x	x	x	x	x	x
LO	Explain why a UIR or Upper CTA should be delineated to include the Upper Airspace within the lateral limits of a number of lower FIRs or CTAs.	x	x	x	x	x	x
LO	Describe in general the lateral limits of CTRs.	x	x	x	x	x	x
LO	State the minimum extension (in NM) of the lateral limits of a CTR.	x	x	x	x	x	x
LO	State the upper limits of a CTR located within the lateral limits of a CTA.	x	x	x	x	x	x
010 07 01 04	**Air Traffic Control services**						
LO	Name all classes of airspace in which ATC shall be provided.	x	x	x	x	x	x
LO	Name the ATS units providing ATC service (area control service, approach control service, aerodrome control service).	x	x	x	x	x	x
LO	Describe which unit(s) may be assigned with the task to provide specified services on the apron.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the purpose of clearances issued by an ATC unit.	x	x	x	x	x	x
LO	Describe the aim of clearances issued by ATC with regard to IFR, VFR or special VFR flights, and refer to the different airspaces.	x	x	x	x	x	x
LO	List the various (five possible) parts of an ATC clearance.	x	x	x	x	x	x
LO	Describe the various aspects of clearance coordination.	x	x	x	x	x	x
LO	State how ATC shall react when it becomes apparent that traffic, additional to that already accepted, cannot be accommodated within a given period of time at a particular location or in a particular area, or can only be accommodated at a given rate.	x	x	x	x	x	x
LO	Explain why the movement of persons, vehicles and towed aircraft on the manoeuvring area of an AD shall be controlled by the AD TWR (as necessary).	x	x	x	x	x	x
010 07 01 05	**Flight Information Service (FIS)**						
LO	State for which aircraft FIS shall be provided.	x	x	x	x	x	x
LO	State whether or not FIS shall include the provision of pertinent SIGMET and AIRMET information.	x	x	x	x	x	x
LO	State which information FIS shall include in addition to SIGMET and AIRMET information.	x	x	x	x	x	x
LO	Indicate which other information the FIS shall include in addition to the special information given in ANNEX 11.	x	x	x	x	x	x
LO	Name the three major types of operational FIS broadcasts.	x	x	x	x	x	x
LO	Give the meaning of the acronym ATIS in plain language.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Show that you are acquainted with the basic conditions for transmitting an ATIS as indicated in ANNEX 11.	x	x	x	x	x	x
LO	Mention the four possible ATIS messages.	x	x	x	x	x	x
LO	List the basic information concerning ATIS broadcasts (e.g. frequencies used, number of ADs included, updating, identification, acknowledgment of receipt, language and channels, ALT setting).	x	x	x	x	x	x
LO	Understand the content of an ATIS message and the factors involved.	x	x	x	x	x	
LO	State the reasons and circumstances when an ATIS message shall be updated.	x	x	x	x	x	x
010 07 01 06	**Alerting service**						
LO	Indicate who provides the alerting service.	x	x	x	x	x	
LO	State who is responsible for initiating the appropriate emergency phase.	x	x	x	x	x	
LO	Indicate the aircraft to which alerting service shall be provided.	x	x	x	x	x	
LO	Name the unit which shall be notified by the responsible ATS unit immediately when an aircraft is considered to be in a state of emergency.	x	x	x	x	x	
LO	Name the three stages of emergency and describe the basic conditions for each kind of emergency.	x	x	x	x	x	
LO	Demonstrate knowledge of the meaning of the expressions INCERFA, ALERFA and DETRESFA.	x	x	x	x	x	
LO	Describe the limiting conditions for the information of aircraft in the vicinity of an aircraft being in a state of emergency.	x	x	x	x	x	
010 07 01 07	**Principles governing RNP and ATS route designators**						
LO	State the meaning of the expressions RNP 4, RNP 1, etc.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the factors that RNP is based on.	x	x	x	x	x	
LO	Describe the reason for establishing a system of route designators and Required Navigation Performance (RNP).	x	x	x	x	x	
LO	State whether or not a prescribed RNP type is considered an integral part of the ATS route designator.	x	x	x	x	x	
LO	Demonstrate general knowledge of the composition of an ATS route designator.	x	x	x	x	x	
010 07 02 00	**ICAO Document 4444 — Air Traffic Management**						
010 07 02 01	**Foreword (Scope and purpose)**						
LO	Explain in plain language the meaning of the acronym 'PANS-ATM'.	x	x	x	x	x	x
LO	State whether or not the procedures prescribed in ICAO Doc 4444 are directed exclusively to ATS services personnel.	x	x	x	x	x	x
LO	Describe the relationship between ICAO Doc 4444 and other documents.	x	x	x	x	x	x
LO	State whether or not a clearance issued by ATC units does include prevention of collision with terrain, and if there is an exception to this, name the exception.	x	x	x	x	x	x
010 07 02 02	**Definitions**						
LO	Recall all definitions given in Doc 4444 except the following: accepting unit/controller, AD taxi circuit, aeronautical fixed service (AFS), aeronautical fixed station, air-taxiing, allocation, approach funnel, assignment, data convention, data processing, discrete code, D-value, flight status, ground effect, receiving unit/controller, sending unit/controller, transfer of control point, transferring unit/controller, unmanned free balloon.	x	x	x	x	x	x
010 07 02 03	**ATS system capacity and Air Traffic Flow Management (ATFM)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain when and where ATFM service shall be implemented.	x	x	x	x	x	x
010 07 02 04	**General provisions for Air Traffic Services**						
LO	Describe who is responsible for the provision of flight information and alerting service within a Flight Information Region (FIR) within controlled airspace and at controlled aerodromes.	x	x	x	x	x	x
010 07 02 05	**ATC clearances**						
LO	Explain 'the sole scope and purpose' of an ATC clearance.	x	x	x	x	x	x
LO	State which information the issue of an ATC clearance is based on.	x	x	x	x	x	x
LO	Describe what a PIC should do if an ATC clearance is not suitable.	x	x	x	x	x	x
LO	Indicate who bears the responsibility for adhering to the applicable rules and regulations whilst flying under the control of an ATC unit.	x	x	x	x	x	x
LO	Name the two primary purposes of clearances issued by ATC units.	x	x	x	x	x	x
LO	State why clearances must be issued 'early enough' to en route aircraft.	x	x	x	x	x	x
LO	Explain what is meant by the expression 'clearance limit'.	x	x	x	x	x	x
LO	Explain the meaning of the phrases 'cleared via flight planned route', 'cleared via (designation) departure' and 'cleared via (designation) arrival' in an ATC clearance.	x	x	x	x	x	x
LO	List which items of an ATC clearance shall always be read back by the flight crew.	x	x	x	x	x	x
010 07 02 06	**Horizontal speed control instructions**						
LO	Explain the reason for speed control by ATC.	x	x	x	x	x	x
LO	Define the maximum speed changes that ATC may impose.	x	x	x	x	x	x
LO	State within which distance from the threshold the PIC must not expect any kind of speed control.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 07 02 07	**Change from IFR to VFR flight**						
LO	Explain how the change from IFR to VFR can be initiated by the PIC.	x		x			x
LO	Indicate the expected reaction of the appropriate ATC unit upon a request to change from IFR to VFR.	x		x			x
010 07 02 08	**Wake turbulence**						
LO	State the wake-turbulence categories of aircraft.	x	x	x	x	x	x
LO	State the wake-turbulence separation minima.	x	x	x	x	x	x
LO	Describe how a 'heavy' aircraft shall indicate this in the initial radio-telephony contact with ATS.	x	x	x	x	x	x
010 07 02 09	**Altimeter-setting procedures**						
LO	Define the following terms: transition level; transition layer; and transition altitude.	x	x	x	x	x	x
LO	Indicate how the vertical position of an aircraft in the vicinity of an aerodrome shall be expressed at or below the transition altitude, at or above the transition level, and while climbing or descending through the transition layer.	x	x	x	x	x	x
LO	Describe when the height of an aircraft using QFE during an NDB approach is referred to the landing threshold instead of the aerodrome elevation.	x	x	x	x	x	x
LO	Indicate how far altimeter settings provided to aircraft shall be rounded up or down.	x	x	x	x	x	x
LO	Define the expression 'lowest usable flight level'.	x	x	x	x	x	x
LO	Determine how the vertical position of an aircraft on an en route flight is expressed at or above the lowest usable flight level and below the lowest usable flight level.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State who establishes the transition level to be used in the vicinity of an aerodrome.	x	x	x	x	x	x
LO	Decide how and when a flight crew member shall be informed about the transition level.	x	x	x	x	x	x
LO	State whether or not the pilot can request the transition level to be included in the approach clearance.	x	x	x	x	x	x
LO	State in what kind of clearance the QNH altimeter setting shall be included.	x	x	x	x	x	x
010 07 02 10	**Position reporting**						
LO	Describe when position reports shall be made by an aircraft flying on routes defined by designated significant points.	x	x	x	x	x	x
LO	List the six items that are normally included in a voice position report.	x	x	x	x	x	x
LO	Name the requirements for using a simplified position report with flight level, next position (and time over) and ensuing significant points omitted.	x	x	x	x	x	x
LO	Name the item of a position report which must be forwarded to ATC with the initial call after changing to a new frequency.	x	x	x	x	x	x
LO	Indicate the item of a position report which may be omitted if SSR Mode C is used.	x	x	x	x	x	x
LO	Explain in which circumstances the indicated airspeed should be included in a position report.	x	x	x	x	x	x
LO	Explain the meaning of the acronym 'ADS'.	x	x	x	x	x	x
LO	State to which unit an ADS report shall be made.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe how ADS reports shall be made.	x	x	x	x	x	x
LO	Describe which expression shall precede the level figures in a position report if the level is reported in relation to 1013.2 hPa (standard pressure).	x	x	x	x	x	x
010 07 02 11	**Reporting of operational and meteorological information**						
LO	List the occasions when special air reports shall be made.	x	x	x	x	x	x
010 07 02 12	**Separation methods and minima**						
LO	Explain the general provisions for the separation of controlled traffic.	x		x			x
LO	Name the different kinds of separation used in aviation.	x		x			x
LO	Understand the difference between the type of separation provided within the various classes of airspace and the various types of flight.	x		x			x
LO	State who is responsible for the avoidance of collision with other aircraft when operating in VMC.	x		x			x
LO	State the ICAO documents in which details of current separation minima are prescribed.	x		x			x
LO	Describe how vertical separation is obtained.	x		x			x
LO	State the required vertical separation minimum.	x		x			x
LO	Describe how the cruising levels of aircraft flying to the same destination and in the expected approach sequence are correlated with each other.	x		x			x
LO	Name the conditions that must be adhered to when two aircraft are cleared to	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	maintain a specified vertical separation between them during climb or descent.						
LO	List the two main methods for horizontal separation.	x		x			x
LO	Describe how lateral separation of aircraft at the same level may be obtained.	x		x			x
LO	Explain the term 'geographical separation'.	x		x			x
LO	Describe track separation between aircraft using the same navigation aid or method.	x		x			x
LO	Describe the three basic means for the establishment of longitudinal separation.	x		x			x
LO	Describe the circumstances under which a reduction in separation minima may be allowed.	x		x			x
LO	Indicate the standard horizontal radar separation in NM.	x		x			x
LO	Describe the method of the Mach-number technique.	x					
LO	State the wake-turbulence radar separation for aircraft in the APP and DEP phases of a flight when an aircraft is operating directly behind another aircraft at the same ALT or less than 300 m (1 000 ft) below.	x		x			x
010 07 02 13	**Separation in the vicinity of aerodromes**						
LO	Define the expression 'Essential Local Traffic'.	x	x	x	x	x	x
LO	State which possible decision the PIC may choose to take if departing aircraft are expedited by suggesting a take-off direction which is not 'into the wind'.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the condition to enable ATC to initiate a visual approach for an IFR flight.	x	x	x	x	x	x
LO	Indicate whether or not separation shall be provided by ATC between an aircraft executing a visual approach and other arriving or departing aircraft.	x	x	x	x	x	x
LO	State in which case, when the flight crew are not familiar with the instrument approach procedure being carried out, only the final approach track has to be forwarded to them by ATC.	x	x	x	x	x	x
LO	Describe which flight level should be assigned to an aircraft first arriving over a holding fix for landing.	x	x	x	x	x	x
LO	Talk about the priority that shall be given to aircraft for a landing.	x	x	x	x	x	x
LO	Understand the situation when a pilot of an aircraft in an approach sequence indicates their intention to hold for weather improvements.	x	x	x	x	x	x
LO	Explain the term 'Expected Approach Time' and the procedures for its use.	x	x	x	x	x	x
LO	State the reasons which could probably lead to the decision to use another take-off or landing direction than the one into the wind.	x	x	x	x	x	x
LO	Name the possible consequences for a PIC if the 'RWY-in-use' is not considered suitable for the operation involved.	x	x	x	x	x	x
010 07 02 14	**Miscellaneous separation procedures**						
LO	Be familiar with the separation of aircraft holding in flight.	x	x	x	x	x	x
LO	Be familiar with the minimum separation between departing aircraft.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Be familiar with the minimum separation between departing and arriving aircraft.	x	x	x	x	x	x
LO	Be familiar with the non-radar wake-turbulence longitudinal separation minima.	x	x	x	x	x	x
LO	Know about a clearance to 'maintain own separation' while in VMC.	x	x	x	x	x	x
LO	Give a brief description of 'essential traffic' and 'essential traffic information'.	x	x	x	x	x	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed.	x	x	x	x	x	x
010 07 02 15	**Arriving and departing aircraft**						
LO	List the elements of information which shall be transmitted to an aircraft as early as practicable if an approach for landing is intended.	x	x	x	x	x	x
LO	List the information to be transmitted to an aircraft at the commencement of final approach.	x	x	x	x	x	x
LO	List the information to be transmitted to an aircraft during final approach.	x	x	x	x	x	x
LO	Acquaint yourself with all the information regarding arriving and/or departing aircraft on parallel or near-parallel runways, including knowledge about NTZ and NOZ and the various combinations of parallel arrivals and/or departures.	x	x	x	x	x	x
LO	State the sequence of priority between aircraft landing (or in the final stage of an approach to land) and aircraft intending to depart.	x	x	x	x	x	x
LO	Explain the factors that influence the approach sequence.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the significant changes in the meteorological conditions in the take-off or climb-out area that shall be transmitted without delay to a departing aircraft.	x	x	x	x	x	x
LO	Describe what information shall be forwarded to a departing aircraft as far as visual or non-visual aids are concerned.	x	x	x	x	x	x
LO	State the significant changes that shall be transmitted as early as practicable to an arriving aircraft, particularly changes in the meteorological conditions.	x	x	x	x	x	x
010 07 02 16	**Procedures for aerodrome control service**						
LO	Describe the general tasks of the Aerodrome Control Tower (TWR) when issuing information and clearances to aircraft under its control.	x	x	x	x	x	x
LO	List for which aircraft and their given positions or flight situations the TWR shall prevent collisions.	x	x	x	x	x	x
LO	Name the operational failure or irregularity of AD equipment which shall be reported to the TWR immediately.	x	x	x	x	x	x
LO	State that, after a given period of time, the TWR shall report to the ACC or FIC if an aircraft does not land as expected.	x	x	x	x	x	x
LO	Describe the procedures to be observed by the TWR whenever VFR operations are suspended.	x	x	x	x	x	x
LO	Explain the term 'RWY-in-use' and its selection.	x	x	x	x	x	x
LO	List the information the TWR should give to an aircraft: prior to taxiing for take-off; prior to take-off; prior to entering the traffic circuit.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain that a report of surface wind direction given to a pilot by the TWR is magnetic.	x	x	x	x	x	x
LO	Explain the exact meaning of the expression 'runway vacated'.	x	x	x	x	x	x
010 07 02 17	**Radar services**						
LO	State to what extent the use of radar in air traffic services may be limited.	x	x	x	x	x	x
LO	State what radar-derived information shall be available for display to the controller as a minimum.	x	x	x	x	x	x
LO	Name the two basic identification procedures used with radar.	x	x	x	x	x	x
LO	Define the term 'PSR'.	x	x	x	x	x	x
LO	Describe the circumstances under which an aircraft provided with radar service should be informed of its position.	x	x	x	x	x	x
LO	List the possible forms of position information passed on to the aircraft by radar services.	x	x	x	x	x	x
LO	Define the term 'radar vectoring'.	x	x	x	x	x	x
LO	State the aims of radar vectoring as shown in ICAO Doc 4444.	x	x	x	x	x	x
LO	State how radar vectoring shall be achieved.	x	x	x	x	x	x
LO	Describe the information which shall be given to an aircraft when radar vectoring is terminated and the pilot is instructed to resume own navigation.	x	x	x	x	x	x
LO	Explain the procedures for the conduct of Surveillance Radar Approaches (SRA).	x	x	x	x	x	x
LO	Describe what kind of action (concerning the transponder) the pilot is expected to perform in case of emergency if they	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	have previously been directed by ATC to operate the transponder on a specific code.						
010 07 02 18	**Air traffic advisory service**						
LO	Describe the objective and basic principles of the air traffic advisory service.	x	x	x	x	x	x
LO	State to which aircraft air traffic advisory service shall be provided.	x	x	x	x	x	x
LO	Explain why air traffic advisory service does not deliver 'clearances' but only 'advisory information'.	x	x	x	x	x	x
010 07 02 19	**Procedures related to emergencies, communication failure and contingencies**						
LO	State the mode and code of SSR equipment a pilot might operate in a (general) state of emergency or (specifically) in case the aircraft is subject to unlawful interference.	x	x	x	x	x	x
LO	State the special rights an aircraft in a state of emergency can expect from ATC.	x	x	x	x	x	x
LO	Describe the expected action of aircraft after receiving a broadcast from ATS concerning the emergency descent of an aircraft.	x	x	x	x	x	x
LO	State how it can be ascertained, in case of a failure of two-way communication, whether the aircraft is able to receive transmissions from the ATS unit.	x	x	x	x	x	x
LO	Explain the assumption based on which separation shall be maintained if an aircraft is known to experience a COM failure in VMC or in IMC.	x	x	x	x	x	x
LO	State on which frequencies appropriate information, for an aircraft encountering	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	two-way COM failure, shall be sent by ATS.						
LO	Describe the expected actions of an ATS unit after having been informed that an aircraft is being intercepted in or outside its area of responsibility.	x	x	x	x	x	x
LO	State what is meant by the expression 'strayed aircraft' and 'unidentified aircraft'.	x	x	x	x	x	x
LO	Explain the minimum level for fuel-dumping and the reasons for this.	x	x	x	x	x	x
LO	Explain the possible request of ATC to an aircraft to change its RTF call sign.	x	x	x	x	x	x
010 07 02 20	**Miscellaneous procedures**						
LO	Explain the meaning of 'AIRPROX'.	x	x	x	x	x	x
LO	Determine the task of an air traffic incident report.	x	x	x	x	x	x
010 08 00 00	**AERONAUTICAL INFORMATION SERVICE**						
010 08 01 00	**Introduction**						
LO	State, in general terms, the objective of the Aeronautical Information Service.	x	x	x	x	x	x
010 08 02 00	**Definitions of ICAO Annex 15**						
LO	Recall the following definitions: Aeronautical Information Circular (AIC), Aeronautical Information Publication (AIP), AIP amendment, AIP supplement, AIRAC, danger area, Integrated Aeronautical Information Package, international airport, international NOTAM office (NOF), manoeuvring area, movement area, NOTAM, Pre-flight Information Bulletin (PIB), prohibited area, restricted area, SNOWTAM, ASHTAM.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 08 03 00	**General**						
LO	State during which period of time aeronautical information service shall be available with reference to an aircraft flying in the area of responsibility of an AIS, provided a 24-hour service is not available.	x	x	x	x	x	x
LO	Name (in general) the kind of aeronautical information/data which an AIS service shall make available in a suitable form to flight crews.	x	x	x	x	x	x
LO	Summarise the duties of aeronautical information service concerning aeronautical information data for the territory of the State.	x	x	x	x	x	x
LO	Understand the principles of WGS 84.	x	x	x	x	x	x
010 08 04 00	**Integrated Aeronautical Information Package**						
LO	Name the different elements that make up an Integrated Aeronautical Information Package.	x	x	x	x	x	x
010 08 04 01	**Aeronautical Information Publication (AIP)**						
LO	State the primary purpose of the AIP.	x	x	x	x	x	x
LO	Name the different parts of the AIP.	x	x	x	x	x	x
LO	State in which main part of the AIP the following information can be found: differences from the ICAO Standards, Recommended Practices and Procedures; location indicators, aeronautical information services, minimum flight altitude, VOLMET service, SIGMET service; general rules and procedures (especially general rules, VFR, IFR, ALT-setting	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	procedure, interception of civil aircraft, unlawful interference, air traffic incidents); ATS airspace (especially FIR, UIR, TMA); ATS routes (especially lower ATS routes, upper ATS routes, area navigation routes); aerodrome data including aprons, TWYs and check locations/positions data; navigation warnings (especially prohibited, restricted and danger areas); aircraft instruments, equipment and flight documents; AD surface-movement guidance and control system and markings; RWY physical characteristics, declared distances, APP and RWY lighting; AD radio navigation and landing aids; charts related to an AD; entry, transit and departure of aircraft, passengers, crew and cargo.						
LO	State how permanent changes to the AIP shall be published.	x	x	x	x	x	x
LO	Explain what kind of information shall be published in the form of AIP Supplements.	x	x	x	x	x	x
LO	Describe how conspicuousness of AIP Supplement pages is achieved.	x	x	x	x	x	x
010 08 04 02	**NOTAMs**						
LO	Describe how information shall be published which in principle would belong to NOTAMs but includes extensive text and/or graphics.	x	x	x	x	x	x
LO	Summarise essential information which leads to the issuance of a NOTAM.	x	x	x	x	x	x
LO	State to whom NOTAMs shall be distributed.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain how information regarding snow, ice and standing water on AD pavements shall be reported.	x	x	x	x	x	x
LO	Describe the means by which NOTAMs shall be distributed.	x	x	x	x	x	x
LO	State which information an ASHTAM may contain.	x	x	x	x	x	x
010 08 04 03	**Aeronautical Information Regulation and Control (AIRAC)**						
LO	List the circumstances under which the information concerned shall or should be distributed as AIRAC.	x	x	x	x	x	x
LO	State the sequence in which AIRACs shall be issued and state how many days before the effective date the information shall be distributed by AIS.	x	x	x	x	x	x
010 08 04 04	**Aeronautical Information Circulars (AICs)**						
LO	Describe the reasons for the publication of AICs.	x	x	x	x	x	x
LO	Explain the organisation and standard colour codes of AICs.	x	x	x	x	x	x
LO	Explain the normal publication cycle of AICs.	x	x	x	x	x	x
010 08 04 05	**Pre-flight and post-flight information/ data**						
LO	List (in general) which details shall be included in the aeronautical information provided for pre-flight planning purposes at the appropriate ADs.	x	x	x	x	x	x
LO	Summarise the additional current information relating to the AD of departure that shall be provided as pre-flight information.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe how a recapitulation of current NOTAM and other information of urgent character shall be made available to flight crews.	x	x	x	x	x	x
LO	State which post-flight information from aircrews shall be submitted to AIS for distribution as required by the circumstances.	x	x	x	x	x	x
010 09 00 00	**AERODROMES (ICAO Annex 14, Volume I — Aerodrome Design and Operations)**						
010 09 01 00	**General**						
LO	Recognise all definitions of ICAO Annex 14 **except** the following: accuracy, cyclic redundancy check, data quality, effective intensity, ellipsoid height (geodetic height), geodetic datum, geoid, geoid undulation, integrity (aeronautical data), light failure, lighting system reliability, orthometric height, station declination, usability factor, Reference code.	x	x	x	x	x	x
LO	Describe, in general terms, the intent of the AD reference code as well as its composition of two elements.	x	x	x	x	x	x
010 09 02 00	**Aerodrome data**						
010 09 02 01	**Aerodrome reference point**						
LO	Describe where the aerodrome reference point shall be located and where it shall normally remain.	x	x	x	x	x	x
010 09 02 02	**Pavement strengths**						
LO	Explain the terms PCN and ACN and describe their mutual dependence.	x	x	x	x	x	x
LO	Describe how the bearing strength for an aircraft with an apron mass equal to or less than 5 700 kg shall be reported.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 09 02 03	**Declared distances**						
LO	List the four most important declared RWY distances and indicate where you can find guidance on their calculation in ICAO Annex 14.	x	x	x	x	x	x
LO	Recall the definitions for the four main declared distances.	x	x	x	x	x	x
010 09 02 04	**Condition of the movement area and related facilities**						
LO	Understand the purpose of informing AIS and ATS units about the condition of the movement area and related facilities.	x	x	x	x	x	x
LO	List the matters of operational significance or affecting aircraft performance which should be reported to AIS and ATS units to be transmitted to aircraft involved.	x	x	x	x	x	x
LO	Describe the four different types of water deposit on runways.	x	x	x	x	x	x
LO	Name the three defined states of frozen water on the RWY.	x	x	x	x	x	x
LO	Understand the five levels of braking action including the associated coefficients and codes.	x	x	x	x	x	
010 09 03 00	**Physical characteristics**						
010 09 03 01	**Runways**						
LO	Describe where a threshold should normally be located.	x	x	x	x	x	x
LO	Acquaint yourself with the general considerations concerning runways associated with a stopway or clearway.	x	x	x	x	x	x
LO	State where in Annex 14 you can find detailed information about the required runway width dependent upon code number and code letter.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 09 03 02	**Runway strips**						
LO	Explain the term 'runway strip'.	x	x	x	x	x	x
010 09 03 03	**Runway-end safety area**						
LO	Explain the term 'RWY-end safety area'.	x	x	x	x	x	x
010 09 03 04	**Clearway**						
LO	Explain the term 'clearway'.	x	x	x	x	x	x
010 09 03 05	**Stopway**						
LO	Explain the term 'stopway'.	x	x	x	x	x	x
010 09 03 06	**Radio-altimeter operating area**						
LO	Describe where a radio-altimeter operating area should be established and how far it should extend laterally and longitudinally.	x	x	x	x	x	x
010 09 03 07	**Taxiways**						
LO	Describe the condition which must be fulfilled to maintain the required clearance between the outer main wheels of an aircraft and the edge of the taxiway.	x	x	x	x	x	x
LO	Describe the reasons and the requirements for rapid-exit taxiways.	x	x	x	x	x	x
LO	State the reason for a taxiway widening in curves.	x	x	x	x	x	x
LO	Explain when and where holding bays should be provided.	x	x	x	x	x	x
LO	Describe where runway holding positions shall be established.	x	x	x	x	x	x
LO	Define the term 'road holding position'.	x	x	x	x	x	x
LO	Describe where intermediate taxiway holding positions should be established.	x	x	x	x	x	x
010 09 04 00	**Visual aids for navigation**						
010 09 04 01	**Indicators and signalling devices**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the wind-direction indicators with which ADs shall be equipped.	x	x	x	x	x	x
LO	Describe a landing-direction indicator.	x	x	x	x	x	x
LO	Explain the capabilities of a signalling lamp.	x	x	x	x	x	x
LO	State which characteristics a signal area should have.	x	x	x	x	x	x
LO	Interpret all indications and signals that may be used in a signals area.	x	x	x	x	x	x
010 09 04 02	**Markings**						
LO	Name the colours used for the various markings (RWY, TWY, aircraft stands, apron safety lines).	x	x	x	x	x	x
LO	State where a RWY designation marking shall be provided and how it is designed.	x	x	x	x	x	x
LO	Describe the application and characteristics of: RWY-centre-line markings; THR marking; touchdown-zone marking; RWY-side-stripe marking; TWY-centre-line marking; runway holding position marking; intermediate holding position marking; aircraft-stand markings; apron safety lines; road holding position marking; mandatory instruction marking; information marking.	x	x	x	x	x	x
010 09 04 03	**Lights**						
LO	Describe mechanical safety considerations regarding elevated approach lights and elevated RWY, stopway and taxiway lights.	x	x	x	x	x	x
LO	Describe the relationship of the intensity of RWY lighting, the approach-lighting system and the use of a separate intensity control for different lighting systems.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the conditions for the installation of an AD beacon and describe its general characteristics.	x	x	x	x	x	x
LO	Name the different kinds of operations for which a simple APP lighting system shall be used.	x	x	x	x	x	x
LO	Describe the basic installations of a simple APP lighting system including the dimensions and distances normally used.	x	x	x	x	x	x
LO	Describe the principle of a precision APP category I lighting system including information such as location and characteristics. *Remark: This includes the 'Calvert' system with additional crossbars.*	x	x	x	x	x	x
LO	Describe the principle of a precision APP category II and III lighting system including information such as location and characteristics, especially mentioning the inner 300 m of the system.	x					
LO	Describe the wing bars of PAPI and APAPI.	x	x	x	x	x	x
LO	Interpret what the pilot will see during approach using PAPI, APAPI, T-VASIS and AT-VASIS.	x	x	x	x	x	x
LO	Interpret what the pilot will see during approach using HAPI.			x	x	x	
LO	Explain the application and characteristics of: RWY-edge lights; RWY-threshold and wing-bar lights; RWY-end lights; RWY-centre-line lights; RWY-lead-in lights; RWY-touchdown-zone lights; stopway lights; taxiway-centre-line lights; taxiway-edge lights;	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	stop bars; intermediate holding position lights; RWY-guard lights; road holding position lights.						
LO	Understand the timescale within which aeronautical ground lights shall be made available to arriving aircraft.	x	x	x	x	x	
010 09 04 04	**Signs**						
LO	State the general purpose for installing signs.	x	x	x	x	x	x
LO	Explain which signs are the only ones on the movement area utilising red.	x	x	x	x	x	x
LO	List the provisions for illuminating signs.	x	x	x	x	x	x
LO	State the purpose for installing mandatory instruction signs.	x	x	x	x	x	x
LO	Name the kind of signs which shall be included in the mandatory instruction signs.	x	x	x	x	x	x
LO	Name the colours used for mandatory instruction signs.	x	x	x	x	x	x
LO	Describe by which sign a pattern 'A' runway-holding position (i.e. at an intersection of a taxiway and a non-instrument, non-precision approach or take-off RWY) marking shall be supplemented.	x	x	x	x	x	x
LO	Describe by which sign a pattern 'B' runway-holding position (i.e. at an intersection of a taxiway and a precision approach RWY) marking shall be supplemented.	x	x	x	x	x	x
LO	Describe the location of: a RWY designation sign at a taxiway/RWY intersection; a 'NO ENTRY' sign; a RWY holding position sign.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the sign with which it shall be indicated that a taxiing aircraft is about to infringe an obstacle-limitation surface or to interfere with the operation of radio navigation aids (e.g. ILS/MLS critical/sensitive area).	x	x	x	x	x	x
LO	Describe the various possible inscriptions on RWY designation signs and on holding-position signs.	x	x	x	x	x	x
LO	Describe the inscription on an intermediate holding-position sign on a taxiway.	x	x	x	x	x	x
LO	State when information signs shall be provided.	x	x	x	x	x	x
LO	Describe the colours used in connection with information signs.	x	x	x	x	x	x
LO	Describe the possible inscriptions on information signs.	x	x	x	x	x	x
LO	Explain the application, location and characteristics of aircraft stand-identification signs.	x	x	x	x	x	x
LO	Explain the application, location and characteristics of road holding-position signs.	x	x	x	x	x	x
010 09 04 05	**Markers**						
LO	Explain why markers located near a runway or taxiway shall be limited to their height.	x	x	x	x	x	x
LO	Explain the application and characteristics of: unpaved RWY-edge markers; TWY-edge markers; TWY-centre-line markers; unpaved TWY-edge markers; boundary markers; stopway-edge markers.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 09 05 00	**Visual aids for denoting obstacles**						
010 09 05 01	**Marking of objects**						
LO	State how fixed or mobile objects shall be marked if colouring is not practicable.	x	x	x	x	x	x
LO	Describe marking by colours (fixed or mobile objects).	x	x	x	x	x	x
LO	Explain the use of markers for the marking of objects, overhead wires, cables, etc.	x	x	x	x	x	x
LO	Explain the use of flags for the marking of objects.	x	x	x	x	x	x
010 09 05 02	**Lighting of objects**						
LO	Name the different types of lights to indicate the presence of objects which must be lighted.	x	x	x	x	x	x
LO	State the time period(s) of the 24 hours of a day during which high-intensity lights are intended for use.	x	x	x	x	x	x
LO	Describe (in general terms) the location of obstacle lights.	x	x	x	x	x	x
LO	Describe (in general and for normal circumstances) the colour and sequence of low-intensity obstacle lights, medium-intensity obstacle lights and high-intensity obstacle lights.	x	x	x	x	x	x
LO	State where you can find information about lights to be displayed by aircraft.	x	x	x	x	x	x
010 09 06 00	**Visual aids for denoting restricted use of areas**						
LO	Describe the colours and meaning of ‘closed markings’ on RWYs and taxiways.	x	x	x	x	x	x
LO	State how the pilot of an aircraft moving on the surface of a taxiway, holding bay or	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	apron shall be warned that the shoulders of these surfaces are 'non-load-bearing'.						
LO	Describe the pre-threshold marking (including colours) when the surface before the threshold is not suitable for normal use by aircraft.	x	x	x	x	x	x
010 09 07 00	**Aerodromes operational services, equipment and installations**						
010 09 07 01	**Rescue and Firefighting (RFF)**						
LO	Name the principal objective of a rescue and firefighting service.	x	x	x	x	x	x
LO	List the most important factors bearing on effective rescue in a survivable aircraft accident.	x	x	x	x	x	x
LO	Explain the basic information the AD category (for rescue and firefighting) depends upon.	x	x	x	x	x	x
LO	Describe what is meant by the term 'response time' and state its normal and maximum limits.	x	x	x	x	x	x
LO	State the reasons for emergency-access roads and for satellite firefighting stations.	x	x	x	x	x	x
010 09 07 02	**Apron management service**						
LO	Describe the reason for providing a special apron management service and state what has to be observed if the AD control tower is not participating in the apron management service.	x	x	x	x	x	x
LO	State who has a right-of-way against vehicles operating on an apron.	x	x	x	x	x	x
010 09 07 03	**Ground-servicing of aircraft**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the necessary actions during the ground-servicing of an aircraft with regard to the possible event of a fuel fire.	x	x	x	x	x	x
010 09 08 00	**Attachment A to ICAO Annex 14, Volume 1 — Supplementary Guidance Material**						
010 09 08 01	**Declared distances**						
LO	List the four types of 'declared distances' on a runway and also the appropriate abbreviations.	x	x	x	x	x	x
LO	Explain the circumstances which lead to the situation that the four declared distances on a runway are equal to the length of the runway.	x	x	x	x	x	x
LO	Describe the influence of a clearway, stopway and/or displaced threshold upon the four 'declared distances'.	x	x	x	x	x	x
010 09 08 02	**Radio-altimeter operating areas**						
LO	Describe the purpose of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the physical characteristics of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the dimensions of a radio-altimeter operating area.	x	x	x	x	x	x
LO	Describe the position of a radio-altimeter operating area.	x	x	x	x	x	x
010 09 08 03	**Approach lighting systems**						
LO	Name the two main groups of approach lighting systems.	x	x	x	x	x	x
LO	Describe the two different versions of a simple approach lighting system.	x	x	x	x	x	x
LO	Describe the two different basic versions of precision approach lighting systems for CAT I.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the diagram of the inner 300 m of the precision approach lighting system in the case of CAT II and III.	x					
LO	Describe how the arrangement of an approach lighting system and the location of the appropriate threshold are interrelated between each other.	x	x	x	x	x	x
010 10 00 00	**FACILITATION (ICAO Annex 9)**						
010 10 01 00	**General**						
010 10 01 01	**Foreword**						
LO	Explain the aim of ANNEX 9 as indicated in the Foreword.	x	x	x	x	x	
010 10 01 02	**Definitions (ICAO Annex 9)**						
LO	Understand the definitions.	x	x	x	x	x	
010 10 02 00	**Entry and departure of aircraft**						
010 10 02 01	**General Declaration**						
LO	Describe the purpose and use of aircraft documents — as far as the 'General Declaration' is concerned.	x	x	x	x	x	
LO	State whether or not a 'General Declaration' will be required by a Contracting State under normal circumstances.	x	x	x	x	x	
LO	State the kind of information concerning crew members whenever a 'General Declaration' is required by a Contracting State.	x	x	x	x	x	
010 10 02 02	**Entry and departure of crew**						
LO	Explain entry requirements for crew.	x	x	x	x	x	
LO	Explain the reasons for the use of Crew Member Certificates (CMC) for flight crews and cabin attendants engaged in International Air Transport.	x	x	x	x	x	
LO	Explain in which cases Contracting States shall accept the CMC as an identity document instead of a passport or visa.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State whether the entry privileges for crews of scheduled international air services can be extended to other flight crews of aircraft operated for remuneration or hire but not engaged in scheduled International Air Services.	x	x	x	x	x	
010 10 02 03	**Entry and departure of passengers and baggage**						
LO	Explain the entry requirements for passengers and their baggage.	x	x	x	x	x	
LO	Explain the requirements and documentation for unaccompanied baggage.	x	x	x	x	x	
LO	Be familiar with the documentation required for the departure and entry of passengers and their baggage.	x	x	x	x	x	
LO	Be familiar with the arrangements in the event of a passenger being declared an inadmissible person.	x	x	x	x	x	
LO	Describe the pilots authority towards unruly passengers.	x	x	x	x	x	
010 10 02 04	**Entry and departure of cargo**						
LO	Explain entry requirements for cargo.						
LO	Be familiar with the documentation required for the entry and departure of cargo.	x	x	x	x	x	
010 11 00 00	**SEARCH AND RESCUE**						
010 11 01 00	**Essential Search and Rescue (SAR) definitions in ICAO Annex 12**						
LO	Define the following: alert phase, distress phase, emergency phase, operator, pilot-in-command, rescue co-ordination centre, State of registry, uncertainty phase.	x	x	x	x	x	
010 11 02 00	**Organisation**						
LO	Describe how Contracting States shall arrange for the establishment and prompt provisions of SAR services.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the establishment of SAR Regions by Contracting States.	x	x	x	x	x	
LO	Describe the areas within which SAR services shall be established by Contracting States.	x	x	x	x	x	
LO	State the period of time per day within which SAR services shall be available.	x	x	x	x	x	
LO	Describe for which areas rescue coordination centres shall be established.	x	x	x	x	x	
010 11 03 00	**Operating procedures for non-SAR crews**						
LO	Explain the SAR operating procedures for the pilot-in-command who arrives first at the scene of an accident.	x	x	x	x	x	
LO	Explain the SAR operating procedures for the pilot-in-command intercepting a distress transmission.	x	x	x	x	x	
010 11 04 00	**Search and rescue signals**						
LO	Explain the 'ground–air visual signal code' for use by survivors.	x	x	x	x	x	
LO	Explain the signals to be used for 'air–ground signals'.	x	x	x	x	x	
010 12 00 00	**SECURITY**						
010 12 01 00	**Essential definitions of ICAO Annex 17**						
LO	Define the following terms: airside, aircraft security check, screening, security, security control, security-restricted area, unidentified baggage.	x	x	x	x	x	
010 12 02 00	**General principles**						
LO	State the objectives of security.	x	x	x	x	x	
LO	Explain where further information in addition to ICAO Annex 17 concerning aviation security is available.	x	x	x	x	x	
010 12 03 00	**Organisation**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Understand the required activities expected at each airport serving international civil aviation.	x	x	x	x	x	
010 12 04 00	**Preventive security measures**						
LO	Describe the objects not allowed (for reasons of aviation security) on board an aircraft engaged in international civil aviation.	x	x	x	x	x	
LO	Explain what each Contracting State is supposed to do concerning originating passengers and their cabin baggage prior to boarding an aircraft engaged in international civil aviation operations.	x	x	x	x	x	
LO	State what each Contracting State is supposed to do if passengers subjected to security control have mixed after a security screening point.	x	x	x	x	x	
LO	Explain what has to be done at airports serving international civil aviation to protect cargo, baggage, mail stores and operator supplies against an act of unlawful interference.	x	x	x	x	x	
LO	Explain what has to be done when passengers, who are obliged to travel because of judicial or administrative proceedings, are supposed to board an aircraft.	x	x	x	x	x	
LO	Understand what has to be considered if law-enforcement officers carry weapons on board.	x	x	x	x	x	
LO	Describe what is meant by ‘access control’ at an aerodrome.	x	x	x	x	x	
010 12 05 00	**Management of response to acts of unlawful interference**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the assistance each Contracting State shall provide to an aircraft subjected to an act of unlawful seizure.	x	x	x	x	x	
LO	State the circumstances which could prevent a State to detain an aircraft on the ground after being subjected to an act of unlawful seizure.	x	x	x	x	x	
010 12 06 00	**Operators' security programme**						
LO	Understand the principles of the written operator security programme each Contracting State requires from operators.	x	x	x	x	x	
010 12 07 00	**Security procedures in other documents, i.e. ICAO Annex 2, ICAO Annex 6, ICAO Annex 14, ICAO Doc 4444**						
010 12 07 01	**ICAO Annex 2 — Rules of the Air, Attachment B — Unlawful interference**						
LO	Describe what the PIC should do unless considerations on board the aircraft dictate otherwise.	x	x	x	x	x	
LO	Describe what the PIC should do if: the aircraft must depart from its assigned track; the aircraft must depart from its assigned cruising level; the aircraft is unable to notify an ATS unit of the unlawful interference.	x	x	x	x	x	
LO	Describe what the PIC should attempt to do with regard to broadcast warnings to decide at which level the crew is proceeding if no applicable regional procedures for in-flight contingencies have been established.	x	x	x	x	x	
010 12 07 02	**ICAO Annex 6, Chapter 13 — Security**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the special considerations referring to flight crew compartment doors with regard to aviation security.	x	x	x	x	x	
LO	Explain what an operator shall do to minimise the consequences of acts of unlawful interference.	x	x	x	x	x	
LO	Explain what an operator shall do to have appropriate employees available who can contribute to the prevention of acts of sabotage or other forms of unlawful interference.	x	x	x	x	x	
010 12 07 03	**ICAO Annex 14, Chapter 3 — Physical characteristics**						
LO	Describe what minimum distance an isolated aircraft parking position (after the aircraft has been subjected to unlawful interference) should have from other parking positions, buildings or public areas.	x	x	x	x	x	
010 12 07 04	**ICAO Doc 4444**						
LO	Describe the considerations that must take place with regard to a taxi clearance in case an aircraft is known or believed to have been subjected to unlawful interference.	x	x	x	x	x	
010 13 00 00	**AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION**						
010 13 01 00	**Essential definitions of ICAO Annex 13**						
LO	Define the following: accident, aircraft, flight recorder, incident, investigation, maximum mass, operator, serious incident, serious injury, State of Design, State of Manufacture, State of Occurrence, State of the Operator, State of Registry.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the difference between 'serious incident' and 'accident'.	x	x	x	x	x	
LO	Determine whether a certain occurrence has to be defined as a serious incident or as an accident.	x	x	x	x	x	
LO	Recognise the description of an accident or incident.	x	x	x	x	x	
010 13 02 00	**Applicability of ICAO Annex 13**						
LO	Describe the geographical limits, if any, within which the specifications given in Annex 13 apply.	x	x	x	x	x	
010 13 03 00	**ICAO accident and incident investigation**						
LO	State the objective(s) of the investigation of an accident or incident according to Annex 13.	x	x	x	x	x	
LO	Understand the general procedures for the investigation of an accident or incident according to Annex 13.	x	x	x	x	x	
010 13 04 00	**Accident and incident investigation in accordance with EU documents**						
LO	Be familiar with Council Directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents.	x	x	x	x	x	
LO	Be familiar with Council Directive 2003/42/EC of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation.	x	x	x	x	x	
LO	Be familiar with the differences between the procedures for accident and incident investigation in EU regulations compared to ICAO Annex 13.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
010 14 00 00	**Regulation (EC) No 216/2008 (the Basic Regulation)**						
010 14 01 00	**Definitions**						
LO	Certificate, commercial operation, complex motor-powered aircraft, flight simulation training device and rating.	x	x	x	x	x	
010 14 02 00	**Applicability**						
LO	Explain the applicability of the Basic Regulation.	x	x	x	x	x	

B. SUBJECT 021 — AIRFRAME AND SYSTEMS, ELECTRICS, POWER PLANT AND EMERGENCY EQUIPMENT

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
020 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE**						
021 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — AIRFRAME AND SYSTEMS, ELECTRICS, POWER PLANT, EMERGENCY EQUIPMENT**						
021 01 00 00	**SYSTEM DESIGN, LOADS, STRESSES, MAINTENANCE**						
021 01 01 00	**System design**						
021 01 01 01	**Design concepts**						
LO	Describe the following structural design philosophy: safe life; fail-safe (multiple load paths); damage-tolerant.	x	x	x	x	x	
LO	Describe the following system design philosophy: redundancy.	x	x	x	x	x	
021 01 01 02	**Level of certification**						
LO	Explain and state the safety objectives associated with failure conditions (AMC 25.1309, Fig. 2).	x					
LO	Explain the relationship between the probability of a failure and the severity of the failure effects.	x		x	x		
LO	Explain why some systems are duplicated or triplicated.	x		x	x		

021 01 02 00	**Loads and stresses**						
LO	Explain the following terms: stress, strain, tension, compression, buckling, bending, torsion, static loads, dynamic loads, cyclic loads, elastic and plastic deformation.	x	x	x	x	x	
	Remark: Stress is the internal force per unit area inside a structural part as a result of external loads. Strain is the deformation caused by the action of stress on a material. It is normally given as the change in dimension expressed in a percentage of the original dimensions of the object.						
LO	Describe the relationship between stress and strain for a metal.	x	x	x	x	x	
021 01 03 00	**Fatigue**						
LO	Describe the phenomenon of fatigue.	x	x	x	x	x	
LO	Explain the relationship between the magnitude of the alternating stress and the number of cycles (S/N diagram or Wöhler curve).	x	x	x	x	x	
LO	Explain the implication of stress-concentration factor.	x	x	x	x	x	
021 01 04 00	**Corrosion**						
LO	Describe the following types of corrosion: oxidation, electrolytic.	x	x	x	x	x	
LO	Describe the interaction between fatigue and corrosion (stress corrosion).	x	x	x	x	x	
021 01 05 00	**Maintenance**						
021 01 05 01	**Maintenance methods: hard time and on condition**						

LO	Explain the following terms: hard-time maintenance; on-condition maintenance.	x	x	x	x	x	
021 02 00 00	**AIRFRAME**						
021 02 01 00	**Construction and attachment methods**						
LO	Describe the principles of the following construction methods: monocoque; semi-monocoque; cantilever; sandwich, including honey comb; truss.	x	x	x	x	x	
LO	Describe the following attachment methods: riveting, welding, bolting, pinning, adhesives (bonding).	x	x	x	x	x	
LO	State that sandwich structural parts need additional provisions to carry concentrated loads.	x	x	x	x	x	
021 02 02 00	**Materials**						
LO	Explain the following material properties: elasticity, plasticity, stiffness, strength, strength-to-density ratio.	x	x	x	x	x	
LO	Compare the above properties as they apply to aluminium alloys, magnesium alloys, titanium alloys, steel and composites.	x	x	x	x	x	
LO	Explain the need to use alloys rather than pure metals.	x	x	x	x	x	
LO	Explain the principle of a composite material.	x	x	x	x	x	
LO	Describe the function of the following components: matrix, resin or filler; fibres.	x	x	x	x	x	

LO	State the advantages and disadvantages of composite materials compared with metal alloys by considering the following: strength-to-weight ratio; capability to tailor the strength to the direction of the load; stiffness; electrical conductivity (lightning); resistance to fatigue; resistance to corrosion and cost.	x	x	x	x	x	
LO	State that the following are composite-fibre materials: carbon, glass, aramid (Kevlar).	x	x	x	x	x	
021 02 03 00	**Aeroplane: wings, tail surfaces and control surfaces**						
021 02 03 01	**Design and construction**						
LO	Describe the following types of construction: cantilever, non-cantilever (braced).	x	x				
021 02 03 02	**Structural components**						
LO	Describe the function of the following structural components: spar and its components (web and girder or cap), rib, stringer, skin, torsion box.	x	x				
021 02 03 03	**Loads, stresses and aeroelastic vibrations ('flutter')**						
LO	Describe the vertical and horizontal loads on the ground.	x	x				
LO	Describe the loads in flight for symmetrical and asymmetrical conditions, considering both vertical and horizontal loads and loads due to engine failure.	x	x				
LO	Describe the principle of flutter, flutter damping and resonance for the wing and control surfaces.	x	x				

LO	Explain the significance on stress relief and flutter of the following: chord-wise and span-wise position of masses (e.g. engines, fuel and balance masses, control balance masses); torsional stiffness; bending flexibility.	x	x				
LO	Describe the following design configurations: conventional (low or mid set) tailplane; T-tail.	x	x				
021 02 04 00	**Fuselage, landing gear, doors, floor, windscreen and windows**						
LO	Describe the following types of fuselage construction: monocoque, semi-monocoque.	x	x	x	x	x	
LO	Describe the construction and the function of the following structural components of a fuselage: frames; bulkhead; stiffeners, stringers, longerons; skin, doublers; floor suspension (crossbeams); floor panels; firewall.	x	x	x	x	x	
LO	Describe the loads on the fuselage due to pressurisation.	x	x				
LO	Describe the following loads on a main landing gear: — touch-down loads (vertical and horizontal) — taxi loads on bogie gear (turns).	x	x				
LO	Describe the structural danger of a nose-wheel landing with respect to: fuselage loads; nose-wheel strut loads.	x	x				
LO	Describe the structural danger of a tail strike with respect to: fuselage and aft bulkhead damage (pressurisation).	x	x				

LO	Describe the door and hatch construction for pressurised and unpressurised aeroplanes including: door and frame (plug type); hinge location; locking mechanism.	x	x				
LO	Explain the advantages and disadvantages of the following fuselage cross sections: circular; double bubble (two types); oval; rectangular.	x	x				
LO	State that flight-deck windows are constructed with different layers.	x	x				
LO	Explain the function of window heating for structural purposes.	x	x				
LO	Explain the implication of a direct-vision window (see CS 25.773(b)(3)).	x	x				
LO	State the need for an eye-reference position.	x	x				
LO	Explain the function of floor venting (blow-out panels).	x	x				
LO	Describe the construction and fitting of sliding doors.			x	x	x	
021 02 05 00	**Helicopter: flight controls structural aspects**						
021 02 05 01	**Design and construction**						
LO	List the functions of flight controls.			x	x	x	
LO	Describe and explain the different flight control design concepts for conventional, tandem, coaxial, side by side, NOTAR and Fenestron-equipped helicopters.			x	x	x	
LO	Explain the advantages, disadvantages and limitations of the respective designs above.			x	x	x	
LO	Explain the function of the synchronised elevator.			x	x	x	
LO	Describe the construction methods and alignment of vertical and horizontal stabilisers.			x	x	x	

021 02 05 02	**Structural components and materials**						
LO	Name the main components of flight and control surfaces.			x	x	x	
LO	Describe the fatigue life and methods of checking for serviceability of flight and control surface components and materials.			x	x	x	
021 02 05 03	**Loads, stresses and aeroelastic vibrations**						
LO	Describe and explain where the main stresses are applied to components.			x	x	x	
LO	Describe the dangers and stresses regarding safety and serviceability in flight when the manufacturer's design envelope is exceeded.			x	x	x	
LO	Explain the procedure for: static chord-wise balancing; static span-wise balancing; blade alignment; dynamic chord-wise balancing; dynamic span-wise balancing.			x	x	x	
LO	Explain the process of blade tracking including: the pre-track method of blade tracking; the use of delta incidence numbers; aircraft configuration whilst carrying out tracking; factors affecting blade-flying profile; ground tracking and in-flight trend analysis; use of pitch-link and blade-trim tab adjustments; tracking techniques, including stroboscopic and electronic.			x	x	x	
LO	Describe the early indications and vibrations which are likely to be experienced when the main rotor blades and tail rotor are out of balance and/or tracking, including the possible early indications due to possible fatigue and overload.			x	x	x	
LO	Explain how a vibration harmonic can be set up in other components which can lead to their early failure.			x	x	x	

LO	Describe the three planes of vibration measurement, i.e. vertical, lateral, fore and aft.			x	x	x	
021 02 06 00	**Structural limitations**						
LO	Define and explain the following maximum structural masses: maximum ramp mass; maximum take-off mass; maximum zero-fuel mass; maximum landing mass. *Remark: These limitations may also be found in the relevant part of subjects 031, 032 and 034.*	x	x				
LO	Explain that airframe life is limited by fatigue, created by alternating stress and the number of load cycles.	x	x				
LO	Explain the maximum structural masses: maximum take-off mass.			x	x	x	
LO	Explain that airframe life is limited by fatigue, created by load cycles.			x	x	x	
021 03 00 00	**HYDRAULICS**						
021 03 01 00	**Hydromechanics: basic principles**						
LO	Explain the concept and basic principles of hydromechanics including: hydrostatic pressure; Pascal's law; the relationship between pressure, force and area; transmission of power: multiplication of force, decrease of displacement.	x	x	x	x	x	
021 03 02 00	**Hydraulic systems**						
021 03 02 01	**Hydraulic fluids: types, characteristics, limitations**						
LO	List and explain the desirable properties of a hydraulic fluid: thermal stability; corrosiveness; flashpoint and flammability; volatility; viscosity.	x	x	x	x	x	

LO	State that hydraulic fluids are irritating for skin and eyes.	x	x	x	x	x	
LO	List the two different types of hydraulic fluids: synthetic, mineral.	x	x	x	x	x	
LO	State that different types of hydraulic fluids cannot be mixed.	x	x	x	x	x	
LO	State that at the pressures being considered, hydraulic fluid is considered incompressible.	x	x	x	x	x	
021 03 02 02	**System components: design, operation, degraded modes of operation, indications and warnings**						
LO	Explain the working principle of a hydraulic system.	x	x	x	x	x	
LO	Describe the difference in principle of operation between a constant pressure system and a system pressurised only on specific demand (open-centre).	x	x	x	x	x	
LO	State the differences in principle of operation between a passive hydraulic system (without a pressure pump) and an active hydraulic system (with a pressure pump).	x	x	x	x	x	
LO	List the main advantages and disadvantages of system actuation by hydraulic or purely mechanical means with respect to: weight, size, force.	x	x	x	x	x	
LO	List the main users of hydraulic systems.	x	x	x	x	x	
LO	State that hydraulic systems can be classified as either high pressure (typically 3 000 psi or higher) and low pressure (typically up to 2 000 psi).	x	x	x	x	x	
LO	State that the normal hydraulic pressure of most large transport aircraft is 3 000 psi.	x	x	x	x	x	

LO	Explain the working principle of a low-pressure (0–2000 psi) open centred system using an off loading valve and an RPM dependent pump.	x	x	x	x	x	
LO	Explain the advantages and disadvantages of a high pressure system over a low - pressure system.	x	x	x	x	x	
LO	Describe the working principle and functions of pressure pumps including: constant pressure pump (swash plate or cam plate); pressure pump whose output is dependent on pump RPM (gear type).	x	x	x	x	x	
LO	State that for an aeroplane, the power sources of a hydraulic pressure pump can be: manual; engine gearbox; electrical; air (pneumatic and ram-air turbine); hydraulic (power transfer unit) or reversible motor pumps.	x	x				
LO	State that for a helicopter, the power sources of a hydraulic pressure pump can be: manual, engine, gearbox, electrical.			x	x	x	

LO	Describe the working principle and functions of the following hydraulic-system components: reservoir (pressurised and unpressurised); accumulators; case drain lines and fluid cooler return lines; piston actuators (single and double acting); hydraulic motors; filters; non-return (check) valves; relief valves; restrictor valves; elector valves (linear and basic rotary selectors, two and four ports); bypass valves; shuttle valves; fire shut-off valves; priority valves; fuse valves; pressure and return pipes.	x	x	x	x	x	
LO	Explain why many transport aeroplanes have 'demand' hydraulic pumps.	x	x				
LO	Explain how redundancy is obtained by giving examples.	x	x	x	x	x	
LO	Interpret the hydraulic system schematic appended to these LOs (to be introduced at a later date).	x	x	x	x	x	
LO	Explain the implication of a high system demand.	x	x	x	x	x	
LO	Explain the implication of a system internal leakage including hydraulic lock of piston actuators.	x	x	x	x	x	
LO	List and describe the instruments and alerts for monitoring a hydraulic system.	x	x	x	x	x	
LO	State the indications and explain the implications of the following malfunctions: system leak or low level; low pressure; high temperature.	x	x	x	x	x	

021 04 00 00	**LANDING GEAR, WHEELS, TYRES, BRAKES**						
021 04 01 00	**Landing gear**						
021 04 01 01	**Types**						
LO	Name, for an aeroplane, the following different landing-gear configurations: nose wheel, tail wheel.	x	x				
LO	Name, for a helicopter, the following different landing-gear configurations: nose wheel, tail wheel, skids.			x	x	x	
021 04 01 02	**System components, design, operation, indications and warnings, on-ground/in-flight protections, emergency extension systems**						
LO	Explain the function of the following components of a landing gear: oleo leg/shock strut; axles; bogies and bogie beam; drag struts; side stays/struts; torsion links; locks (over centre); gear doors and retraction mechanisms (normal and emergency operation).	x	x				
LO	Explain the function of the following components of a landing gear: oleo leg/shock strut; axles; drag struts; side stays/struts; torsion links; locks (over centre); gear doors and retraction mechanisms (normal and emergency operation).			x	x	x	
LO	Name the different components of a landing gear, using the diagram appended to these LOs.	x	x				
LO	Describe the sequence of events of the landing gear during normal operation.	x	x	x	x	x	

LO	State how landing-gear position indication and alerting is implemented.	x	x	x	x	x	
LO	Describe the various protection devices to avoid inadvertent gear retraction on the ground: ground lock (pins); protection devices in the gear-retraction mechanism.	x	x	x	x	x	
LO	Explain the speed limitations for gear operation (VLO and VLE).	x	x				
LO	Describe the sequence for emergency gear extension: unlocking; operating; down-locking.	x	x	x	x	x	
	Describe some methods for emergency gear extension including: gravity/free fall; air or nitrogen pressure; manually/mechanically.	x	x	x	x	x	
021 04 02 00	**Nose-wheel steering: design, operation**						
LO	Explain the operating principle of nose-wheel steering.	x	x	x	x	x	
LO	Explain, for a helicopter, the functioning of differential braking with free-castoring nose wheel.			x	x	x	
LO	Describe, for an aeroplane, the functioning of the following systems: differential braking with free-castoring nose wheel; tiller or hand wheel steering; rudder pedal nose-wheel steering.	x	x				
LO	Explain the centring mechanism of the nose wheel.	x	x				
LO	Define the term ‘shimmy’ and the possible consequences for the nose and the main-wheel system.	x	x	x	x	x	
LO	Explain the purpose of main-wheel (body) steering.	x	x				

021 04 03 00	**Brakes**						
021 04 03 01	**Types and materials**						
LO	Describe the basic operating principle of a disk brake.	x	x	x	x	x	
LO	State the different materials used in a disc brake (steel, carbon).	x	x	x	x	x	
LO	Describe their characteristics, advantages and disadvantages such as: weight; temperature limits; internal-friction coefficient; wear.	x	x	x	x	x	
021 04 03 02	**System components, design, operation, indications and warnings**						
LO	State the limitation of brake energy and describe the operational consequences.	x	x				
LO	Explain how brakes are actuated.	x	x	x	x	x	
LO	Identify the task of an auto-retract or in-flight brake system.	x	x				
LO	State that brakes can be torque-limited.	x	x				
LO	Describe the function of a brake accumulator.	x	x	x	x	x	
LO	Describe the function of the parking brake.	x	x	x	x	x	
LO	Explain the function of wear indicators.	x	x				
LO	Explain the reason for the brake-temperature indicator.	x	x				
LO	State that the main power source for brakes in normal operation and for alternate operation for large transport aeroplanes is hydraulic.	x	x				
021 04 03 03	**Anti-skid**						
LO	Describe the operating principle of an anti-skid system where the brake performance is based on maintaining the optimum wheel-slip value.	x	x				

LO	Explain the purpose of the wheel-speed signal (tachometer) and of the aeroplane reference speed signal to the anti-skid computer, considering: slip ratio for maximum braking performance; locked-wheel prevention (protection against deep skid on one wheel); touchdown protection (protection against brake-pressure application during touchdown); hydroplane protection.	x	x				
LO	Give examples of the impact of an anti-skid system on performance.	x	x				
021 04 03 04	**Autobrake**						
LO	Describe the operating principle of an autobrake system.	x	x				
LO	State that the anti-skid system must be available when using autobrakes.	x	x				
LO	Explain the difference between the three possible levels of operation of an autobrake system: OFF (system off or reset); Arm/Disarm (arm: the system is ready to operate under certain conditions); Operative/Inoperative or Activated/ Deactivated (application of pressure on brakes).	x	x				
021 04 04 00	**Wheels, rims and tyres**						
021 04 04 01	**Types, structural components and materials, operational limitations, thermal plugs**						
LO	Describe the different types of tyres such as: tubeless; diagonal (cross ply); radial (circumferential bias).	x	x	x	x	x	
LO	Define the following terms: ply rating; tyre tread; tyre creep; retread (cover).	x	x	x	x	x	
LO	Explain the function of thermal/fusible plugs.	x	x				

LO	Explain the implications of tread separation and tyre burst.	x	x				
LO	State that the ground speed of tyres is limited.	x	x				
LO	Describe material and basic construction of the rim of an aeroplane wheel.	x	x				
021 04 05 00	**Helicopter equipment**						
LO	Explain flotation devices and how they are operated.			x	x	x	
LO	Explain the IAS limitations before, during and after flotation-device deployment.			x	x	x	
021 05 00 00	**FLIGHT CONTROLS**						
021 05 01 00	**Aeroplane: primary flight controls**						
	Remark: The manual, irreversible and reversible flight control systems as discussed in 021 05 01 01, 05 01 02 and 05 01 03 are all considered to be mechanical flight control systems. Fly-by-wire flight control systems are discussed in 021 05 04 00.						
LO	Define a 'primary flight control'.	x	x				
LO	List the following primary flight control surfaces: elevator; aileron, roll spoilers; rudder.	x	x				
LO	List the various means of control surface actuation including: manual; fully powered (irreversible); partially powered (reversible).	x	x				
021 05 01 01	**Manual controls**						
LO	Explain the basic principle of a fully manual control system.	x	x				

021 05 01 02	**Fully powered controls (irreversible)**						
LO	Explain the basic principle of a fully powered control system.	x					
LO	Explain the concept of irreversibility in a flight control system.	x					
LO	Explain the need for a ‘feel system’ in a fully powered control system.	x					
LO	Explain the operating principle of a stabiliser trim system in a fully powered control system.	x					
LO	Explain the operating principle of rudder and aileron trim in a fully powered control system.	x					
021 05 01 03	**Partially powered controls (reversible)**						
LO	Explain the basic principle of a partially powered control system.	x	x				
LO	Explain why a ‘feel system’ is not necessary in a partially powered control system.	x	x				
021 05 01 04	**System components, design, operation, indications and warnings, degraded modes of operation, jamming**						
LO	List and describe the function of the following components of a flight control system: actuators; control valves; cables or electrical wiring; control surface position sensors.	x	x				
LO	Explain how redundancy is obtained in primary flight control systems of large transport aeroplanes.	x	x				
LO	Explain the danger of control jamming and the means of retaining sufficient control capability.	x	x				
LO	Explain the methods of locking the controls on the ground and describe ‘gust or control lock’ warnings.	x	x				

LO	Explain the concept of a rudder-deflection limitation (rudder limiter) system and the various means of implementation (rudder ratio changer, variable stops, blow-back).	x	x				
021 05 02 00	**Aeroplane: secondary flight controls**						
021 05 02 01	**System components, design, operation, degraded modes of operation, indications and warnings**						
LO	Define a 'secondary flight control'.	x	x				
	List the following secondary flight control surfaces: lift-augmentation devices (flaps and slats); speed brakes; flight and ground spoilers; trimming devices such as trim tabs, trimmable horizontal stabiliser.	x	x				
LO	Describe secondary flight control actuation methods and sources of actuating power.	x	x				
LO	Explain the function of a mechanical lock when using hydraulic motors driving a screw jack.	x	x				
LO	Describe the requirement for limiting speeds for the various secondary flight control surfaces.	x	x				
LO	For lift-augmentation devices, explain the load-limiting (relief) protection devices and the functioning of an autoretraction system.	x	x				
LO	Explain how a flap/slat asymmetry protection device functions.	x	x				
LO	Describe the function of an autoslat system.	x	x				
LO	Explain the concept of control surface blow-back (aerodynamic forces overruling hydraulic forces).	x	x				
021 05 03 00	**Helicopter: flight controls**						
LO	Explain the methods of locking the controls on the ground.			x	x	x	
LO	Describe main-rotor droop stops and how static rotor flapping is restricted.			x	x	x	

LO	Describe the need for linear and rotary control input/output.			x	x	x	
LO	Explain the principle of phase lag and advance angle.			x	x	x	
LO	Describe the following four axes of control operation, their operating principle and their associated cockpit controls: collective control; cyclic fore and aft (pitch axis); cyclic lateral (roll axis); yaw.			x	x	x	
LO	Describe the swash plate or azimuth star control system including the following: swash plate inputs; the function of the non-rotating swash plate; the function of the rotating swash plate; how swash plate tilt is achieved; swash plate pitch axis; swash plate roll axis; balancing of pitch/roll/collective inputs to the swash plate to equalise torsional loads on the blades.			x	x	x	
LO	Describe the main-rotor spider control system including the following: the collective beam; pitch/roll/collective inputs to the collective beam; spider drive.			x	x	x	
LO	Describe the need for control system interlinks, in particular: collective/yaw; collective/throttle; cyclic/stabilator; interaction between cyclic controls and horizontal/stabilator.			x	x	x	
LO	State the need for 'feel systems' in the hydraulic actuated flight control system.			x	x	x	
LO	Describe the purpose of a trim system.			x	x	x	
LO	Describe the purpose of a cyclic beep-trim system that utilises parallel trim actuators to enable the pilot to control the aircraft.			x	x	x	

LO	List and describe the different types of trim systems.			x	x	x	
LO	Explain the basic components of a trim system, in particular: force-trim switch; force gradient; parallel trim actuator; cyclic 4-way trim switch; interaction of trim system with an SAS/SCAS/ASS stability system; trim-motor indicators.			x	x	x	
LO	Describe the different types of control runs.			x	x	x	
LO	Explain the use of control stops.			x	x	x	
021 05 04 00	**Aeroplane: Fly-by-Wire (FBW) control systems**						
LO	Explain that a FBW flight control system is composed of the following: pilot's input command (control stick/column); electrical signalling, including: • pilot input to computer; • computer to flight control surfaces; • feedback from aircraft response to computer; flight control computers; actuators; control surfaces.	x	x				
LO	State the advantages and disadvantages of a FBW system in comparison with a conventional flight control system including: weight; pilot workload; flight-envelope protection.	x	x				
LO	Explain why a FBW system is always irreversible.	x	x				
LO	State the existence of degraded modes of operation.	x	x				
021 05 05 00	**Helicopter: Fly-by-Wire (FBW) control systems**						
LO	To be introduced at a later date.			x	x	x	

021 06 00 00	**PNEUMATICS — PRESSURISATION AND AIR-CONDITIONING SYSTEMS**						
021 06 01 00	**Pneumatic/bleed air supply**						
021 06 01 01	**Piston-engine air supply**						
LO	State the method of supplying air for the pneumatic systems for piston engine aircraft.	x	x	x	x	x	
LO	State that air supply is required for the following systems: instrumentation, heating, de-icing.	x	x	x	x	x	
021 06 01 02	**Gas turbine engine: bleed air supply**						
LO	State that the possible bleed air sources for gas turbine engine aircraft are the following: engine, APU, ground supply.	x	x	x	x	x	
LO	State that for an aeroplane a bleed air supply can be used for the following systems or components: anti-icing; engine air starter; pressurisation of a hydraulic reservoir; air-driven hydraulic pumps; pressurisation and air conditioning.	x	x				
LO	State that for a helicopter a bleed air supply can be used for the following systems or components: anti-icing; engine air starter; pressurisation of a hydraulic reservoir.			x	x	x	
LO	State that the bleed air supply system can comprise the following: pneumatic ducts; isolation valve; pressure-regulating valve; engine bleed valve (HP/IP valves); fan-air pre-cooler; temperature and pressure sensors.	x	x	x	x	x	

LO	Interpret the pneumatic system schematic appended to these LOs (to be introduced at a later date).	x	x	x	x	x	
LO	Describe the cockpit indications for bleed air systems.	x	x	x	x	x	
LO	State how the bleed air supply system is controlled and monitored.	x	x	x	x	x	
LO	List the following air bleed malfunctions: over-temperature; over-pressure; low pressure; overheat/duct leak.	x	x	x	x	x	
021 06 02 00	**Helicopter: air-conditioning systems**						
021 06 02 01	**Types, system components, design, operation, degraded modes of operation, indications and warnings**						
LO	Describe the purpose of an air-conditioning system.			x	x	x	
LO	Explain how an air-conditioning system is controlled.			x	x	x	
LO	Describe the vapour cycle air-conditioning system including system components, design, operation, degraded modes of operation and system malfunction indications.			x	x	x	
LO	Identify the following components from a diagram of an air-conditioning system and describe the operating principle and function: air-cycle machine (pack, bootstrap system); pack-cooling fan; water separator; mixing valves; flow-control valves; isolation valves; recirculation fans; filters for recirculation; temperature sensors.			x	x	x	
LO	List and describe the controls, indications and warnings related to an air-conditioning system.			x	x	x	

021 06 03 00	**Aeroplane: pressurisation and air-conditioning system**						
021 06 03 01	**System components, design, operation, degraded modes of operation, indications and warnings**						
LO	State that a pressurisation and an air-conditioning system of an aeroplane controls: ventilation, temperature, pressure.	x	x				
LO	State that in general humidity is not controlled.	x	x				
LO	Explain that the following components constitute a pressurisation system: pneumatic system as the power source; outflow valve; outflow valve actuator; pressure controller; excessive differential pressure-relief valve; negative differential pressure-relief valve.	x	x				
LO	Explain that the following components constitute an air-conditioning system and describe their operating principles and function: air-cycle machine (pack, bootstrap system); pack-cooling fan; water separator; mixing valves; flow-control valves (outflow valve); isolation valves; ram-air valve; recirculation fans; filters for recirculated air; temperature sensors. *Remark: The bootstrap system is the only air-conditioning system considered for Part-FCL aeroplane examinations.*	x	x				
LO	Describe the use of hot trim air.	x	x				
LO	Define the following terms: cabin altitude; cabin vertical speed; differential pressure; ground pressurisation.	x	x				

LO	Describe the operating principle of a pressurisation system.	x	x				
LO	Describe the emergency operation by manual setting of the outflow valve position.	x	x				
LO	Describe the working principle of an electronic cabin-pressure controller.	x	x				
LO	State how the maximum operating altitude is determined.	x	x				
LO	State: the maximum allowed value of cabin altitude; a typical value of maximum differential pressure for large transport aeroplanes (8 to 9 psi); the relation between cabin altitude, the maximum differential pressure and maximum aeroplane operating altitude.	x	x				
LO	Identify the aural warning when cabin altitude exceeds 10 000 ft.	x	x				
LO	List the indications of the pressurisation system.	x	x				
021 07 00 00	**ANTI-ICING AND DE-ICING SYSTEMS**						
021 07 01 00	**Types, design, operation, indications and warnings, operational limitations**						
LO	Explain the concepts of de-icing and anti-icing.	x	x	x	x	x	
LO	Name the components of an aircraft which can be protected from ice accretion.	x	x	x	x	x	
LO	State that on some aeroplanes the tail does not have an ice-protection system.	x	x				
LO	State the different types of anti-icing/de-icing systems (hot air, electrical, fluid).	x	x	x	x	x	
LO	Describe the operating principle of these systems.	x	x	x	x	x	
LO	Describe the operating principle of the inflatable boot de-icing system.	x	x				

021 07 02 00	**Ice-warning systems: types, operation, and indications**						
LO	Describe the different operating principles of the following ice detectors: mechanical systems using air pressure; electromechanical systems using resonance frequencies.	x	x				
LO	Describe the principle of operation of ice-warning systems.	x	x				
021 07 03 00	**Helicopter blade-heating systems**						
LO	Explain the limitations on blade heating and the fact that on some helicopters the heating does not heat all the main rotor blades at the same time.			x	x	x	
021 08 00 00	**FUEL SYSTEM**						
021 08 01 00	**Piston engine**						
021 08 01 01	**Fuel: types, characteristics, limitations**						
LO	State the types of fuel used by piston engine (diesel, AVGAS, MOGAS) and their associated limitations.	x	x	x	x	x	
LO	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.	x	x	x	x	x	
021 08 01 02	**Design, operation, system components, indications**						
LO	State the tasks of the fuel system.	x	x	x	x	x	
LO	Name the following main components of a fuel system, and state their location and their function. lines; boost pump; pressure valves; filter, strainer; tanks (wing, tip, fuselage); vent system; sump; drain; fuel-quantity sensor; temperature sensor.	x	x	x	x	x	

LO	Describe a gravity fuel feed system and a pressure feed fuel system.	x	x	x	x	x	
LO	Describe the construction of the different types of fuel tanks and state their advantages and disadvantages: drum tank, bladder tank, integral tank.	x	x	x	x	x	
LO	Explain the function of cross-feed.	x	x	x	x	x	
LO	Define the term 'unusable fuel'.	x	x	x	x	x	
LO	List the following parameters that are monitored for the fuel system: fuel quantity (low-level warning); fuel temperature.	x	x	x	x	x	
021 08 02 00	**Turbine engine**						
021 08 02 01	**Fuel: types, characteristics, limitations**						
LO	State the types of fuel used by gas turbine engine (JET-A, JET-A1, JET-B).	x	x	x	x	x	
LO	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.	x	x	x	x	x	
LO	State the existence of additives for freezing.	x	x	x	x	x	
021 08 02 02	**Design, operation, system components, indications**						
LO	State the tasks of the fuel system.	x	x	x	x	x	
LO	Name the main components of a fuel system, and state their location and their function: lines; centrifugal boost pump; pressure valves; fuel shut-off valve; filter, strainer; tanks (wing, tip, fuselage, tail); bafflers; sump; vent system; drain; fuel-quantity sensor; temperature sensor; refuelling/defuelling system; fuel dump/jettison system.	x	x	x	x	x	

LO	Interpret the fuel-system schematic appended to these LOs.	x	x				
LO	Explain the limitations in the event of loss of booster pump fuel pressure.	x	x	x	x	x	
LO	Describe the construction of the different types of fuel tanks and state their advantages and disadvantages: drum tank, bladder tank, integral tank.	x	x	x	x	x	
LO	Explain the function of cross-feed and transfer.	x	x	x	x	x	
LO	Define the term 'unusable fuel'.	x	x	x	x	x	
LO	Describe the use and purpose of drip sticks (manual magnetic indicators).	x	x	x	x	x	
LO	Explain the considerations for fitting a fuel dump/jettison system.	x	x	x	x	x	
LO	List the following parameters that are monitored for the fuel system: fuel quantity (low-level warning); fuel temperature.	x	x	x	x	x	
021 09 00 00	**ELECTRICS**						
021 09 01 00	**General, definitions, basic applications: circuit breakers, logic circuits.**						
021 09 01 01	**Static electricity**						
LO	Explain static electricity.	x	x	x	x	x	
LO	Describe a static discharger and explain its purpose.	x	x	x	x	x	
LO	Explain why an aircraft must first be grounded before refuelling/defuelling.	x	x	x	x	x	
LO	Explain the reason for electrical bonding.	x	x	x	x	x	
021 09 01 02	**Direct current**						
LO	State that a current can only flow in a closed circuit.	x	x	x	x	x	
LO	Explain the basic principles of conductivity and give examples of conductors, semiconductors and insulators.	x	x	x	x	x	

LO	State the operating principle of mechanical (toggle, rocker, push and pull), thermo, time and proximity switches.	x	x	x	x	x	
LO	Define 'voltage', 'current and resistance', and state their unit of measurement.	x	x	x	x	x	
LO	Explain Ohm's law in qualitative terms.	x	x	x	x	x	
LO	Explain the effect on total resistance when resistors are connected in series or in parallel.	x	x	x	x	x	
LO	State that resistances can have a positive or a negative temperature coefficient (PTC/ NTC) and state their use.	x	x	x	x	x	
LO	Define 'electrical work and power' in qualitative terms and state the unit of measurement.	x	x	x	x	x	
LO	Define the term 'electrical field' and 'magnetic field' in qualitative terms and explain the difference with the aid of the Lorentz force (Electromotive Force (EMF)).	x	x	x	x	x	
LO	Explain the term 'capacitance' and explain the use of a capacitor as a storage device.	x	x	x	x	x	
021 09 01 03	**Alternating current**						
LO	Explain the term 'alternating current' (AC).	x	x	x	x	x	
LO	Define the term 'phase'.	x	x	x	x	x	
LO	Explain the principle of single-phase and three-phase AC and state its use in the aircraft.	x	x	x	x	x	
LO	Define 'frequency' in qualitative terms and state the unit of measurement.	x	x	x	x	x	
LO	Explain the use of a particular frequency in aircraft.	x	x	x	x	x	
LO	Define 'phase shift' in qualitative terms.	x	x	x	x	x	
021 09 01 04	**Resistors, capacitors, inductance coil**						
LO	Describe the relation between voltage and current of an ohmic resistor in an AC/DC circuit.	x	x	x	x	x	

LO	Describe the relation between voltage and current of a capacitor in an AC/DC circuit.	x	x	x	x	x	
LO	Describe the relation between voltage and current of a coil in an AC/DC circuit.	x	x	x	x	x	
021 09 01 05	**Permanent magnets**						
LO	Explain the term ‘magnetic flux’.	x	x	x	x	x	
LO	State the pattern and direction of the magnetic flux outside the magnetic poles and inside the magnet.	x	x	x	x	x	
021 09 01 06	**Electromagnetism**						
LO	State that an electrical current produces a magnetic field and define the direction of that field.	x	x	x	x	x	
LO	Describe how the strength of the magnetic field changes if supported by a ferromagnetic core.	x	x	x	x	x	
LO	Explain the purpose and the working principle of a solenoid.	x	x	x	x	x	
LO	Explain the purpose and the working principle of a relay.	x	x	x	x	x	
LO	Explain the principle of electromagnetic induction.	x	x	x	x	x	
LO	List the parameters affecting the inductance of a coil.	x	x	x	x	x	
LO	List the parameters affecting the induced voltage in a coil.	x	x	x	x	x	
021 09 01 07	**Circuit breakers**						
LO	Explain the operating principle of a fuse and a circuit breaker.	x	x	x	x	x	
LO	Explain how a fuse is rated.	x	x	x	x	x	
LO	State the difference between a ‘trip-free’ and ‘non-trip-free’ circuit breaker.	x	x	x	x	x	
LO	List the following different types of circuit breakers: thermal circuit breaker; magnetic circuit breaker.	x	x	x	x	x	
021 09 01 08	**Semiconductors and logic circuits**						

LO	State the differences between semiconductor materials and conductors and explain how the conductivity of semiconductors can be altered.	x	x	x	x	x	
LO	State the principal function of diodes, such as rectification and voltage limiting.	x	x	x	x	x	
LO	State the principal function of transistors, such as switching and amplification.	x	x	x	x	x	
LO	Explain the following five basic functions: AND, OR, NOT, NOR and NAND.	x	x	x	x	x	
LO	Describe their associated symbols.	x	x	x	x	x	
LO	Interpret logic diagrams using a combination of these functions.	x	x	x	x	x	
021 09 02 00	**Batteries**						
021 09 02 01	**Types, characteristics and limitations**						
LO	State the function of an aircraft battery.						
LO	Name the types of rechargeable batteries used in aircraft.	x	x	x	x	x	
LO	Compare lead-acid and nickel-cadmium (Ni-Cd) batteries with respect to weight, voltage, load behaviour, self-discharge, charging characteristics, thermal runaway and storage life.	x	x	x	x	x	
LO	Explain the term ‘cell voltage’.	x	x	x	x	x	
LO	State that a battery is composed of several cells.	x	x	x	x	x	
LO	Explain the difference between battery voltage and charging voltage.	x	x	x	x	x	
LO	State the charging voltage that corresponds with different battery voltages.	x	x	x	x	x	
LO	Define the term ‘capacity of batteries’ and state the unit of measurement used.	x	x	x	x	x	
LO	State the effect of temperature on battery capacity.	x	x	x	x	x	
LO	State the relationship between voltage and capacity when batteries are connected in series or in parallel.	x	x	x	x	x	

LO	State that in the case of loss of all generated power (battery power only) the remaining electrical power is time-limited.	x	x	x	x	x	
021 09 03 00	**Generation**						
	Remark: For standardisation purposes, the following standard expressions are used: *DC generator: produces DC output;* *DC alternator: produces internal AC, rectified by integrated rectifying unit, the output is DC;* *AC generator: produces AC output;* *starter generator: integrated combination of a DC generator with DC output and a starter motor using battery DC;* *permanent magnet alternator/ generator: produces AC output without field excitation using a permanent magnet.*	x	x	x	x	x	
021 09 03 01	**DC generation**						
LO	Describe the working principle of a simple DC alternator and name its main components.	x	x	x	x	x	
LO	State in qualitative terms how voltage depends on the number of windings, field strength, RPM and load.	x	x	x	x	x	
LO	List the differences between a DC generator and a DC alternator with regard to voltage response at low RPM, power–weight ratio, and brush sparking.	x	x	x	x	x	
LO	Explain the principle of voltage control.	x	x	x	x	x	
LO	Explain why reverse current flow from the battery to the generator must be prevented.	x	x	x	x	x	
LO	Describe the operating principle of a starter generator and state its purpose.	x	x	x	x	x	
021 09 03 02	**AC generation**						
LO	Describe the components of a three-phase AC generator and the operating principle.	x	x	x	x	x	
LO	State that the generator field current is used to control voltage.	x	x	x	x	x	

LO	State in qualitative terms the relation between frequency, number of pole pairs and RPM of a three-phase generator.	x	x	x	x	x	
LO	Explain the term 'wild-frequency generator'.	x	x	x	x	x	
LO	Describe how a three-phase AC generator can be connected to the electrical system.	x	x	x	x	x	
LO	Describe the purpose and the working principle of a permanent magnet alternator/generator.	x	x	x	x	x	
LO	List the following different power sources that can be used for an aeroplane to drive an AC generator: engine, APU, RAT, hydraulic.	x	x				
LO	List the following different power sources that can be used for a helicopter to drive an AC generator: engine, APU, gearbox.			x	x	x	
021 09 03 03	**Constant Speed Drive (CSD) and Integrated Drive Generator (IDG) systems.**						
LO	Describe the function and the working principle of a CSD.	x	x				
LO	Explain the parameters of a CSD that are monitored.	x	x				
LO	Describe the function and the working principle of an IDG.	x	x				
LO	Explain the consequences of a mechanical disconnection during flight for a CSD and an IDG.	x	x				
021 09 03 04	**Transformers, transformer rectifier units, static inverters**						
LO	State the function of a transformer and its operating principle.	x	x	x	x	x	
LO	State the function of a Transformer Rectifier Unit (TRU), its operating principle and the voltage output.	x	x	x	x	x	

LO	State the function of static inverters, their operating principle and the voltage output.	x	x	x	x	x	
021 09 04 00	**Distribution**						
021 09 04 01	**General**						
LO	Explain the function of a bus (bus bar).	x	x	x	x	x	
LO	Describe the function of the following buses: main bus, tie bus, essential bus, emergency bus, ground bus, battery bus, hot (battery) bus.	x	x	x	x	x	
LO	State that the aircraft structure can be used as a part of the electrical circuit (common earth) and explain the implications for electrical bonding.	x	x	x	x	x	
LO	Explain the function of external power.	x	x	x	x	x	
LO	State that a priority sequence exists between the different sources of electrical power on ground and in flight.	x	x	x	x	x	
LO	Introduce the term 'load sharing'.	x	x	x	x	x	
LO	Explain that load sharing is always achieved during parallel operations.	x	x	x	x	x	
LO	Introduce the term 'load shedding'.	x	x	x	x	x	
LO	Explain that an AC load can be shed in case of generator overload.	x	x	x	x	x	
LO	Interpret an electrical-system schematic (appended to these LOs). *Remark: The system described is a split system.*	x	x	x	x	x	
021 09 04 02	**DC distribution**						
LO	Describe a simple DC electrical system of a single-engine aircraft.	x	x	x	x	x	
LO	Describe a DC electrical system of a multi-engine aircraft (CS-23/CS-27) including the distribution consequences of loss of generator(s) or bus failure.	x	x	x	x	x	

LO	Describe the DC part of an electrical system of a transport aircraft (CS-25/CS-29) including the distribution consequences of loss of DC supply or bus failure.	x	x	x	x	x	
LO	Give examples of DC consumers.	x	x	x	x	x	
021 09 04 03	**AC distribution**						
LO	Describe the AC electrical system of a transport aircraft for split and parallel operation.	x	x	x	x	x	
LO	Describe the distribution consequences of: APU electrical supply and external power priority switching; loss of (all) generator(s); bus failure.	x	x	x	x	x	
LO	Give examples of AC consumers.	x	x	x	x	x	
LO	Explain the conditions to be met for paralleling AC generators.	x	x	x	x	x	
LO	Explain the terms ‘real and reactive loads’.	x	x	x	x	x	
LO	State that real/reactive loads are compensated in the case of paralleled AC generators.	x	x	x	x	x	
021 09 04 04	**Electrical load management and monitoring systems: automatic generators and bus switching during normal and failure operation, indications and warnings**						
LO	Give examples of system control, monitoring and annunciators.	x	x	x	x	x	
LO	Describe, for normal (on ground/in flight) and degraded modes of operation, the following functions of an electrical load management system: distribution, monitoring, protection (overloading, over/under voltage, incorrect frequency).	x	x	x	x	x	
LO	State which parameters are used to monitor an electrical system for parallel and split system operation.	x	x	x	x	x	
LO	Describe how batteries are monitored.	x	x	x	x	x	

LO	State that Ni-Cd batteries are monitored to avoid damage resulting from excessive temperature increase (thermal runaway).	x	x	x	x	x	
LO	Interpret various different ammeter indications of an ammeter which monitors the charge current of the battery.	x	x	x	x	x	
021 09 05 00	**Electrical motors**						
021 09 05 01	**General**						
LO	State that the purpose of an electric motor is to convert electrical energy into mechanical energy.	x	x	x	x	x	
021 09 05 02	**Operating principle**						
LO	Explain the operating principle of an electric motor as being an electrical current carrying conductor inside a magnetic field that experiences a Lorentz/electromotive (EMF) force.	x	x	x	x	x	
LO	State that electrical motors can be AC or DC type.	x	x	x	x	x	
021 09 05 03	**Components**						
LO	Name the following components of an electric motor and explain their function: rotor (rotating part of an electric motor); stator (stationary part of an electric motor).	x	x	x	x	x	
021 10 00 00	**PISTON ENGINES**						
	Remark: This topic includes diesel engines and petrol engines.						
021 10 01 00	**General**						
021 10 01 01	**Types of internal-combustion engines: basic principles, definitions**						
LO	Define the following terms and expressions: RPM; torque; Manifold Absolute Pressure (MAP); power output; specific fuel consumption; mechanical efficiency, thermal efficiency, volumetric efficiency; compression ratio, clearance volume, swept (displaced) volume, total volume.	x	x	x	x	x	

LO	Describe the influence of compression ratio on thermal efficiency.	x	x	x	x	x	

021 10 01 02	**Engine: design, operation, components and materials**						
LO	Describe the following main engine components and state their function. crankcase, crankshaft, connecting rod, piston, piston pin, piston rings, cylinder, cylinder head, valves, valve springs, push rod, camshaft, rocker arm, camshaft gear, bearings.	x	x	x	x	x	
LO	State the materials used for the following engine components: crankcase, crankshaft, connecting rod, piston, piston pin, cylinder, cylinder head, valves, camshaft.	x	x	x	x	x	
LO	Name and identify the various types of engine design with regard to cylinder arrangement, such as: horizontal opposed, in line, radial, and working cycle (four stroke: petrol and diesel).	x	x	x	x	x	
LO	Describe the gas-state changes, the valve positions and the ignition timing during the four strokes of the theoretical piston-engine cycle.	x	x	x	x	x	
LO	Explain the main differences between the theoretical (Otto cycle) and the practical four-stroke piston-engine cycles.	x	x	x	x	x	

LO	Describe the differences between petrol engines and diesel engines with respect to: means of ignition; maximum compression ratio; air or mixture supply to the cylinder; specific power output (kW/kg); thermal efficiency; pollution from the exhaust.	x	x	x	x	x	
021 10 02 00	**Fuel**						
021 10 02 01	**Types, grades, characteristics, limitations**						
LO	Name the type of fuel used for petrol engines including its colour (AVGAS).	x	x	x	x	x	
LO	Name the types of fuel used for diesel engines (kerosene or diesel).	x	x	x	x	x	
LO	Define the term 'octane rating'.	x	x	x	x	x	
LO	Describe the combustion process in a piston-engine cylinder for both petrol and diesel engines.	x	x	x	x	x	
LO	Define the term 'flame front velocity' and describe its variations depending on the fuel-air mixture for petrol engines.	x	x	x	x	x	
LO	Define the term 'detonation' and describe the causes and effects of detonation for both petrol and diesel engines.	x	x	x	x	x	
LO	Define the term 'pre-ignition' and describe the causes and effects of pre-ignition for both petrol and diesel engines.	x	x	x	x	x	
LO	Identify the conditions and power settings that promote detonation for petrol engines.	x	x	x	x	x	
LO	Describe how detonation in petrol engines is recognised.	x	x	x	x	x	
LO	Name the anti-detonation petrol fuel additive (tetraethyl lead).	x	x	x	x	x	
LO	Describe the method and occasions for checking the fuel for water content.	x	x	x	x	x	
LO	State the typical value of fuel density for aviation gasoline and diesel fuel.	x	x	x	x	x	
LO	Explain volatility, viscosity and vapour locking for petrol and diesel fuels.	x	x	x	x	x	

021 10 03 00	**Engine fuel pumps**						
LO	Describe the need for a separate engine-driven fuel pump.	x	x	x	x	x	
LO	List the different types of engine-driven fuel pumps: gear type, vane type.	x	x	x	x	X	
021 10 04 00	**Carburettor/injection system**						
021 10 04 01	**Carburettor: design, operation, degraded modes of operation, indications and warnings**						
LO	State the purpose of a carburettor.	x	x	x	x	x	
LO	Describe the operating principle of the simple float chamber carburettor.	x	x	x	x	x	
LO	Describe the method of achieving reliable idle operation.	x	x	x	x	x	
LO	Describe the methods of obtaining mixture control over the whole operating engine power setting range (compensation jet, diffuser).	x	x	x	x	x	
LO	Describe the methods of obtaining mixture control over the whole operating altitude range.	x	x	x	x	x	
LO	Explain the purpose and the operating principle of an accelerator pump.	x	x	x	x	x	
LO	Explain the purpose of power enrichment.	x	x	x	x	x	
LO	Describe the function of the carburettor heat system.	x	x	x	x	x	
LO	Explain the effect of carburettor heat on mixture ratio and power output.	x	x	x	x	x	
LO	Explain the purpose and the operating principle of a primer pump.	x	x	x	x	x	
LO	Discuss other methods for priming an engine (acceleration pumps).	x	x	x	x	x	
LO	Explain the danger of carburettor fire, including corrective measures.	x	x	x	x	x	

021 10 04 02	**Injection: design, operation, degraded modes of operation, indications and warnings**						
LO	Describe the low pressure, continuous flow type, fuel injection system used on light aircraft piston petrol engines with the aid of a schematic diagram.	x	x	x	x	x	
LO	Explain the advantages of an injection system compared with a carburettor system.	x	x	x	x	x	
LO	Explain the requirement for two different pumps in the fuel injection system and describe their operation.	x	x	x	x	x	
LO	Describe the task and explain the operating principle of fuel and mixture control valves in the injection system for petrol engines.	x	x	x	x	x	
LO	Describe the task and explain the operating principle of the fuel manifold valve, the discharge nozzles and the fuel-flow meter in the fuel injection system for petrol engines.	x	x	x	x	x	
LO	Describe the injection system of a diesel engine and explain the function of the following components: high-pressure fuel injection pump; common-rail principle; fuel lines; fuel injectors.	x	x	x	x	x	
021 10 04 03	**Icing**						
LO	Describe the causes and effects of carburettor icing and the action to be taken if carburettor icing is suspected.	x	x	x	x	x	
LO	Name the meteorological conditions under which carburettor icing may occur.	x	x	x	x	x	
LO	Describe the indications of the presence of carburettor icing with both a fixed pitch and a constant speed propeller.	x	x				
LO	Describe the indications of the presence of carburettor icing with a helicopter.			x	x	x	

LO	Describe the indications that will occur upon selection of carburettor heat depending on whether ice is present or not.	x	x	x	x	x	
LO	Explain the reason for the use of alternate air on fuel injection systems and describe its operating principle.	x	x	x	x	x	
LO	State the meteorological conditions under which induction-system icing may occur.	x	x	x	x	x	
021 10 05 00	**Cooling systems**						
021 10 05 01	**Design, operation, indications and warnings**						
LO	Specify the reasons for cooling a piston engine.	x	x	x	x	x	
LO	Describe the design features to enhance cylinder air cooling for aeroplanes.	x	x				
LO	Describe the design features to enhance cylinder air cooling for helicopters (e.g. engine-driven impeller and scroll assembly, baffles).			x	x	x	
LO	Compare the advantages of liquid and air-cooling systems.	x	x	x	x	x	
LO	Identify the cylinder head temperature indication to monitor engine cooling.	x	x	x	x	x	
LO	Describe the function and the operation of cowl flaps.	x	x				
021 10 06 00	**Lubrication systems**						
021 10 06 01	**Lubricants: characteristics, limitations**						
LO	Describe the term ‘viscosity’ including the effect of temperature.	x	x	x	x	x	
LO	Describe the viscosity grade numbering system used in aviation.	x	x	x	x	x	
021 10 06 02	**Design, operation, indications and warnings**						
LO	State the functions of a piston-engine lubrication system.	x	x	x	x	x	

LO	Describe the working principle of a dry-sump lubrication system and describe the functions of the following components: oil tank (reservoir) and its internal components: hot well, de-aerator, vent, expansion space; check valve (non-return valve); pressure pump and pressure-relief valve; scavenge pump; filters (suction, pressure and scavenge); oil cooler; oil cooler bypass valve (anti-surge and thermostatic); pressure and temperature sensors; lines.	x	x	x	x	x	
LO	Describe a wet-sump lubrication system.	x	x	x	x	x	
LO	State the differences between a wet and a dry-sump lubrication system.	x	x	x	x	x	
LO	State the advantages/disadvantages of each system.	x	x	x	x	x	
LO	List the following factors that influence oil consumption: oil grade, cylinder and piston wear, condition of piston rings.	x	x	x	x	x	
LO	Describe the interaction between oil pressure, oil temperature and oil quantity.	x	x	x	x	x	
021 10 07 00	**Ignition circuits**						
021 10 07 01	**Design, operation**						
LO	Describe the working principle of a magneto-ignition system and the functions of the following components: magneto, contact-breaker points, capacitor (condenser), coils or windings, ignition switches, distributor, spark plug, high-tension (HT) cable.	x	x	x	x	x	
LO	State why piston engines are equipped with two electrically independent ignition systems.	x	x	x	x	x	

LO	State the function and operating principle of the following methods of spark augmentation: starter vibrator (booster coil), impulse-start coupling.	x	x				
LO	State the function and operating principle of the following methods of spark augmentation: starter vibrator (booster coil), both magnetos live.			x	x	x	
LO	Explain the function of the magneto check.	x	x	x	x	x	
LO	State the reasons for using the correct temperature grade for a spark plug.	x	x	x	x	x	
LO	Explain the function of ignition timing advance or retard.	x	x	x	x	x	
LO	Explain how combustion is initiated in diesel engines.	x	x	x	x	x	
021 10 08 00	**Mixture**						
021 10 08 01	**Definition, characteristic mixtures, control instruments, associated control levers, indications**						
LO	Define the following terms: mixture, chemically correct ratio (stoichiometric), best power ratio, lean (weak) mixture (lean or rich side of the EGT top), rich mixture.	x	x	x	x	x	
LO	State the typical fuel-to-air ratio values or range of values for the above mixtures.	x	x	x	x	x	
LO	Describe the advantages and disadvantages of weak and rich mixtures.	x	x	x	x	x	
LO	Describe the relation between engine-specific fuel consumption and mixture ratio.	x	x	x	x	x	
LO	Describe the use of the exhaust gas temperature as an aid to mixture-setting.	x	x	x	x	x	
LO	Explain the relation between mixture ratio, cylinder head temperature, detonation and pre-ignition.	x	x	x	x	x	

LO	Explain the absence of mixture control in diesel engines.	x	x	x	x	x	
021 10 09 00	**Aeroplane: propellers**						
021 10 09 01	**Definitions, general**						
	Remark: Definitions and aerodynamic concepts are detailed in subject 081, topic 07 (Propellers) but need to be appreciated for this subject as well.	x	x				
021 10 09 02	**Constant-speed propeller: design, operation, system components**						
LO	Describe the operating principle of a constant-speed propeller system under normal flight operations with the aid of a schematic.	x	x				
LO	Explain the need for a Manifold Absolute Pressure (MAP) indicator to control the power setting with a constant-speed propeller.	x	x				
LO	State the purpose of a torque-meter.	x	x				
LO	State the purpose and describe the operation of a low-pitch stop (centrifugal latch).	x	x				
LO	Describe the operating principle of a single-acting and a double-acting variable pitch propeller for single and multi-engine aeroplanes.	x	x				
LO	Describe the function and the basic operating principle of synchronising and synchro-phasing systems.	x	x				
LO	Explain the purpose and the basic operating principle of an auto-feathering system including un-feathering.	x	x				
021 10 09 03	**Reduction gearing: design**						
LO	State the purpose of reduction gearing.	x	x				
LO	Explain the principles of design for reduction gearing.	x	x				

021 10 09 04	**Propeller handling: associated control levers, degraded modes of operation, indications and warnings**						
LO	Describe the checks to be carried out on a constant-speed propeller system after engine start.	x	x				
LO	Describe the operation of a constant-speed propeller system during flight at different true airspeeds and RPM including an overspeeding propeller.	x	x				
LO	Describe the operating principle of a variable pitch propeller when feathering and unfeathering, including the operation of cockpit controls.	x	x				
LO	Describe the operating principle of a variable pitch propeller when reverse pitch is selected, including the operation of cockpit controls.	x	x				
LO	Describe the operation of the propeller levers during different phases of flight.	x	x				
021 10 10 00	**Performance and engine handling**						
021 10 10 01	**Performance**						
LO	Engine performance: define 'pressure altitude' and 'density altitude'.	x	x	x	x	x	
LO	Describe the effect on power output of a petrol and diesel engine taking into consideration the following parameters: ambient pressure, exhaust back pressure; temperature; density altitude; humidity.	x	x	x	x	x	
LO	Explain the term 'normally aspirated engine'.	x	x	x	x	x	
LO	Power-augmentation devices: explain the requirement for power augmentation (turbocharging) of a piston engine.	x	x	x	x	x	

LO	Describe the function and the principle of operation of the following main components of a turbocharger: turbine, compressor, waste gate, waste-gate actuator, absolute-pressure controller, density controller, differential-pressure controller.	x	x	x	x	x	
LO	Explain the difference between an altitude-boosted turbocharger and a ground-boosted turbocharger.	x	x	x	x	x	
LO	Explain turbo lag.	x	x	x	x	x	
LO	Define the term 'critical altitude'.	x	x	x	x	x	
LO	Explain the function of an intercooler.	x	x	x	x	x	
LO	Define the terms 'full-throttle height' and 'rated altitude'.	x	x	x	x	x	
021 10 10 02	**Engine handling**						
LO	State the correct procedures for setting the engine controls when increasing or decreasing power.	x	x	x	x	x	
LO	Define the following terms: take-off power; maximum continuous power.	x	x	x	x	x	
LO	Describe the term 'hydraulicing' and the precautions to be taken prior to engine start.	x	x	x	x	x	
LO	Describe the start problems associated with extreme cold weather.	x	x	x	x	x	
LO	FADEC for a piston engine: To be introduced at a later date.	x	x	x	x	x	
021 11 00 00	**TURBINE ENGINES**						
021 11 01 00	**Basic principles**						
021 11 01 01	**Basic generation of thrust and the thrust formula**						
LO	Describe how thrust is produced by a basic gas turbine engine.	x	x				

LO	Describe the simple form of the thrust formula for a basic, straight turbojet and perform simple calculations (including pressure thrust).	x	x				
LO	State that thrust can be considered to remain approximately constant over the whole aeroplane subsonic speed range.	x	x				
021 11 01 02	**Design, types of turbine engines, components**						
LO	List the main components of a basic gas turbine engine. inlet, compressor, combustion chamber, turbine, outlet.	x	x	x	x	x	
LO	Describe the system of station numbering in a gas turbine engine.	x	x	x	x	x	
LO	Describe the variation of static pressure, temperature and axial velocity in a gas turbine engine under normal operating conditions and with the aid of a working cycle diagram.	x	x	x	x	x	
LO	Describe the differences between absolute, circumferential (tangential) and axial velocity.	x	x	x	x	x	
LO	List the different types of gas turbine engines: straight jet, turbo fan, turbo prop.	x	x				
LO	State that a gas turbine engine can have one or more spools.	x	x	x	x	x	
LO	Describe how thrust is produced by turbojet and turbofan engines.	x	x				
LO	Describe how power is produced by turboprop engines.	x	x				
LO	Describe the term 'equivalent horsepower' (= thrust horsepower + shaft horsepower).	x	x				

LO	Explain the principle of a free turbine or free-power turbine.	x	x	x	x	x	
LO	Define the term 'bypass ratio' and perform simple calculations to determine bypass ratio.	x	x				
LO	Define the terms 'propulsive power', 'propulsive efficiency', 'thermal efficiency' and 'total efficiency'.	x	x				
LO	Describe the influence of compressor-pressure ratio on thermal efficiency.	x	x	x	x	x	
LO	Explain the variations of propulsive efficiency with forward speed for turbojet, turbofan and turboprop engines.	x	x				
LO	Define the term 'specific fuel consumption' for turbojets and turboprops.	x	x				
021 11 01 03	**Coupled turbine engine: design, operation, components and materials**						
LO	Name the main assembly parts of a coupled turbine engine and explain the operation of the engine.			x	x	x	
LO	Explain the limitations of the materials used with regard to maximum turbine temperature, engine and drive train torque limits.			x	x	x	
LO	Describe the possible effects on engine components when limits are exceeded.			x	x	x	
LO	Explain that when engine limits are exceeded, this event must be reported.			x	x	x	
021 11 01 04	**Free turbine engine: design, components and materials**						
LO	Describe the design methods to keep the engine's size small for installation in helicopters.			x	x	x	
LO	List the main components of a free turbine engine.			x	x	x	
LO	Describe how the power is developed by a turboshaft/free turbine engine.			x	x	x	

LO	Explain how the exhaust gas temperature is used to monitor turbine stress.			x	x	x	
021 11 02 00	**Main-engine components**						
021 11 02 01	**Aeroplane: air intake**						
LO	State the functions of the engine air inlet/air intake.	x	x				
LO	Describe the geometry of a subsonic (pitot-type) air inlet.	x	x				
LO	Explain the gas-parameter changes in a subsonic air inlet at different flight speeds.	x	x				
LO	Describe the reasons for, and the dangers of, the following operational problems concerning the engine air inlet: airflow separation, inlet icing, inlet damage, Foreign Object Damage (FOD), heavy in-flight turbulence.	x	x				
021 11 02 02	**Compressor and diffuser**						
LO	State the purpose of the compressor.	x	x	x	x	x	
LO	Describe the working principle of a centrifugal and an axial flow compressor.	x	x	x	x	x	
LO	Name the following main components of a single stage and describe their function for a centrifugal compressor: impeller, diffuser.	x	x	x	x	x	
LO	Name the following main components of a single stage and describe their function for an axial compressor: rotor vanes, stator vanes.	x	x	x	x	x	
LO	Describe the gas-parameter changes in a compressor stage.	x	x	x	x	x	
LO	Define the term ‘pressure ratio’ and state a typical value for one stage of a centrifugal and an axial flow compressor and for the complete compressor.	x	x	x	x	x	

LO	State the advantages and disadvantages of increasing the number of stages in a centrifugal compressor.	x	x	x	x	x	
LO	Explain the difference in sensitivity for Foreign Object Damage (FOD) of a centrifugal compressor compared with an axial flow type.	x	x	x	x	x	
LO	Explain the convergent air annulus through an axial flow compressor.	x	x	x	x	x	
LO	Describe the reason for twisting the compressor blades.	x	x	x	x	x	
LO	State the tasks of inlet guide vanes (IGVs).	x	x	x	x	x	
LO	State the reason for the clicking noise whilst the compressor slowly rotates on the ground.	x	x	x	x	x	
LO	State the advantages of increasing the number of spools.	x	x	x	x	x	
LO	Explain the implications of tip losses and describe the design features to minimise the problem.	x	x	x	x	x	
LO	Explain the problems of blade bending and flapping and describe the design features to minimise the problem.	x	x	x	x	x	
LO	Explain the following terms: compressor stall, engine surge.	x	x	x	x	x	
LO	State the conditions that are possible causes of stall and surge.	x	x	x	x	x	
LO	Describe the indications of stall and surge.	x	x	x	x	x	
LO	Describe the design features used to minimise the occurrence of stall and surge.	x	x	x	x	x	
LO	Describe a compressor map (surge envelope) with RPM lines, stall limit, steady state line and acceleration line.	x	x	x	x	x	
LO	Describe the function of the diffuser.	x	x	x	x	x	
021 11 02 03	**Combustion chamber**						
LO	Define the purpose of the combustion chamber.	x	x	x	x	x	

LO	List the requirements for combustion.	x	x	x	x	x	
LO	Describe the working principle of a combustion chamber.	x	x	x	x	x	
LO	Explain the reason for reducing the airflow axial velocity at the combustion chamber inlet (snout).	x	x	x	x	x	
LO	State the function of the swirl vanes (swirler).	x	x	x	x	x	
LO	State the function of the drain valves.	x	x	x	x	x	
LO	Define the terms 'primary airflow' and 'secondary airflow' and explain their purpose.	x	x	x	x	x	
LO	Explain the following two mixture ratios: primary airflow to fuel, total airflow (within the combustion chamber) to fuel.	x	x	x	x	x	
LO	Describe the gas-parameter changes in the combustion chamber.	x	x	x	x	x	
LO	State a typical maximum value of the outlet temperature of the combustion chamber.	x	x	x	x	x	
LO	Describe the following types of combustion chamber and state the differences between them: can type; can-annular, cannular or tubo-annular; annular; reverse-flow annular.	x	x	x	x	x	
LO	Describe the principle of operation of a simplex and a duplex fuel spray nozzle (atomiser).	x	x	x	x	x	
021 11 02 04	**Turbine**						
LO	Explain the purpose of a turbine in different types of gas turbine engines.	x	x	x	x	x	
LO	Describe the principles of operation of impulse, reaction and impulse-reaction axial flow turbines.	x	x	x	x	x	
LO	Name the main components of a turbine stage and their function.	x	x	x	x	x	
LO	Describe the working principle of a turbine.	x	x	x	x	x	

LO	Describe the gas-parameter changes in a turbine stage.	x	x	x	x	x	
LO	Describe the function and the working principle of active clearance control.	x	x	x	x	x	
LO	Describe the implications of tip losses and the means to minimise them.	x	x	x	x	x	
LO	Explain why the available engine thrust is limited by the turbine inlet temperature.	x	x	x	x	x	
LO	Explain the divergent gas-flow annulus through an axial-flow turbine.	x	x	x	x	x	
LO	Describe turbine-blade convection, impingement and film cooling.	x	x	x	x	x	
LO	Explain the high mechanical-thermal stress in the turbine blades and wheels.	x	x	x	x	x	
LO	Explain the term 'creep'.	x	x	x	x	x	
LO	Explain the consequences of creep on the turbine.	x	x	x	x	x	
LO	Explain the terms 'low-cycle fatigue' and 'high-cycle fatigue'.	x	x	x	x	x	
021 11 02 05	**Aeroplane: exhaust**						
LO	Name the following main components of the exhaust unit and their function: jet pipe, propelling nozzle, exhaust cone.	x	x				
LO	Describe the working principle of the exhaust unit.	x	x				
LO	Describe the gas-parameter changes in the exhaust unit.	x	x				
LO	Define the term 'choked exhaust nozzle' (not applicable to turboprops).	x					
LO	Explain how jet exhaust noise can be reduced.	x	x				
021 11 02 06	**Helicopter: air intake**						
LO	Name and explain the main task of the engine air intake.			x	x	x	

LO	Describe the use of a convergent air-intake ducting on helicopters.			x	x	x	
LO	Describe the reasons for and the dangers of the following operational problems concerning engine air intake: airflow separations, intake icing, intake damage, foreign object damage, heavy in-flight turbulence.			x	x	x	
LO	Describe the conditions and circumstances during ground operations when foreign object damage is most likely to occur.			x	x	x	
LO	Describe and explain the principles of air intake filter systems that can be fitted to some helicopters for operations in icing and sand conditions.			x	x	x	
LO	Describe the function of the heated pads on some helicopter air intakes.			x	x	x	
021 11 02 07	**Helicopter: exhaust**						
LO	Name the following main components of the exhaust unit and their function. jet pipe, exhaust cone.			x	x	x	
LO	Describe the working principle of the exhaust unit.			x	x	x	
LO	Describe the gas-parameter changes in the exhaust unit.			x	x	x	
021 11 03 00	**Additional components and systems**						
021 11 03 01	**Engine fuel system**						
LO	Name the main components of the engine fuel system and state their function.	x	x	x	x	x	
LO	Name the two types of engine-driven high-pressure pumps, such as: gear-type, swash plate-type.	x	x	x	x	x	
LO	State the tasks of the fuel control unit.	x	x	x	x	x	

LO	List the possible input parameters to a fuel control unit to achieve a given thrust/ power setting.	x	x	x	x	x	
021 11 03 02	**Engine control system**						
LO	State the tasks of the engine control system.	x	x	x	x	x	
LO	List the following different types of engine control systems (refer to AMC to CS-E 50 Engine control system (1) Applicability) and state their respective engine control (output) parameters: hydro mechanical (Main Engine Control (MEC)); hydro mechanical with a limited authority electronic supervisor (Power Management System/Control (PMS/PMC)); single channel full-authority engine control with hydro-mechanical backup; dual channel full-authority electronic engine control system with no backup or any other combination (FADEC).	x	x	x	x	x	
LO	Describe a FADEC as a full-authority dual-channel system including functions such as an electronic engine control unit, wiring, sensors, variable vanes, active clearance control, bleed configuration, electrical signalling of TLA (see also AMC to CS-E-50), and an EGT protection function and engine overspeed.	x		x	x		
LO	Explain how redundancy is achieved by using more than one channel in a FADEC system.	x		x	x		
LO	State the consequences of a FADEC single input data failure.	x		x	x		
LO	State that all input and output data are checked by both channels.	x		x	x		
LO	State that a FADEC system uses its own sensors and that in some cases also data from aircraft systems is used.	x		x	x		
LO	State that a FADEC must have its own source of electrical power.	x		x	x		

021 11 03 03	**Engine lubrication**						
LO	State the tasks of an engine lubrication system.	x	x				
LO	Name the following main components of a lubrication system and state their function: oil tank and centrifugal breather, oil pumps (pressure and scavenge pumps), oil filters (including the bypass), oil sumps, chip detectors, coolers.	x	x				
LO	Explain that each spool is fitted with at least one ball bearing two or more roller bearings.	x	x				
LO	Explain the use of compressor air in oil-sealing systems (e.g. labyrinth seals).	x	x				
021 11 03 04	**Engine auxiliary gearbox**						
LO	State the tasks of the auxiliary gearbox.	x	x				
LO	Describe how the gearbox is driven and lubricated.	x	x				
021 11 03 05	**Engine ignition**						
LO	State the task of the ignition system.	x	x				
LO	Name the following main components of the ignition system and state their function. power sources, trembler mechanism (vibrator), transformer, diodes, capacitors, discharge gap (high-tension tube), igniters.	x	x				
LO	State why jet turbine engines are equipped with two electrically independent ignition systems.	x	x				
LO	Explain the different modes of operation of the ignition system.	x	x				
021 11 03 06	**Engine starter**						
LO	Name the main components of the starting system and state their function.	x	x				

LO	Explain the principle of a turbine engine start.	x	x				
LO	Describe the following two types of starters: electric, pneumatic.	x	x				
LO	Describe a typical start sequence (on ground/in flight) for a turbofan.	x	x				
LO	Define 'self-sustaining RPM'.	x	x				
021 11 03 07	**Reverse thrust**						
LO	Name the following main components of a reverse-thrust system and state their function: reverse-thrust select lever, power source (pneumatic or hydraulic), actuators, doors, annunciations.	x	x				
LO	Explain the principle of a reverse-thrust system.	x	x				
LO	Identify the advantages and disadvantages of using reverse thrust.	x	x				
LO	Describe and explain the following different types of thrust-reverser systems: hot-stream reverser, clamshell or bucket-door system, cold-stream reverser (only turbofan engines), blocker doors, cascade vanes.	x	x				
LO	Explain the implications of reversing the cold stream (fan reverser) only on a high bypass ratio engine.	x	x				
LO	Describe the protection features against inadvertent thrust-reverse deployment in flight as present on most transport aeroplanes.	x	x				
LO	Describe the controls and indications provided for the thrust-reverser system.	x	x				

021 11 03 08	**Helicopter specifics on design, operation and components for: Additional components and systems such as lubrication system, ignition circuit, starter, accessory gearbox**						
LO	State the task of the lubrication system.			x	x	x	
LO	List and describe the common helicopter lubrication systems.			x	x	x	
LO	Name the following main components of a helicopter lubrication system: reservoir; pump assembly; external oil filter; magnetic chip detectors, electronic chip detectors; thermostatic oil coolers; breather.			x	x	x	
LO	Identify and name the components of a helicopter lubrication system from a diagram.			x	x	x	
LO	Identify the indications used to monitor a lubrication system including warning systems.			x	x	x	
LO	Explain the differences and appropriate use of straight oil and compound oil, and describe the oil numbering system for aviation use.			x	x	x	
LO	Explain and describe the ignition circuit for engine start and engine relight facility when the selection is set for both automatic and manual functions.			x	x	x	
LO	Explain and describe the starter motor and the sequence of events when starting, and that for most helicopters the starter becomes the generator after the starting sequence is over.			x	x	x	
LO	Explain and describe why the engine drives the accessory gearbox.			x	x	x	
021 11 04 00	**Engine operation and monitoring**						
021 11 04 01	**General**						

LO	Explain the following aeroplane engine limitations: take-off, go-around, maximum continuous thrust/power, maximum climb thrust/power.	x	x				
LO	Explain spool-up time.	x	x	x	x	x	
LO	Explain the reason for the difference between ground and approach flight idle values (RPM).	x	x				
LO	State the parameters that can be used for setting and monitoring the thrust/power.	x	x	x	x	x	
LO	Describe the terms ‘alpha range’, ‘beta range’ and ‘reverse thrust’ as applied to a turboprop power lever.	x	x				
LO	Explain the dangers of inadvertent beta-range selection in flight for a turboprop.	x	x				
LO	Explain the purpose of engine trending.	x	x	x	x		
LO	Explain how the exhaust gas temperature is used to monitor turbine stress.	x	x	x	x		
LO	Describe the effect of engine acceleration and deceleration on the EGT.	x	x	x	x		
LO	Describe the possible effects on engine components when EGT limits are exceeded.	x	x	x	x		
LO	Explain why engine-limit exceedances must be reported.	x	x	x	x		
LO	Explain the limitations on the use of the thrust-reverser system at low forward speed.	x	x				
LO	Explain the term ‘engine seizure’.	x	x	x	x		
LO	State the possible causes of engine seizure and explain their preventative measures.	x	x	x	x		
LO	Explain the reason for the difference in the pressures of the fuel and oil in the heat exchanger.	x	x	x	x		
LO	Explain oil-filter clogging (blockage) and the implications for the lubrication system.	x	x	x	x		

LO	Give examples of monitoring instruments of an engine.	x	x	x	x		
021 11 04 02	**Starting malfunctions**						
LO	Describe the indications and the possible causes of the following aeroplane starting malfunctions: false (dry or wet) start, tailpipe fire (torching), hot start, abortive (hung) start, no N1 rotation, no FADEC indications.	x	x				
LO	Describe the indications and the possible causes of the following helicopter starting malfunctions: false (dry or wet) start, tailpipe fire (torching), hot start, abortive (hung) start, no N1 rotation, freewheel failure,			x	x	x	
LO	no FADEC indications.			x	x		
021 11 04 03	**Re-light envelope**						
LO	Explain the re-light envelope.	x	x				
021 11 05 00	**Performance aspects**						
021 11 05 01	**Thrust, performance aspects, and limitations**						
LO	Describe the variation of thrust and specific fuel consumption with altitude at constant TAS.	x	x				
LO	Describe the variation of thrust and specific fuel consumption with TAS at constant altitude.	x	x				
LO	Explain the term 'flat-rated engine' by describing the change of take-off thrust, turbine inlet temperature and engine RPM with OAT.	x	x				
LO	Define the term 'Engine Pressure Ratio' (EPR).	x	x				

LO	Explain the use of reduced (flexible) and derated thrust for take-off, and explain the advantages and disadvantages when compared with a full-rated take-off.	x	x				
LO	Describe the effects of use of bleed air on RPM, EGT, thrust and specific fuel consumption.	x	x				
021 11 05 02	**Helicopter engine ratings, engine performance and limitations, engine handling: torque, performance aspects, engine handling and limitations.**						
LO	Describe engine rating torque limits for take-off, transient and maximum continuous.			x	x	x	
LO	Describe turbine outlet temperature (TOT) limits for take-off.			x	x	x	
LO	Explain why TOT is a limiting factor for helicopter performance.			x	x	x	
LO	Describe and explain the relationship between maximum torque available and density altitude, which leads to decreasing torque available with the increase of density altitude.			x	x	x	
LO	Explain that hovering downwind on some helicopters will noticeably increase the engine TOT.			x	x	x	
LO	Explain the reason why the engine performance is less when aircraft accessories are switched on, i.e. anti-ice, heating, hoist, filters.			x	x	x	
LO	Describe the effects of use of bleed air on engine parameters.			x	x	x	
LO	Explain that on some helicopter exceeding the TOT limit may cause the main rotor to droop (slow down).			x	x	x	
021 11 06 00	**Auxiliary Power Unit (APU)**						
021 11 06 01	**Design, operation, functions, operational limitations**						

LO	State that an APU is a gas turbine engine and list its tasks.	x		x	x		
LO	State the difference between the two types of APU inlets.	x		x	x		
LO	Define ‘maximum operating and maximum starting altitude’.	x		x	x		
LO	Name the typical APU control and monitoring instruments.	x		x	x		
LO	Describe the APU’s automatic shutdown protection.	x		x	x		
021 12 00 00	**PROTECTION AND DETECTION SYSTEMS**						
021 12 01 00	**Smoke detection**						
021 12 01 01	**Types, design, operation, indications and warnings**						
LO	Explain the operating principle of the following types of smoke detection sensors: optical, ionising.	x	x				
LO	Give an example of warnings, indications and function tests.	x	x				
021 12 02 00	**Fire-protection systems**						
021 12 02 01	**Fire extinguishing (engine and cargo compartments)**						
LO	Explain the operating principle of a built-in fire-extinguishing system and describe its components.	x	x	x	x	x	
LO	State that two discharges must be provided for each engine (see CS 25.1195(c)).	x	x				
021 12 02 02	**Fire detection**						
LO	Explain the following principles involved in fire detection: resistance and capacitance, gas pressure.	x	x	x	x	x	
LO	Explain fire-detection applications such as: bimetallic, continuous loop, gaseous loop (gas-filled detectors).	x	x	x	x	x	

LO	Explain why generally double-loop systems are used.	x	x	x	x	x	
LO	Give an example of warnings, indications and function test of a fire-protection system.	x	x	x	x	x	
021 12 03 00	**Rain-protection system**						
LO	Explain the principle and method of operation of the following windshield rain-protecting systems for an aeroplane: wipers, liquids (rain repellent), coating.	x	x				
LO	Explain the principle and method of operation of wipers for a helicopter.			x	x	x	
021 13 00 00	**OXYGEN SYSTEMS**						
LO	Describe the basic operating principle of a cockpit oxygen system and describe the following different modes of operation: normal (diluter demand), 100 %, emergency.	x	x				
LO	Describe the operating principle and the purposes of the following two portable oxygen systems: smoke hood, portable bottle.	x	x				
LO	Describe the following two oxygen systems that can be used to supply oxygen to passengers: fixed system (chemical oxygen generator or gaseous); portable.	x	x				
LO	Describe the actuation methods (automatic and manual) and the functioning of a passenger oxygen mask.	x	x				
LO	Compare chemical oxygen generators to gaseous systems with respect to: capacity, flow regulation.	x	x				
LO	State the dangers of grease or oil related to the use of oxygen systems.	x	x				

021 14 00 00	**HELICOPTER: MISCELLANEOUS SYSTEMS**						
021 14 01 00	**Variable rotor speed**						
LO	Explain the system when pilots can 'beep' the N_R an additional amount when manoeuvring, landing and taking off, normally at higher altitudes to obtain extra tail-rotor thrust, which makes manoeuvring more positive and safer.			x	x	x	
LO	Explain the system for 'beeping' the N_R to its upper limit to enable safer take-off.			x	x	x	
021 14 02 00	**Active vibration suppression**						
LO	Explain and describe how the active vibration suppression system works through high-speed actuators and accelerometer inputs.			x	x	x	
021 14 03 00	**Night-vision goggles**						
LO	To be introduced at a later date.			x	x	x	
021 15 00 00	**HELICOPTER: ROTOR HEADS**						
021 15 01 00	**Main rotor**						
021 15 01 01	**Types**						
LO	Describe the following rotor-head systems: teetering, articulated, hingeless, bearingless.			x	x	x	
LO	Describe the following configuration of rotor systems and their advantages and disadvantages: tandem, coaxial, side by side.			x	x	x	
LO	Explain how flapping, dragging and feathering is achieved in each rotor-head system.			x	x	x	
021 15 01 02	**Structural components and materials, stresses, structural limitations**						
LO	Identify from a diagram the main structural components of the main types of rotor-head system.			x	x	x	

LO	List and describe the methods used on how to detect damage and cracks.			x	x	x	
LO	Explain and describe the structural limitations to respective rotor systems, including the dangers of negative G inputs to certain rotor-head systems.			x	x	x	
LO	Describe the various rotor-head lubrication methods.			x	x	x	
021 15 01 03	**Design and construction**						
LO	Describe the material technology used in rotor-head design, including construction using the following materials or mixture of materials: composites, fibreglass, alloys, elastomers.			x	x	x	
021 15 01 04	**Adjustment**						
LO	Describe and explain the methods of adjustment which are possible on various helicopter rotor-head assemblies.			x	x	x	
021 15 02 00	**Tail rotor**						
021 15 02 01	**Types**						
LO	Describe the following tail-rotor systems: delta 3 hinge; multi-bladed delta 3 effect; Fenestron or ducted fan tail rotor; No Tail Rotor (NOTAR) high-velocity air jet flows from adjustable nozzles (the Coandă effect).			x	x	x	
LO	Identify from a diagram the main structural components of the four main types of tail-rotor systems.			x	x	x	
LO	Explain and describe the methods to detect damage and cracks on the tail rotor and assembly.			x	x	x	
LO	Explain and describe the structural limitations to the respective tail-rotor systems and possible limitations regarding the turning rate of the helicopter.			x	x	x	

LO	Explain and describe the following methods that helicopter designers use to minimise tail-rotor drift and roll: reducing the couple arm (tail rotor on a pylon); offsetting the rotor mast; use of 'bias' in cyclic control mechanism.			x	x	x	
LO	Explain pitch-input mechanisms.			x	x	x	
LO	Explain the relationship between tail-rotor thrust and engine power.			x	x	x	
LO	Describe how the vertical fin on some helicopters reduces the power demand of the Fenestron.			x	x	x	
021 15 02 02	**Design and construction**						
LO	List and describe the various tail-rotor designs and construction methods used on current helicopters in service.			x	x	x	
021 15 02 03	**Adjustment**						
LO	Describe the rigging and adjustment of the tail-rotor system to obtain optimum position of the pilot's yaw pedals.			x	x	x	

021 16 00 00	**HELICOPTER: TRANSMISSION**						
021 16 01 00	**Main gearbox**						
021 16 01 01	**Different types, design, operation, limitations**						
LO	Describe the following main principles of helicopter transmission systems for single and twin-engine helicopters: drive for the main and tail rotor; accessory drive for the generator(s) alternator(s), hydraulic and oil pumps, oil cooler(s) and tachometers.			x	x	x	
LO	Describe the reason for limitations on multi-engine helicopter transmissions in various engine-out situations.			x	x	x	
LO	Describe how the passive vibration control works with gearbox mountings.			x	x	x	
021 16 02 00	**Rotor brake**						
LO	Describe the main function of the disc type of rotor brake.			x	x	x	
LO	Describe both hydraulic and cable operated rotor-brake systems.			x	x	x	
LO	Describe the different options for the location of the rotor brake.			x	x	x	
LO	List the following operational considerations for the use of rotor brakes: rotor speed at engagement of rotor brake; risk of blade sailing in windy conditions; risk of rotor-brake overheating and possible fire when brake is applied above the maximum limit, particularly when spilled hydraulic fluid is present; avoid stopping blades over jet-pipe exhaust with engine running; cockpit annunciation of rotor-brake operation.			x	x	x	
021 16 03 00	**Auxiliary systems**						
LO	Explain how the hoist/winch can be driven by an off-take from the auxiliary gearbox.			x	x	x	
LO	Explain how power for the air-conditioning system is taken from the auxiliary gearbox.			x	x	x	

021 16 04 00	**Driveshaft and associated installation**						
LO	Describe how power is transmitted from the engine to the main rotor gearbox.			x	x	x	
LO	Describe the material and construction of the driveshaft.			x	x	x	
LO	Explain the need for alignment between the engine and the main rotor gearbox.			x	x	x	
LO	Identify how temporary misalignment occurs between driving and driven components.			x	x	x	
LO	Explain the use of: flexible couplings; Thomas couplings; flexible disc packs; driveshaft support bearings and temperature measurement; subcritical and supercritical driveshafts.			x	x	x	
LO	Explain the relationship between the driveshaft speed and torque.			x	x	x	
LO	Describe the methods with which power is delivered to the tail rotor.			x	x	x	
LO	Describe and identify the construction and materials of tail rotor/Fenestron driveshafts.			x	x	x	
021 16 05 00	**Intermediate and tail gearbox**						
LO	Explain and describe the various arrangements when the drive changes direction and the need for an intermediate or tail gearbox.			x	x	x	
LO	Explain the lubrication requirements for intermediate and tail-rotor gearboxes and methods of checking levels.			x	x	x	
LO	Explain how on most helicopters the tail-rotor gearbox contains gearing, etc., for the tail-rotor pitch-change mechanism.			x	x	x	
021 16 06 00	**Clutches**						
LO	Explain the purpose of a clutch.			x	x	x	

	Describe and explain the operation of a: centrifugal clutch, actuated clutch.			x	x	x	
LO	List the typical components of the various clutches.			x	x	x	
LO	Identify the following methods by which clutch serviceability can be ascertained: brake-shoe dust; vibration; main-rotor run-down time; engine speed at time of main-rotor engagement; belt tensioning; start protection in a belt-drive clutch system.			x	x	x	
021 16 07 00	**Freewheels**						
LO	Explain the purpose of a freewheel.			x	x	x	
LO	Describe and explain the operation of a: cam and roller type freewheel, sprag-clutch type freewheel.			x	x	x	
LO	List the typical components of the various freewheels.			x	x	x	
LO	Identify the various locations of freewheels in power plant and transmission systems.			x	x	x	
LO	Explain the implications regarding the engagement and disengagement of the freewheel.			x	x	x	
021 17 00 00	**HELICOPTER: BLADES**						
021 17 01 00	**Main-rotor blade**						
021 17 01 01	**Design, construction**						
LO	Describe the different types of blade construction and the need for torsional stiffness.			x	x	x	
LO	Describe the principles of heating systems/pads on some blades for anti-icing/de-icing.			x	x	x	
021 17 01 02	**Structural components and materials**						
LO	List the materials used in the construction of main-rotor blades.			x	x	x	
LO	List the main structural components of a main-rotor blade and their function.			x	x	x	

021 17 01 03	**Stresses**						
LO	Describe main-rotor blade-loading on the ground and in flight.			x	x	x	
LO	Describe where the most common stress areas are on rotor blades.			x	x	x	
021 17 01 04	**Structural limitations**						
LO	Explain the structural limitations in terms of bending and rotor RPM.			x	x	x	
021 17 01 05	**Adjustment**						
LO	Explain the use of trim tabs.			x	x	x	
021 17 01 06	**Tip shape**						
LO	Describe the various blade-tip shapes used by different manufacturers and compare their advantages and disadvantages.			x	x	x	
LO	Describe how on some rotor-blade tips, static and dynamic balancing weights are attached to threaded rods and screwed into sockets in the leading edge spar and others in a support embedded into the blade tip.			x	x	x	
021 17 02 00	**Tail-rotor blade**						
021 17 02 01	**Design, construction**						
LO	Describe the most common design of tail-rotor blade construction, consisting of stainless steel shell reinforced by a honeycomb filler and stainless steel leading abrasive strip.			x	x	x	
LO	Explain that ballast weights are located at the inboard trailing edge and tip of blades, and that the weights used are determined when the blades are manufactured.			x	x	x	
LO	Describe how anti-icing/de-icing systems are designed into the blade construction of some helicopters.			x	x	x	
021 17 02 02	**Structural components and materials**						
LO	List the materials used in the construction of tail-rotor blades.			x	x	x	

LO	List the main structural components of a tail-rotor blade and their function.			x	x	x	
021 17 02 03	**Stresses**						
LO	Describe the tail-rotor blade-loading on the ground and in flight.			x	x	x	
021 17 02 04	**Structural limitations**						
LO	Describe the structural limitations of tail-rotor blades.			x	x	x	
LO	Describe the method of checking the strike indicators placed on the tip of some tail-rotor blades.			x	x	x	
021 17 02 05	**Adjustment**						
LO	Describe the adjustment of yaw pedals in the cockpit to obtain full control authority of the tail rotor.			x	x	x	

C. SUBJECT 022 — INSTRUMENTATION

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
020 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE**						
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**						
022 01 00 00	**SENSORS AND INSTRUMENTS**						
022 01 01 00	**Pressure gauge**						
LO	Define 'pressure', 'absolute pressure' and 'differential pressure'.	x	x	x	x	x	
LO	List the following units used for pressure: Pascal, bar, inches of mercury (in Hg), pounds per square inch (PSI).	x	x	x	x	x	
LO	State the relationship between the different units.	x	x	x	x	x	
LO	List and describe the following different types of sensors used according to the pressure to be measured: aneroid capsules, bellows, diaphragms, bourdon tube.	x	x	x	x	x	
LO	Solid-state sensors (to be introduced at a later date)	x	x	x	x	x	
LO	For each type of sensor identify applications such as: liquid-pressure measurement (fuel, oil, hydraulic); air-pressure measurement (bleed-air systems, air-conditioning systems); Manifold Absolute Pressure (MAP) gauge.	x	x	x	x	x	
LO	Pressure probes for Engine Pressure Ratio (EPR).	x	x				
LO	Give examples of display for each of the applications above.	x	x	x	x	x	
LO	Explain the need for remote-indicating systems.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
022 01 02 00	**Temperature sensing**						
LO	Explain temperature.	x	x	x	x	x	
LO	List the following units that can be used for temperature measurement: Kelvin, Celsius, Fahrenheit.	x	x	x	x	x	
LO	State the relationship between these different units.	x	x	x	x	x	
LO	Describe and explain the operating principles of the following types of sensors: expansion type (bimetallic strip), electrical type (resistance, thermocouple).	x	x	x	x	x	
LO	State the relationship for a thermocouple between the electromotive force and the temperature to be measured.	x	x	x	x	x	
LO	For each type, identify applications such as: gas-temperature measurement (ambient air, bleed-air systems, air-conditioning systems, air inlet, exhaust gas, gas turbine outlets); liquid-temperature measurement (fuel, oil, hydraulic).	x	x	x	x	x	
LO	Give examples of display for each of the applications above.	x	x	x	x	x	
022 01 03 00	**Fuel gauge**						
LO	State that the quantity of fuel can be measured by volume or mass.	x	x	x	x	x	
LO	List the following units used for fuel quantity when measured by mass: kilogramme; pound.	x	x	x	x	x	
LO	State the relationship between these different units.	x	x	x	x	x	
LO	Define ‘capacitance’ and ‘permittivity’, and state their relationship with density.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List and explain the parameters that can affect the measurement of the volume and/or mass of the fuel in a wing fuel tank: temperature; aircraft accelerations and attitudes, and explain how the fuel-gauge system design compensates for these changes.	X	X	X	X	X	
LO	Describe and explain the operating principles of the following types of fuel gauges: float system; capacitance type fuel-gauge system; ultrasound type of fuel gauge: to be introduced at a later date.	x	x	x	x	x	
022 01 04 00	**Fuel flowmeters**						
LO	Define 'fuel flow' and where it is measured.	x	x	x	x	x	
LO	State that fuel flow may be measured by volume or mass per unit of time.	x	x	x	x	x	
LO	List the following units used for fuel flow when measured by mass per hour: kilogrammes/hour, pounds/hour.	x	x	x	x	x	
LO	List the following units used for fuel flow when measured by volume per hour: litres/hour, US gallons/hour.	x	x	x	x	x	
LO	List and describe the following different types of fuel flowmeter: mechanical, electrical (analogue), electronic (digital), and explain how the signal can be corrected to measure mass flow.	x	x	x	x	x	
LO	Explain how total fuel consumption is obtained.	x	x	x	x	x	
022 01 05 00	**Tachometer**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the following types of tachometers: mechanical (rotating magnet); electrical (three-phase tacho-generator); electronic (impulse measurement with speed probe and phonic wheel); and describe the operating principle of each type.	x	x	x	x	x	
LO	For each type, identify applications such as engine-speed measurement (crankshaft speed for piston engines, spool speed for gas turbine engines), wheel-speed measurement for anti-skid systems (anti-skid systems for aeroplane only), and give examples of display.	x	x	x	x	x	
LO	State that engine speed is most commonly displayed as a percentage.	x	x	x	x	x	
022 01 06 00	**Thrust measurement**						
LO	List and describe the following two parameters used to represent thrust: N1, EPR.	x	x				
LO	Explain the operating principle of the EPR gauge and the consequences for the pilot in case of a malfunction including blockage and leakage.	x	x				
LO	Give examples of display for N1 and EPR.	x	x				
022 01 07 00	**Engine torquemeter**						
LO	Define 'torque'.	x	x	x	x	x	
LO	Explain the relationship between power, torque and RPM.	x	x	x	x	x	
LO	List the following units used for torque: Newton meters, inch or foot pounds.	x	x	x	x	x	
LO	State that engine torque can be displayed as a percentage.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List and describe the following different types of torquemeters: mechanical, electronic, and explain their operating principles.	x	x	x	x	x	
LO	Compare the two systems with regard to design and weight.	x	x	x	x	x	
LO	Give examples of display.	x	x	x	x	x	
022 01 08 00	**Synchroscope**						
LO	State the purpose of a synchroscope.	x	x				
LO	Explain the operating principle of a synchroscope.	x	x				
LO	Give examples of display.	x	x				
022 01 09 00	**Engine-vibration monitoring**						
LO	State the purpose of a vibration-monitoring system for a jet engine.	x	x				
LO	Describe the operating principle of a vibration-monitoring system using the following two types of sensors: piezoelectric crystal, magnet.	x	x				
LO	State that no specific unit is displayed for a vibration-monitoring system.	x	x				
LO	Give examples of display.	x	x				
022 01 10 00	**Time measurement**						
LO	Explain the use of time/date measurement and recording for engines and system maintenance.	x	x	x	x	x	
022 02 00 00	**MEASUREMENT OF AIR-DATA PARAMETERS**						
022 02 01 00	**Pressure measurement**						
022 02 01 01	**Definitions**						
LO	Define 'static, total and dynamic pressures' and state the relationship between them.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'impact pressure' as total pressure minus static pressure and discuss the conditions when dynamic pressure equals impact pressure.	x	x	x	x	x	x
022 02 01 02	**Pitot/static system: design and errors**						
LO	Describe the design and the operating principle of a: static source, pitot tube, combined pitot/static probe.	x	x	x	x	x	x
LO	For each of these indicate the various locations, and describe the following associated errors: position errors; instrument errors; errors due to a non-longitudinal axial flow (including manoeuvre-induced errors); and the means of correction and/or compensation.	x	x	x	x	x	x
LO	Describe a typical pitot/static system and list the possible outputs.	x	x	x	x	x	x
LO	Explain the redundancy and the interconnections of typical pitot/static systems.	x	x	x	x	x	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed pressure.	x	x	x	x	x	x
LO	List the affected instruments and explain the consequences for the pilot in case of a malfunction including blockage and leakage.	x	x	x	x	x	x
LO	Describe alternate static sources and their effects when used.	x	x	x	x	x	x
LO	Solid-state sensors (to be introduced at a later date).	x	x	x	x	x	x
022 02 02 00	**Temperature measurement**						
022 02 02 01	**Definitions**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'OAT', 'SAT', 'TAT' and 'measured temperature'.	x	x	x	x	x	x
LO	Define 'ram rise' and 'recovery factor'.	x					
LO	State the relationship between the different temperatures according to Mach number.	x					
022 02 02 02	**Design and operation**						
LO	Describe the following types of air-temperature probes and their features: expansion type: bimetallic strip, direct reading; electrical type wire resistance, remote reading.	x	x	x	x	x	x
LO	For each of these indicate the various locations, and describe the following associated errors: position errors, instrument errors, and the means of correction and/or compensation.	x	x	x	x	x	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed temperature.	x	x	x	x	x	x
022 02 03 00	**Angle-of-attack measurement**						
LO	Describe the following two types of angle-of-attack sensors: null-seeking (slotted) probe, vane detector.	x	x				
LO	For each type, explain the operating principles.	x	x				
LO	Explain how both types are protected against ice.	x	x				
LO	Give examples of systems that use the angle of attack as an input, such as: air-data computer; Stall Warning Systems; flight-envelope protection systems.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Give examples of different types of angle-of-attack (AoA) displays.	x	x				
022 02 04 00	**Altimeter**						
LO	Define 'ISA'.	x	x	x	x	x	x
LO	List the following two units used for altimeters: feet, metres, and state the relationship between them.	x	x	x	x	x	x
LO	Define the following terms: height, altitude; indicated altitude, true altitude; pressure altitude, density altitude.	x	x	x	x	x	x
LO	Define the following barometric references: 'QNH', 'QFE', '1013,25'.	x	x	x	x	x	x
LO	Explain the operating principles of an altimeter.	x	x	x	x	x	x
LO	Describe and compare the following three types of altimeters: simple altimeter (single capsule); sensitive altimeter (multi-capsule); servoassisted altimeter.	x	x	x	x	x	x
LO	Give examples of associated displays: pointer, multi-pointer, drum, vertical straight scale.	x	x	x	x	x	x
LO	Describe the following errors: pitot/static system errors; temperature error (air column not at ISA conditions); time lag (altimeter response to change of height); and the means of correction.	x	x	x	x	x	x
LO	Give examples of altimeter corrections table from an Aircraft Operating Handbook (AOH).	x	x	x	x	x	x
LO	Describe the effects of a blockage or a leakage on the static pressure line.	x	x	x	x	x	x
022 02 05 00	**Vertical Speed Indicator (VSI)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the two units used for VSI: metres per second, feet per minute, and state the relationship between them.	x	x	x	x	x	x
LO	Explain the operating principles of a VSI.	x	x	x	x	x	x
LO	Describe and compare the following two types of vertical speed indicators: barometric type, inertial type (inertial information provided by an inertial reference unit).	x	x	x	x	x	x
LO	Describe the following VSI errors: pitot/static system errors, time lag, and the means of correction.	x	x	x	x	x	x
LO	Describe the effects on a VSI of a blockage or a leakage on the static pressure line.	x	x	x	x	x	x
LO	Give examples of a VSI display.	x	x	x	x	x	x
022 02 06 00	**Airspeed Indicator (ASI)**						
LO	List the following three units used for airspeed: nautical miles/hour (knots), statute miles/hour, kilometres/hour, and state the relationship between them.	x	x	x	x	x	x
LO	Define 'IAS', 'CAS', 'EAS', 'TAS' and state and explain the relationship between these speeds.	x	x	x	x	x	x
LO	Describe the following ASI errors and state when they must be considered: pitot/static system errors, compressibility error, density error.	x	x	x	x	x	x
LO	Explain the operating principles of an ASI (as appropriate to aeroplanes or helicopters).	x	x	x	x	x	x
LO	Give examples of an ASI display: pointer, vertical straight scale.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret ASI corrections tables as used in an Aircraft Operating Handbook (AOH).	x	x	x	x	x	x
LO	Define and explain the following colour codes that can be used on an ASI: white arc (flap operating speed range); green arc (normal operating speed range); yellow arc (caution speed range); red line (VNE); blue line (best rate of climb speed, one-engine-out for multi-engine piston light aeroplanes).	x	x				
LO	Describe the effects on an ASI of a blockage or a leakage in the static and/or total pressure line(s).	x	x	x	x	x	x
022 02 07 00	**Machmeter**						
LO	Define 'Mach number' and 'Local Speed of Sound' (LSS), and perform simple calculations that include these terms.	x					
LO	Describe the operating principle of a Machmeter.	x					
LO	Explain why a Machmeter suffers only from pitot/static system errors.	x					
LO	Give examples of a Machmeter display: pointer, drum, vertical straight scale, digital.	x					
LO	Describe the effects on a Machmeter of a blockage or a leakage in the static and/or total pressure line(s).	x					
LO	State the relationship between Mach number, CAS and TAS, and interpret their variations according to FL and temperature changes.	x					
LO	State the existence of MMO.	x					
022 02 08 00	**Air-Data Computer (ADC)**						
LO	Explain the operating principle of an ADC.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the following possible input data: TAT, static pressure, total pressure, measured temperature, angle of attack, flaps and landing gear position, stored aircraft data.	x		x	x		
LO	List the following possible output data: IAS, TAS, SAT, TAT, Mach number, angle of attack, altitude, vertical speed, VMO/MMO pointer.	x		x	x		
LO	For each output, list the datum/data sensed and explain the principle of calculation.	x		x	x		
LO	Explain how position, instrument, compressibility and density errors can be compensated/corrected to achieve a TAS calculation.	x		x	x		
LO	Explain why accuracy is improved for each output datum when compared to raw data.	x		x	x		
LO	Give examples of instruments and/or systems which may use ADC output data.	x		x	x		
LO	State that an ADC can be a stand-alone system or integrated with the Inertial Reference Unit (ADIRU).	x		x	x		
LO	Explain the ADC architecture for air-data measurement including sensors, processing units and displays, as opposed to stand-alone air-data measurement instruments.	x		x	x		
LO	Explain the advantage of an ADC for air-data information management compared to raw data.	x		x	x		
022 03 00 00	**MAGNETISM — DIRECT-READING COMPASS AND FLUX VALVE**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
022 03 01 00	**Earth's magnetic field**						
LO	Describe the magnetic field of the Earth.	x	x	x	x	x	x
LO	Explain the properties of a magnet.	x	x	x	x	x	x
LO	Define the following terms: magnetic variation, magnetic dip (inclination).	x	x	x	x	x	x
022 03 02 00	**Aircraft magnetic field**						
LO	Define and explain the following terms: magnetic and non-magnetic material; hard and soft iron; permanent magnetism and electromagnetism.	x	x	x	x	x	x
LO	Explain the principles and the reasons for: compass swinging (determination of initial deviations); compass compensation (correction of deviations found); compass calibration (determination of residual deviations).	x	x	x	x	x	x
LO	List the causes of the aircraft's magnetic field and explain how it affects the accuracy of the compass indications.	x	x	x	x	x	x
LO	Describe the purpose and the use of a deviation correction card.	x	x	x	x	x	x
022 03 03 00	**Direct-reading magnetic compass**						
LO	Define the role of a direct-reading magnetic compass.	x	x	x	x	x	x
LO	Describe and explain the design of a vertical card-type compass.	x	x	x	x	x	x
LO	Describe the deviation compensation.	x	x	x	x	x	x
LO	Describe and interpret the effects of the following errors: acceleration, turning, attitude, deviation.	x	x	x	x	x	x
LO	Explain how to use and interpret the direct-reading compass indications during a turn.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
022 03 04 00	**Flux valve**						
LO	Explain the purpose of a flux valve.	x	x	x	x	x	x
LO	Explain its operating principle.	x	x	x	x	x	x
LO	Indicate various locations and precautions needed.	x	x	x	x	x	x
LO	Give the remote-reading compass system as example of application.	x	x	x	x	x	x
LO	State that because of the electromagnetic deviation correction, the flux-valve output itself does not have a deviation correction card.	x	x	x	x	x	x
LO	Describe and interpret the effects of the following errors: acceleration, turning, attitude, deviation.	x	x	x	x	x	x
022 04 00 00	**GYROSCOPIC INSTRUMENTS**						
022 04 01 00	**Gyroscope: basic principles**						
LO	Define a 'gyro'.	x	x	x	x	x	x
LO	Explain the fundamentals of the theory of gyroscopic forces.	x	x	x	x	x	x
LO	Define the 'degrees of freedom' of a gyro. *Remark: As a convention, the degrees of freedom of a gyroscope do not include its own axis of rotation (the spin axis).*	x	x	x	x	x	x
LO	Explain the following terms: rigidity, precession, wander (drift/topple).	x	x	x	x	x	x
LO	Distinguish between: real wander and apparent wander; apparent wander due to the rotation of the Earth and transport wander.	x	x	x	x	x	x
LO	Describe a free (space) gyro and a tied gyro.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe and compare electrically and pneumatically-driven gyroscopes.	x	x	x	x	x	x
LO	Explain the construction and operating principles of a: rate gyro, rate-integrating gyro.	x	x	x	x	x	x
022 04 02 00	**Rate-of-turn indicator — Turn coordinator — Balance (slip) indicator**						
LO	Explain the purpose of a rate-of-turn and balance (slip) indicator.	x	x	x	x	x	x
LO	Define a 'rate-one turn'.	x	x	x	x	x	x
LO	Describe the construction and principles of operation of a rate-of-turn indicator.	x	x	x	x	x	x
LO	State the degrees of freedom of a rate-of-turn indicator.	x	x	x	x	x	x
LO	Explain the relation between bank angle, rate of turn and TAS.	x	x	x	x	x	x
LO	Explain why the indication of a rate-of-turn indicator is only correct for one TAS and when turn is coordinated.	x	x	x	x	x	x
LO	Describe the construction and principles of operation of a balance (slip) indicator.	X	X	X	X	X	x
LO	Explain the purpose of a balance (slip) indicator.	x	x	x	x	x	x
LO	Describe the indications of a rate-of-turn and balance (slip) indicator during a balanced, slip or skid turn.	x	x	x	x	x	x
LO	Describe the construction and principles of operation of a turn coordinator (or turn-and-bank indicator).	x	x	x	x	x	x
LO	Compare the rate-of-turn indicator and the turn coordinator.	x	x	x	x	x	x
022 04 03 00	**Attitude indicator (artificial horizon)**						
LO	Explain the purpose of the attitude indicator.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the different designs and principles of operation of attitude indicators (air-driven, electric).	x	x	x	x	x	x
LO	State the degrees of freedom.	x	x	x	x	x	x
LO	Describe the gimbal system.	x	x	x	x	x	x
LO	Describe the effects of the aircraft's acceleration and turns on instrument indications.	x	x	x	x	x	x
LO	Describe the attitude display and instrument markings.	x	x	x	x	x	x
LO	Explain the purpose of a vertical gyro unit.	x	x	x	x	x	x
LO	List and describe the following components of a vertical gyro unit: inputs: pitch and roll sensors; transmission and amplification (synchros and amplifiers); outputs: display units such as Attitude Direction Indicator (ADI), auto-flight control systems.	x	x	x	x	x	x
LO	State the advantages and disadvantages of a vertical gyro unit compared to an attitude indicator with regard to: design (power source, weight and volume); accuracy of the information displayed; availability of the information for several systems (ADI, AFCS).	x	x	x	x	x	x
022 04 04 00	**Directional gyroscope**						
LO	Explain the purpose of the directional gyroscope.	x	x	x	x	x	x
LO	Describe the following two types of directional gyroscopes: air-driven directional gyro; electric directional gyro.	x	x	x	x	x	x
LO	State the degrees of freedom.	x	x	x	x	x	x
LO	Describe the gimbal system.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the following different errors: design and manufacturing imperfections (random wander); apparent wander (rotation of the Earth); transport wander (movement relative to the Earth's surface); and explain their effects.	x	x	x	x	x	x
LO	Calculate the apparent wander (apparent drift rate in degrees per hour) of an uncompensated gyro according to latitude.	x	x	x	x	x	x
022 04 05 00	**Remote-reading compass systems**						
LO	Describe the principles of operation of a remote-reading compass system.	x	x	x	x	x	x
LO	Using a block diagram, list and explain the function of the following components of a remote-reading compass system: flux detection unit; gyro unit; transducers, precession amplifiers, annunciator; display unit (compass card, synchronising and set-heading knob, DG/compass switch).	x	x	x	x	x	x
LO	State the advantages and disadvantages of a remote-reading compass system compared to a direct-reading magnetic compass with regard to: design (power source, weight and volume); deviation due to aircraft magnetism; turning and acceleration errors; attitude errors; accuracy and stability of the information displayed; availability of the information for several systems (compass card, RMI, AFCS).	x	x	x	x	x	x
022 04 06 00	**Solid-state systems — AHRS (the following paragraph is to be introduced at a later date)**	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the Micro-Electromechanical Sensors (MEMS) technology can be used to make: solid-state accelerometers; solid-state rate sensor gyroscopes; solid-state magnetometers (measurement of the Earth's magnetic field).	x	x	x	x	x	x
LO	Describe the basic principle of a solid-state Attitude and Heading Reference System (AHRS) using a solid-state 3-axis rate sensor, 3-axis accelerometer and a 3-axis magnetometer.	x	x	x	x	x	x
LO	Compare the solid-state AHRS with the mechanical gyroscope and flux-gate system with regard to: size and weight, accuracy, reliability, cost.	x	x	x	x	x	x
022 05 00 00	**INERTIAL NAVIGATION AND REFERENCE SYSTEMS (INS AND IRS)**						
022 05 01 00	**Inertial Navigation Systems (INS) (stabilised inertial platform)**						
022 05 01 01	**Basic principles**						
LO	Explain the basic principles of inertial navigation.	x		x	x		
022 05 01 02	**Design**						
LO	List and describe the main components of a stabilised inertial platform.	x		x	x		
LO	Explain the different corrections made to stabilise the platform.	x		x	x		
LO	List the following two effects that must be compensated for: Coriolis, centrifugal.	x		x	x		
LO	Explain the alignment of the system, the different phases associated and the conditions required.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the Schuler condition and give the value of the Schuler period.	x		x	x		
022 05 01 03	**Errors, accuracy**						
LO	State that there are three different types of errors: bounded errors, unbounded errors, other errors.	x		x	x		
LO	Give average values for bounded and unbounded errors according to time.	x		x	x		
LO	State that an average value for the position error of the INS according to time is 1,5 NM/hour or more.	x		x	x		
022 05 01 04	**Operation**						
LO	Give examples of INS control and display panels.	x		x	x		
LO	Give an average value of alignment time at midlatitudes.	x		x	x		
LO	List the outputs given by an INS.	x		x	x		
LO	Describe and explain the consequences concerning the loss of alignment by an INS in flight.	x		x	x		
022 05 02 00	**Inertial Reference Systems (IRS) (strapped-down)**						
022 05 02 01	**Basic principles**						
LO	Describe the operating principle of a strapped-down IRS.	x		x	x		
LO	State the differences between a strapped-down inertial system (IRS) and a stabilised inertial platform (INS).	x		x	x		
022 05 02 02	**Design**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List and describe the following main components of an IRS: rate sensors (laser gyros), inertial accelerometers, high-performance processors, display unit.	x		x	x		
LO	Explain the construction and operating principles of a Ring Laser Gyroscope (RLG).	x		x	x		
LO	Explain the different computations and corrections to be made to achieve data processing.	x		x	x		
LO	Explain the alignment of the system, the different phases associated and the conditions required.	x		x	x		
LO	Explain why the Schuler condition is still required.	x		x	x		
LO	Describe the 'lock-in' (laser lock) phenomena and the means to overcome it.	x		x	x		
LO	State that an IRS can be a stand-alone system or integrated with an ADC (ADIRU).	x		x	x		
022 05 02 03	**Errors, accuracy**						
LO	Compare IRS and INS for errors and accuracy.	x		x	x		
022 05 02 04	**Operation**						
LO	Compare IRS and INS, and give recent examples of control panels.	x		x	x		
LO	List the outputs given by an IRS.	x		x	x		
LO	Give the advantages and disadvantages of an IRS compared to an INS.	x		x	x		
022 06 00 00	**AEROPLANE: AUTOMATIC FLIGHT CONTROL SYSTEMS**						
022 06 01 00	**General: Definitions and control loops**						
LO	State the following purposes of an Automatic Flight Control System (AFCS): enhancement of flight controls; reduction of pilot workload.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define and explain the following two functions of an AFCS: aircraft control: control of the aeroplane's movement about its centre of gravity (CG); aircraft guidance: guidance of the aeroplane's CG (flight path).	x	x				
LO	Define and explain 'closed loop' and open loop.	x	x				
LO	Explain that the inner loop is for aircraft control and outer loop is for aircraft guidance.	x	x				
LO	List the following different elements of a closed-loop control system and explain their function: input signal; error detector; signal processing (computation of output signal according to control laws); output signal; control element; feedback signal.	x	x				
022 06 02 00	**Autopilot system: design and operation**						
LO	Define the three basic control channels.	x	x				
LO	List the following different types of autopilot systems: 1-axis, 2-axis and 3-axis.	x	x				
LO	List and describe the main components of an autopilot system.	x	x				
LO	Explain and describe the following lateral modes: roll, heading, VOR/LOC, NAV or LNAV.	x	x				
LO	Describe the purpose of control laws for pitch and roll modes.	x	x				
LO	Explain and describe the following longitudinal (or vertical) modes: pitch, vertical speed, level change, altitude hold (ALT), profile or VNAV, G/S.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Give basic examples for pitch and roll channels of inner loops and outer loops with the help of a diagram.	x	x				
LO	Explain the influence of gain variation on precision and stability.	x	x				
LO	Explain gain adaptation with regard to speed, configuration or flight phase.	x	x				
LO	Explain and describe the following common (or mixed) modes: take-off, go-around and approach. *Remark: The landing sequence is studied in 022 06 04 00.*	x	x				
LO	List the different types of actuation configuration and compare their advantages/disadvantages.	x	x				
LO	List the inputs and outputs of a 3-axis autopilot system.	x	x				
LO	Describe and explain the synchronisation function.	x	x				
LO	Give examples of engagement and disengagement systems and conditions.	x	x				
LO	Define the 'Control Wheel Steering' (CWS) mode according to CS-25 (see AMC 25.1329, paragraph 4.3).	x	x				
LO	Describe the CWS mode operation.	x	x				
LO	Describe with the help of a control panel of an autopilot system and a flight mode annunciator/indicator the actions and the checks performed by a pilot through a complete sequence: from Heading (HDG) selection to VOR/LOC guidance (arm/capture/ track); from Altitude selection (LVL change) to Altitude (ALT) hold (arm/intercept/ hold).	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe and explain the different phases and the associated annunciations/ indications from level change to altitude capture and from heading mode to VOR/ LOC capture.	x	x				
LO	Describe and explain the existence of operational limits for lateral modes (LOC capture) with regard to speed/angle of interception/distance to threshold, and for longitudinal modes (ALT or G/S capture) with regard to V/S.	x	x				
022 06 03 00	**Flight Director: design and operation**						
LO	State the purpose of a Flight Director (FD) system.	x	x				
LO	List and describe the main components of an FD system.	x	x				
LO	List the different types of display.	x	x				
LO	Explain the differences between an FD system and an Autopilot (AP) system.	x	x				
LO	Explain how an FD and an AP can be used together, separately (AP with no FD, or FD with no AP), or none of them.	x	x				
LO	Give examples of different situations with the respective indications of the command bars.	x	x				
022 06 04 00	**Aeroplane: Flight Mode Annunciator (FMA)**						
LO	Explain the purpose and the importance of the FMA.	x	x				
LO	State that the FMA provides: AFCS lateral and vertical modes; auto-throttle modes; FD selection, AP engagement and automatic landing capacity; failure and alert messages.	x	x				
022 06 05 00	**Autoland: design and operation**						
LO	Explain the purpose of an autoland system.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List and describe the main components of an autoland system.	x					
LO	Define the following terms: 'fail passive system'; 'fail operational' (fail active) system; alert height; according to CS-AWO.	x					
LO	Describe and explain the autoland sequence and the associated annunciations/indications from initial approach to roll-out (AP disengagement) or go-around.	x					
LO	List and explain the operational limitations to perform an autoland.	x					
022 07 00 00	**HELICOPTER: AUTOMATIC FLIGHT CONTROL SYSTEMS**						
022 07 01 00	**General principles**						
022 07 01 01	**Stabilisation**						
LO	Explain the similarities and differences between SAS and AFCS (the latter can actually fly the helicopter to perform certain functions selected by the pilot). Some AFCSs just have altitude and heading hold whilst others include a vertical speed or IAS hold mode, where a constant rate of climb/decent or IAS is maintained by the AFCS.			x	x	x	
022 07 01 02	**Reduction of pilot workload**						
LO	Appreciate how effective the AFCS is in reducing pilot workload by improving basic aircraft control harmony and decreasing disturbances.			x	x	x	

022 07 01 03	**Enhancement of helicopter capability**						
LO	Explain how an AFCS improves helicopter flight safety during: search and rescue because of increased capabilities; flight by sole reference to instruments; underslung load operations; white-out conditions in snow-covered landscapes; an approach to land with lack of visual cues.			x	x	x	
LO	Explain that the Search and Rescue (SAR) modes of AFCS include the following functions: ability to autohover; automatically transition down from cruise to a predetermined point or over-flown point; ability for the rear crew to move the helicopter around in the hover; the ability to automatically transition back from the hover to cruise flight; the ability to fly various search patterns.			x	x	x	
LO	Explain that the earlier autohover systems use Doppler velocity sensors and the later systems use inertial sensors plus GPS, and normally include a two-dimensional hover-velocity indicator for the pilots.			x	x	x	
LO	Explain why some SAR helicopters have both radio-altimeter height hold and barometric altitude hold.			x	x	x	
022 07 01 04	**Failures**						
LO	Explain the various redundancies and independent systems that are built into the AFCSs.			x	x	x	
LO	Appreciate that the pilot can override the system in the event of a failure.			x	x	x	
LO	Explain a series actuator ‘hard over’ which equals aircraft attitude runaway.			x	x	x	
LO	Explain the consequences of a saturation of the series actuators.			x	x	x	
022 07 02 00	**Components: Operation**						
022 07 02 01	**Basic sensors**						

LO	Explain the basic sensors in the system and their functions.			x	x	x	
LO	Explain that the number of sensors will be dependent on the number of couple modes of the system.			x	x	x	
022 07 02 02	**Specific sensors**						
LO	Explain the function of the microswitches and strain gauges in the system which sense pilot input to prevent excessive feedback forces from the system.			x	x	x	
022 07 02 03	**Actuators**						
LO	Explain the principles of operation of the series and parallel actuators, spring-box clutches and the autotrim system.			x	x	x	
LO	Explain the principle of operation of the electronic hydraulic actuators in the system.			x	x	x	
022 07 02 04	**Pilot/system interface: control panels, system indication, warnings**						
LO	Describe the typical layout of the AFCS control panel.			x	x	x	
LO	Describe the system indications and warnings.			x	x	x	
022 07 02 05	**Operation**						
LO	Explain the functions of the redundant sensors' simplex and duplex channels (single/dual channel).			x	x	x	
022 07 03 00	**Stability Augmentation System (SAS)**						
022 07 03 01	**General principles and operation**						

LO	Explain the general principles and operation of an SAS with regard to: rate damping; short-term attitude hold; effect on static stability; effect on dynamic stability; aerodynamic cross-coupling; effect on manoeuvrability; control response; engagement/disengagement; authority.			x	x	x	
LO	Explain and describe the general working principles and primary use of SAS by damping pitch, roll and yaw motions.			x	x	x	
LO	Describe a simple SAS with forced trim system which uses magnetic clutch and springs to hold cyclic control in the position where it was last released.			x	x	x	
LO	Explain the interaction of trim with SAS/Stability and Control Augmentation System (SCAS).			x	x	x	
LO	Appreciate that the system can be overridden by the pilot and individual channels deselected.			x	x	x	
LO	Describe the operational limits of the system.			x	x	x	
LO	Explain why the system should be turned off in severe turbulence or when extreme flight attitudes are reached.			x	x	x	
LO	Explain the safety design features built into some SASs to limit the authority of the actuators to 10–20 % of the full-control throw in order to allow the pilot to override if actuators demand an unsafe control input.			x	x	x	
LO	Explain how cross-coupling produces an adverse effect on roll to yaw coupling, when the helicopter is subject to gusts.			x	x	x	
LO	Explain the collective-to-pitch coupling, side-slip-to-pitch coupling and inter-axis coupling.			x	x	x	

022 07 04 00	**Autopilot — Automatic stability equipment**						
022 07 04 01	**General principles**						
LO	Explain the general autopilot principles with regard to: long-term attitude hold; fly-through; changing the reference (beep trim, trim release).			X	X	X	
022 07 04 02	**Basic modes (3/4 axes)**						
LO	Explain the AFCS operation on cyclic axes (pitch/roll), yaw axis, and on collective (fourth axis).			X	X	X	
022 07 04 03	**Automatic guidance (upper modes of AFCS)**						
LO	Explain the function of the attitude-hold system in an AFCS.			X	X	X	
LO	Explain the function of the heading-hold system in an AFCS.			X	X	X	
LO	Explain the function of the vertical-speed hold system in an AFCS.			X	X	X	
LO	Explain the function of the navigation-coupling system in an AFCS.			X	X	X	
LO	Explain the function of the VOR/ILS-coupling system in an AFCS.			X	X	X	
LO	Explain the function of the hover-mode system in an AFCS (including Doppler and radio altimeter systems).			X	X	X	
LO	Explain the function of the SAR mode (automatic transition to hover and back to cruise) in an AFCS.			X	X	X	
022 07 04 04	**Flight Director: design and operation**						
LO	Explain the purpose of a Flight Director (FD) system.			X	X	X	
LO	List the different types of display.			X	X	X	
LO	State the difference between the FD system and the autopilot system. Explain how each can be used independently.			X	X	X	

LO	List and describe the main components of an FD system.			x	x	x	
LO	Give examples of different situations with the respective indications of the command bars.			x	x	x	
LO	Explain the architecture of the different FDs fitted to helicopters and the importance to monitor other instruments as well as the FD, because on some helicopter types which have the collective setting on the FD, there is no protection against a collective transmission overtorque.			x	x	x	
LO	Describe the collective setting and yaw depiction on FD for some helicopters.			x	x	x	
022 07 04 05	**Automatic Flight Control Panel (AFCP)**						
LO	Explain the purpose and the importance of the AFCP.			x	x	x	
LO	State that the AFCP provides: AFCS basic and upper modes; FD selection, SAS and AP engagement; failure and alert messages.			x	x	x	
022 08 00 00	**TRIMS — YAW DAMPER — FLIGHT-ENVELOPE PROTECTION**						
022 08 01 00	**Trim systems: design and operation**						
LO	Explain the purpose of the trim system.	x	x				
LO	State the existence of a trim system for each of the three axes.	x	x				
LO	Give examples of trim indicators and their function.	x	x				
LO	Describe and explain an automatic pitch-trim system for a conventional aeroplane.	x	x				
LO	Describe and explain an automatic pitch-trim system for a fly-by-wire aeroplane.	x					
LO	State that for a fly-by-wire aeroplane the automatic pitch-trim system operates also during manual flight.	x					

LO	Describe the consequences of manual operation on the trim wheel when the automatic pitch-trim system is engaged.	x	x				
LO	Describe and explain the engagement and disengagement conditions of the autopilot according to trim controls.	x	x				
LO	Define 'Mach trim' and state that the Mach-trim system can be independent.	x	x				
LO	State that for a fly-by-wire aeroplane an autotrim system can be available for each of the three axes. *Remark: For the fly-by-wire LOs, please refer to reference 21.5.4.0.*	x	x				
022 08 02 00	**Yaw damper: design and operation**						
LO	Explain the purpose of the yaw-damper system.	x	x				
LO	List and describe the main components of a yaw-damper system.	x	x				
LO	Explain the purpose of the Dutch-roll filter (filtering of the yaw input signal).	x	x				
LO	Explain the operation of a yaw-damper system and state the difference between a yaw-damper system and a 3-axis autopilot operation on the rudder channel.	x	x				
022 08 03 00	**Flight-Envelope Protection (FEP)**						
LO	Explain the purpose of the FEP.	x					
LO	List the input parameters of the FEP.	x					
LO	Explain the following functions of the FEP: stall protection, overspeed protection.	x					
LO	State that the stall protection function and the overspeed protection function apply to both mechanical/conventional and fly-by-wire control systems, but other functions (e.g. pitch or bank limitation) can only apply to fly-by-wire control systems.	x					

022 09 00 00	**AUTO-THROTTLE — AUTOMATIC THRUST CONTROL SYSTEM**						
LO	State the purpose of the auto-throttle (AT) system.	x					
LO	Explain the operation of an AT system with regard to the following modes: take-off/go-around; climb or Maximum Continuous Thrust (MCT): N1 or EPR targeted; speed; idle thrust; landing ('flare' or 'retard').	x					
LO	Describe the control loop of an AT system with regard to: inputs: mode selection unit and switches (disengagement and engagement: TO-GA switches), radio altitude, air–ground logic switches; error detection: comparison between reference values (N1 or EPR, speed) and actual values; signal processing (control laws of the thrust-lever displacement according to error signal); outputs: AT servo-actuator; feedback: Thrust Lever Angle (TLA), data from ADC (TAS, Mach number), engine parameters (N1 or EPR).	x					
LO	State the existence of AT systems where thrust modes are determined by the lever position (no thrust mode panel or thrust rating panel, no TOGA switches).	x					
LO	Explain the limitations of an AT system in case of turbulence.	x					
022 10 00 00	**COMMUNICATION SYSTEMS**						
022 10 01 00	**Voice communication, data link transmission**						
022 10 01 01	**Definitions and transmission modes**						
LO	State the purpose of a data link transmission system.	x					
LO	Compare voice communication versus data link transmission systems.	x					

LO	State that VHF, HF and SATCOM devices can be used for voice communication and data link transmission.	x					
LO	State the advantages and disadvantages of each transmission mode with regard to: range; line-of-sight limitations; quality of the signal received; interference due to ionospheric conditions; data transmission speed.	x					
LO	State that the satellite communication networks do not cover extreme polar regions.	x					
LO	Define 'downlink and uplink communications'.	x					
LO	State that a D-ATIS is an ATIS message received by data link.	x					
022 10 01 02	**Systems: Architecture, design and operation**						
LO	Name the two following data link service providers: SITA, ARINC, and state their function.	x					
LO	Describe the ACARS network.	x					
LO	Describe the two following systems using the VHF/HF/SATCOM data link transmission: Aircraft Communication Addressing and Reporting System (ACARS); Air Traffic Service Unit (ATSU).	x					
LO	List and describe the following possible onboard components of an ATSU: communications management unit (VHF/HF/SATCOM); Data Communication Display Unit (DCDU); Multi-Control Display Unit (MCDU) for AOC, ATC and messages from the crew (downlink communication); ATC message visual warning; printer.	x					

LO	Give examples of Airline Operations Communications (AOC) data link messages such as: Out of the gate, Off the ground, On the ground, Into the gate (OOOI); load sheet; passenger information (connecting flights); weather reports (METAR, TAF); maintenance reports (engine exceedances); free-text messages.	x					
LO	Give examples of Air Traffic Communications (ATC) data link messages such as: departure clearance, oceanic clearance.	x					
022 10 02 00	**Future Air Navigation Systems (FANS)**						
LO	State the existence of the ICAO Communication, Navigation, Surveillance/ Air Traffic Management (CNS/ATM) concept.	x					
LO	Define and explain the 'FANS concept' (including FANS A and FANS B).	x					
LO	State that FANS A uses the ACARS network.	x					
LO	List and explain the following FANS A applications: ATS Facility Notification (AFN); Automatic Dependent Surveillance (ADS); Controller–Pilot Data Link Communications (CPDLC).	x					
LO	Compare the ADS application with the secondary surveillance radar function, and the CPDLC application with VHF communication systems.	x					
LO	State that an ATC centre can use the ADS application only, or the CPDLC application only, or both of them (not including AFN).	x					
LO	Describe a notification phase (LOG ON) and state its purpose.	x					
LO	List the different types of messages of the CPDLC function and give examples of CPDLC data link messages.	x					

LO	List the different types of ADS contracts: periodic, on demand, on event, emergency mode.	x					
LO	State that the controller can modify the 'periodic', 'on demand' and 'on event' contracts or the parameters of these contracts (optional data groups), and that these modifications do not require crew notification.	x					
LO	Describe the 'emergency mode'.	x					
022 11 00 00	**FLIGHT MANAGEMENT SYSTEM (FMS)**						
LO	*Remark: The use of an FMS as a navigation system is detailed in Radio Navigation (062), reference 062 05 04 00.*						
022 11 01 00	**Design**						
LO	State the purpose of an FMS.	x		x	x		
LO	Describe a typical dual FMS architecture.	x		x	x		
LO	Describe the different possible configurations of this architecture during degraded modes of operation.	x		x	x		
LO	List the possible inputs and outputs of an FMS. *Remark: No standard of FMS can be given because the FMS is type specific for aircraft manufacturers and the FMS standard is defined by the airline customer.*	x		x	x		
LO	Describe the interfaces of the FMS with AFCS.	x		x	x		
LO	Describe the interfaces of the FMS with the AT system.	x					
022 11 02 00	**Navigation database, aircraft database**						
LO	Describe the contents and the main features of the navigation database and of the aircraft database: read-only information, updating cycle.	x		x	x		
LO	Define and explain the 'performance factor'.	x		x	x		

022 11 03 00	**Operations, limitations**						
LO	List and describe data computation and functions including position computations (multisensors), flight management, lateral/vertical navigation and guidance.	x		x	x		
LO	State the difference between computations based on measured data (use of sensors) and computations based on database information and give examples.	x		x	x		
LO	Define and explain the 'Cost Index' (CI).	x					
LO	Describe navigation accuracy computations and approach capability, degraded modes of operation: back-up navigation, use of raw data to confirm position/RAIM function for RNAV procedures.	x		x	x		
LO	Describe fuel computations with standard and non-standard configurations including one engine out, landing gear down, flaps, spoilers, use of the anti-icing system, increase of consumption due to an MEL/CDL item, etc.	x		x	x		
LO	Describe automatic radio navigation and tuning (COMM, NAV).	x		x	x		
022 11 04 00	**Man–machine interface (Multifunction Control Display Unit (MCDU))**						
LO	Give examples and describe the basic functions of the man–machine interface (MCDU).	x		x	x		
022 12 00 00	**ALERTING SYSTEMS, PROXIMITY SYSTEMS**						
022 12 01 00	**General**						
LO	State definitions, category, criteria and characteristics of alerting systems according to CS 25/AMJ 25.1322 for aeroplanes and CS-29 for helicopters as appropriate.	x	x	x	x	x	
022 12 02 00	**Flight Warning Systems (FWS)**						
LO	State the purpose of an FWS and list the typical sources (abnormal situations) of a warning and/or an alert.	x		x	x	x	

LO	List the main components of an FWS.	x		x	x	x	
022 12 03 00	**Stall Warning Systems (SWS)**						
LO	State the function of an SWS.	x	x				
LO	State the characteristics of an SWS according to CS 25.207(c).	x	x				
LO	List the different types of stall warning systems.	x	x				
LO	List the main components of an SWS.	x	x				
LO	List the inputs and outputs of an SWS.	x	x				
022 12 04 00	**Stall protection**						
LO	State the function of a stall protection system.	x					
LO	List the different types of stall protection systems including the difference between mechanical and fly-by-wire controls.	x					
LO	List the main components of a stall protection system.	x					
LO	List the inputs and outputs of a stall protection system.	x					
LO	Explain the difference between a stall warning system and a stall protection system.	x					
022 12 05 00	**Overspeed warning**						
LO	Explain the purpose of an overspeed warning system (VMO/MMO pointer).	x	x				
LO	Explain the design of a mechanical VMO/ MMO pointer.	x	x				
LO	State that for large aeroplanes, an aural warning must be associated to the overspeed warning if an electronic display is used (see AMC 25.11, paragraph 10.b(2), p. 2-GEN-22).	x	x				
LO	Give examples of VMO/MMO pointer: barber pole pointer, barber pole vertical scale.	x	x				
022 12 06 00	**Take-off warning**						

LO	State the purpose of a take-off warning system and list the typical abnormal situations which generate a warning (see AMC 25.703, paragraphs 4 and 5).	x					
022 12 07 00	**Altitude alert system**						
LO	State the function and describe an altitude alert system.	x	x	x	x	x	x
LO	List and describe the different types of displays and possible alerts.	x	x	x	x	x	x
022 12 08 00	**Radio altimeter**						
LO	State the function of a low-altitude radio altimeter.	x	x	x	x	x	x
LO	Describe the principle of the distance (height) measurement.	x	x	x	x	x	x
LO	State the bandwidth and frequency range used.	x	x	x	x	x	x
LO	List the different components of a radio altimeter and describe the different types of displays.	x	x	x	x	x	x
LO	List the systems using radio-altimeter information.	x	x	x	x	x	x
LO	State the range and accuracy of a radio altimeter.	x	x	x	x	x	x
LO	Describe and explain the cable-length compensation.	x	x	x	x	x	x
022 12 09 00	**Ground-proximity warning systems (GPWS)**						
022 12 09 01	**GPWS: design, operation, indications**						
LO	State the purpose of a ground-proximity warning system (GPWS).	x		x	x		
LO	List the components of a GPWS.	x		x	x		
LO	List the inputs and outputs of a GPWS.	x		x	x		
LO	List and describe the different modes of operation of a GPWS.	x		x	x		

022 12 09 02	**Terrain-Avoidance Warning System (TAWS), other name: Enhanced GPWS (EGPWS)**						
LO	State the purpose of a TAWS for aeroplanes and HTAWS for helicopters and explain the difference from a GPWS.	x		x	x		
LO	List the components of a TAWS/ HTAWS.	x		x	x		
LO	List the inputs and outputs of a TAWS/ HTAWS.	x		x	x		
LO	Give examples of terrain displays and list the different possible alerts.	x		x	x		
LO	Give examples of time response left to the pilot according to look-ahead distance, speed and aircraft performances.	x		x	x		
LO	Explain why the TAWS/HTAWS must be coupled to a precise-position sensor.	x		x	x		
022 12 09 03	**Runway awareness and advisory system** (to be introduced at a later date)						
LO	Explain that a runway awareness and advisory system is a software upgrade of the existing TAWS (EGPWS) to reduce runway incursions.	x					
022 12 10 00	**ACAS/TCAS principles and operations**	x	x	x	x	x	x
LO	State that ACAS II is an ICAO standard for anti-collision purposes.	x	x	x	x	x	x
LO	State that TCAS II version 7 is compliant with the ACAS II standard.	x	x	x	x	x	x
LO	Explain that ACAS II is an anti-collision system and does not guarantee any specific separation.	x	x	x	x	x	x
LO	Describe the purpose of an ACAS II system as an anti-collision system.	x	x	x	x	x	x
LO	Define a 'Resolution Advisory' (RA) and a 'Traffic Advisory' (TA).	x	x	x	x	x	x
LO	State that RAs are calculated in the vertical plane only (climb or descent).	x	x	x	x	x	x

LO	Explain the difference between a corrective RA and a preventive RA (no modification of vertical speed).	x	x	x	x	x	x
LO	Explain that if two aircraft are fitted with ACAS II, the RA will be coordinated.	x	x	x	x	x	x
LO	State that ACAS II equipment can take into account several threats simultaneously.	x	x	x	x	x	x
LO	State that a detected aircraft without altitude-reporting can only generate a TA.	x	x	x	x	x	x
LO	Describe the TCAS II system in with regard to: antenna used; computer and links with radio altimeter, air-data computer and mode-S transponder.	x	x	x	x	x	x
LO	Identify the inputs and outputs of TCAS II.	x	x	x	x	x	x
LO	Explain the principle of TCAS II interrogations.	x	x	x	x	x	x
LO	State that the standard detection range is approximately 30 NM.	x	x	x	x	x	x
LO	State that the normal interrogation period is 1 second.	x	x	x	x	x	x
LO	Explain the principle of ‘reduced surveillance’.	x	x	x	x	x	x
LO	Explain that in high-density traffic areas the period can be extended to 5 seconds and the transmission power reduction can reduce the range detection down to 5 NM.	x	x	x	x	x	x
LO	Identify the equipment which an intruder must be fitted with in order to be detected by TCAS II.	x	x	x	x	x	x

LO	Explain in the anti-collision process: that the criteria used to trigger an alarm (TA or RA) are the time to reach the closest point of approach (called TAU) and the difference of altitude; that an intruder will be classified as 'proximate' when being less than 6 NM and 1 200 ft from the TCAS-equipped aircraft; that the time limit to CPA is different depending on aircraft altitude, is linked to a sensitivity level (SL), and state that the value to trigger an RA is from 15 to 35 seconds; that, in case of an RA, the intended vertical separation varies from 300 to 600 ft (700 ft above FL420), depending on the SL; that below 1 000 ft above ground, no RA can be generated; that below 1 450 ft (radio-altimeter value) 'increase descent' RA is inhibited; that, in high altitude, performances of the type of aircraft are taken into account to inhibit 'climb' and 'increase climb' RA.	x	x	x	x	x	x
LO	List and interpret the following information available from TCAS: the different possible statuses of a detected aircraft: other, proximate, intruder; the appropriate graphic symbols and their position on the horizontal display; different aural warnings.	x	x	x	x	x	x
LO	Explain that an RA is presented as a possible vertical speed on a TCAS indicator or on the Primary Flight Display (PFD).	x	x	x	x	x	x
LO	Describe the possible presentation of an RA on a VSI or on a PFD.	x	x	x	x	x	x
LO	Explain that the pilot must not interpret the horizontal track of an intruder upon the display.	x	x	x	x	x	x
022 12 11 00	**Rotor/engine overspeed alert system**						
022 12 11 01	**Design, operation, displays, alarms**						

LO	Describe the basic design principles, operation, displays and warning/alarm systems fitted to different helicopters.			x	x	x	
022 13 00 00	**INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS**						
022 13 01 00	**Electronic display units**						
022 13 01 01	**Design, limitations**						
LO	List the different technologies used, e.g. CRT and LCD, and the associated limitations: cockpit temperature, glare.	x	x	x	x	x	x
022 13 02 00	**Mechanical integrated instruments: Attitude and Director Indicator (ADI)/Horizontal Situation Indicator (HSI)**						
LO	Describe an ADI and an HSI.	x	x	x	x	x	x
LO	List all the information that can be displayed for either instruments.	x	x	x	x	x	x
022 13 03 00	**Electronic Flight Instrument Systems (EFIS)**						
	Remarks: *1 — The use of EFIS as navigation display system is also detailed in Radio Navigation (062), reference 062 05 05 02 (EFIS instruments).* *2 — Reference to AMC 25-1322 can be used for aeroplanes only.*						
022 13 03 01	**Design, operation**						
LO	List and describe the different components of an EFIS.	x	x	x	x	x	x
LO	List the following possible inputs and outputs of an EFIS: control panel, display units, symbol generator, remote-light sensor.	x	x	x	x	x	x
LO	Describe the function of the symbol generator unit.	x	x	x	x	x	x
022 13 03 02	**Primary Flight Display (PFD), Electronic Attitude Director Indicator (EADI)**						

LO	State that a PFD (or an EADI) presents a dynamic colour display of all the parameters necessary to control the aircraft.	x	x	x	x	x	x
LO	List and describe the following information that can be displayed on the PFD unit of an aircraft: flight mode annunciation; basic T: • attitude, • IAS, • altitude, • heading/track indications; vertical speed; maximum-airspeed warning; selected airspeed; speed-trend vector; selected altitude; current barometric reference; steering indications (FD command bars); selected heading; flight path vector (FPV); radio altitude; decision height; ILS indications; ACAS (TCAS) indications; failure flags and messages.	x	x	x	x	x	x
LO	List and describe the following information that can also be displayed on the PFD unit of an aeroplane: take-off and landing reference speeds; minimum airspeed; lower selectable airspeed; Mach number.	x					
022 13 03 03	**Navigation Display (ND), Electronic Horizontal Situation Indicator (EHSI)**						
LO	State that an ND (or an EHSI) provides a mode-selectable colour flight navigation display.	x	x	x	x	x	x
LO	List and describe the following four modes displayed on an ND unit: MAP (or ARC), VOR (or ROSE VOR), APP (or ROSE LS), PLAN.	x	x	x	x	x	x

LO	List and explain the following information that can be displayed with the MAP (or ARC) mode on an ND unit: selected and current track; selected and current heading (magnetic or true-north reference); cross-track error; origin and destination airport with runway selected; bearings to or from the tuned and selected stations; active and/or secondary flight plan; range marks; ground speed; TAS and ground speed; wind direction and speed; next-waypoint distance and estimated time of arrival; additional navigation facilities (STA), waypoint (WPT) and airports (ARPT); weather radar information; traffic information from the ACAS (TCAS); terrain information from the TAWS or HTAWS (EGPWS); failure flags and messages.	x	x	x	x	x	x
LO	List and explain the following information that can be displayed with the VOR/APP (or ROSE VOR/ROSE LS) mode on an ND unit: selected and current track; selected and current heading (magnetic or true-north reference) VOR course or ILS localizer course VOR (VOR or ROSE VOR mode) or LOC course deviation (APP or ROSE LS); glide-slope pointer (APP or ROSE LS); frequency or identifier of the tuned station; ground speed; TAS and ground speed; wind direction and speed; failure flags and messages.	x	x	x	x	x	x

LO	List and explain the following information that can be displayed with the PLAN mode on an ND unit: selected and current track; origin and destination airport with runway selected; active and/or secondary flight plan; range marks; ground speed; TAS and ground speed; wind direction and speed; next-waypoint distance and estimated time of arrival; additional navigation facilities (STA), waypoint (WPT) and airports (ARPT); failure flags and messages.	x	x				
LO	Give examples of possible transfers between units.	x	x	x	x	x	x
LO	Give examples of EFIS control panels.	x	x	x	x	x	x
022 13 04 00	**Engine parameters, crew warnings, aircraft systems, procedure and mission display systems**						
LO	State the purpose of the following systems: engine instruments centralised display unit; crew alerting system associated with an electronic checklist display unit; that the aircraft systems display unit enables the display of normal and degraded modes of operation of the aircraft systems.	x		x	x		
LO	Describe the architecture of each system and give examples of display.	x		x	x		
LO	Give the following different names by which engine parameters, crew warnings, aircraft systems and procedures display systems are known: Multifunction Display Unit (MFDU); Engine Indication and Crew Alerting Systems (EICAS); Engine and Warning Display (EWD); Electronic Centralised Aircraft Monitor (ECAM).	x					

LO	Give the names of the following different display systems and describe their main functions: Vehicle Engine Monitoring Display (VEMD); Integrated Instruments Display System (IIDS).			x	x		
LO	State the purpose of a mission display unit.			x	x		
LO	Describe the architecture of each system and give examples of display.			x	x		
022 13 05 00	**Engine first limit indicator**						
LO	Describe the principles of design and operation, and compare the different indications and displays available.			x	x	x	
LO	Describe what information can be displayed on the screen, when in the limited screen composite mode.			x	x	x	
022 13 06 00	**Electronic Flight Bag (EFB)** (to be introduced at a later date)						
022 14 00 00	**MAINTENANCE, MONITORING AND RECORDING SYSTEMS**						
LO	State the basic technologies used for this equipment and its performances. *Remark: No knowledge of the applicable operational requirements is necessary.*	x	x	x	x	x	x
022 14 01 00	**Cockpit Voice Recorder (CVR)**						
LO	State the purpose of a CVR.	x					
LO	List the main components of a CVR: a shock-resistant tape recorder associated with an underwater locating device; an area microphone; a control unit with the following controls: auto/on, test and erase, and a headset jack.	x					

LO	List the following main parameters recorded on the CVR: voice communications transmitted from or received on the flight deck; the aural environment of the flight deck; voice communication of flight crew members using the aeroplane's interphone system; voice or audio signals introduced into a headset or speaker; voice communication of flight crew members using the public address system, when installed.	x					
022 14 02 00	**Flight Data Recorders (FDR)**						
LO	State the purpose of an FDR.	x					
LO	List the main components of an FDR: a data interface and acquisition unit; a recording system (digital flight data recorder); two control units (start sequence, event mark setting).	x					
LO	List the following main parameters recorded on the FDR: time or relative time count; attitude (pitch and roll); airspeed; pressure altitude; heading; normal acceleration; propulsive/thrust power on each engine and cockpit thrust/power lever position, if applicable; flaps/slats configuration or cockpit selection; ground spoilers and/or speed brake selection.	x					
LO	State that additional parameters can be recorded according to FDR capacity and the applicable operational requirements.	x					
022 14 03 00	**Maintenance and monitoring systems**						
022 14 03 01	**Helicopter Operations Monitoring Programme (HOMP): design, operation, performance**						

LO	Describe the HOMP as a helicopter version of the aeroplane Flight Data Monitoring (FDM) programmes.			x	x		
LO	State that the HOMP software consists of three integrated modules: Flight Data Events (FDE); Flight Data Measurements (FDM); Flight Data Traces (FDT).			x	x		
LO	Describe and explain the information flow of HOMP.			x	x		
LO	Describe HOMP operation and management processes.			x	x		
022 14 03 02	**Integrated Health & Usage Monitoring System (IHUMS): design, operation, performance**						
LO	Describe the main features of IHUMS: rotor system health; cockpit voice recorder/flight data recorder; gearbox system health; engine health; exceedance monitoring; usage monitoring; transparent operation; ground station features; exceedance monitoring; monitoring; gearbox health; rotor track & balance; engine performance trending; usage monitoring; quality controlled to level 2.			x	x		
LO	Describe the ground station features of IHUMS.			x	x		
LO	Summarise the benefits of IHUMS including: reduced risk of catastrophic failure of rotor or gearbox; improved rotor track & balance giving lower vibration levels; accurate recording of flight exceedances; cockpit voice recorder/flight data recorder allows accurate accident /incident investigation & HOMP; maintenance cost savings.			x	x		

LO	State the benefits of IHUMS and HOMP.			x	x		
022 14 03 03	**Aeroplane Condition Monitoring System (ACMS): general, design, operation**						
LO	State the purpose of an ACMS.	x					
LO	Describe the structure of an ACMS including: inputs: aircraft systems (such as air conditioning, autoflight, flight controls, fuel, landing gear, navigation, pneumatic, APU, engine), MCDU; data management unit; recording unit: digital recorder; outputs: printer, ACARS or ATSU.	x					
LO	State that maintenance messages sent by an ACMS can be transmitted without crew notification.	x					
022 15 00 00	**DIGITAL CIRCUITS AND COMPUTERS**						
022 15 01 00	**Digital circuits and computers: General, definitions and design**						
LO	Define a ‘computer’ as a machine for manipulating data according to a list of instructions.	x		x	x		
LO	List the following main components of a stored-programme (‘Von Neumann architecture’) on a basic computer: Central Processing Unit (CPU) including the Arithmetic Logic Unit (ALU) and the control unit; memory; input and output devices (peripherals); and state their functions.	x		x	x		
LO	State the existence of the different buses and their function.	x		x	x		
LO	Define the terms ‘hardware’ and ‘software’.	x		x	x		
LO	Define and explain the terms ‘multitasking’ and ‘multiprocessing’.	x		x	x		

LO	With the help of the relevant 022 references, give examples of airborne computers, such as ADC, FMS, GPWS, etc., and list the possible peripheral equipment for each system.	x		x	x		
LO	Describe the principle of the following technologies used for memories: chip circuit, magnetic disk, optical disk.	x		x	x		
022 15 02 00	**Software: General, definitions and certification specifications**						
LO	State the difference between assembly languages, high-level languages and scripting languages.	x		x	x		
LO	Define the term 'Operating System' (OS) and give different examples including airborne systems such as FMS or ATSU (for aeroplanes only).	x		x	x		
LO	State the existence of 'Software Considerations in Airborne Systems and Equipment Certification' (see document referenced RTCA/DO-178B or EUROCAE ED-12B).	x		x	x		
LO	List the specific levels of safety criticality according to the EUROCAE ED-12B document.	x		x	x		

D. SUBJECT 031 — MASS AND BALANCE

(1) MASS DEFINITIONS

Allowed take-off mass
The mass taking into consideration all possible limitations for take-off including restrictions caused by regulated take-off mass and regulated landing mass.

Area load or floor load
The load (or mass) distributed over a defined area. Units of measurement used:
SI: N/m^2, kg/m^2;
Non-SI: psi, lb/ft^2.

Basic empty mass
The mass of an aircraft plus standard items such as: unusable fuel; full operating fluids; fire extinguishers; emergency oxygen equipment. (The lowest mass that is used in FCL exams.)

Dry operating mass
The total mass of an aircraft ready for a specific type of operation excluding all usable fuel and traffic load. This mass includes items such as:

crew and crew baggage;

catering and removable passenger service equipment (food, beverages, potable water, lavatory chemicals, etc.);

special operational equipment (e.g. stretchers, rescue hoist, cargo sling).

In-flight mass
The mass of an aircraft in flight at a specified time.

Landing mass
The mass of the aircraft at landing.

Maximum structural in-flight mass with external loads (applicable to helicopters only)
The maximum permissible total mass of the helicopter with external loads.

Maximum structural landing mass
The maximum permissible total mass of the aircraft at landing under normal circumstances.

Maximum structural mass
The maximum permissible total mass of the aircraft at any time. It will be given only if there is no difference between maximum structural taxi mass, maximum structural take-off mass and maximum structural landing mass.

Maximum structural take-off mass
The maximum permissible total mass of the aircraft at commencement of take-off.

Maximum (structural) taxi mass or maximum (structural) ramp mass
The maximum permissible total mass of the aircraft at commencement of taxiing.

Minimum mass (applicable to helicopters only)
The minimum permissible total mass for specific helicopter operations.

Operating mass
The dry operating mass plus fuel but without traffic load.

Performance-limited landing mass
The mass subject to the destination airfield limitations. It must never exceed the maximum structural

limit.

Performance-limited take-off mass
The take-off mass subject to departure airfield limitations. It must never exceed the maximum structural limit.

Ramp mass (see taxiing mass)

Regulated landing mass
The lower of performance-limited landing mass and maximum structural landing mass.

Regulated take-off mass
The lower of performance limited take-off mass and maximum structural take-off mass.

Running (or linear) load
The load (or mass) distributed over a defined length of a cargo compartment irrespective of load width. Units of measurement used:
SI: N/m, kg/m;
Non-SI: lb/in, lb/ft.

Take-off fuel
The total amount of usable fuel at take-off.

Take-off mass
The mass of the aircraft including everything and everyone contained in it at the commencement of take-off.

Taxi mass or ramp mass
The mass of the aircraft at the commencement of taxiing.

Traffic load
The total mass of passengers, baggage and cargo including any non-revenue load.

Zero-fuel mass
The dry operating mass plus traffic load but excluding fuel.

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
031 00 00 00	**MASS AND BALANCE — AEROPLANES/HELICOPTERS**						
031 01 00 00	**PURPOSE OF MASS-AND-BALANCE CONSIDERATIONS**						
031 01 01 00	**Mass limitations**						
031 01 01 01	**Importance with regard to structural limitations**						
LO	Describe the relationship between aircraft mass and structural stress. *Remark: See also 021 01 01 00.*	x	x	x	x	x	
LO	Describe that mass must be limited to ensure adequate margins of strength.	x	x	x	x	x	
031 01 01 02	**Importance with regard to performance** *Remark: See also subjects 032/034 and 081/082.*						
LO	Describe the relationship between aircraft mass and performance.	x	x	x	x	x	
LO	Describe that aircraft mass must be limited to ensure adequate aircraft performance.	x	x	x	x	x	
LO	Describe that the actual aircraft mass must be known during flight as the basis for performance-related decisions.	x	x	x	x	x	
031 01 02 00 **031 01 02 01**	**Centre-of-gravity (CG) limitations** **Importance with regard to stability and controllability** **Remark: See also subjects 081/082.**						
LO	Describe the relationship between CG position and stability/controllability of the aircraft.	x	x	x	x		
LO	Describe the consequences if CG is in front of the forward limit.	x	x	x	x	x	
LO	Describe the consequences if CG is behind the aft limit.	x	x	x	x	x	

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Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
031 01 02 02	**Importance with regard to performance** *Remark: See also subjects 032/034 and 081/082.*						
LO	Describe the relationship between CG position and aircraft performance.	x	x	x	x		
LO	Describe the effects of CG position on performance parameters (speeds, altitude, endurance and range).	x	x	x	x	x	
031 02 00 00	**LOADING**						
031 02 01 00	**Terminology**						
031 02 01 01	**Mass terms**						
LO	Define the following mass terms: basic empty mass; dry operating mass; operating mass; take-off mass; landing mass; ramp/taxiing mass; in-flight mass (gross mass); zero-fuel mass.	x	x	x	x	x	
031 02 01 02	**Load terms (including fuel terms)** *Remark: See also subject 033.*						
LO	Define the following load terms: payload/traffic load; block fuel; taxiing fuel; take-off fuel; trip fuel; reserve fuel (contingency, alternate, final reserve and additional fuel); extra fuel.	x	x	x	x	x	
LO	Explain the relationship between the various load-and-mass components listed above.	x	x	x	x	x	
LO	Calculate the mass of particular components from other given components.	x	x	x	x	x	

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Convert fuel mass, volume and density given in different units used in aviation.	x	x	x	x	x	
031 02 02 00	**Mass limits**						
031 02 02 01	**Structural limitations**						
LO	Define the following structural limitations:	x	x	x	x	x	
LO	Maximum zero-fuel mass.	x					
LO	Maximum ramp/taxiing mass.	x					
LO	Maximum take-off mass.	x	x	x	x	x	
LO	Maximum in-flight (gross) mass.	x	x	x	x	x	
LO	Maximum in-flight (gross) mass with external load.			x	x	x	
LO	Maximum landing mass.	x	x	x	x	x	
031 02 02 02	**Performance limitations**						
LO	Define the following performance limitations: performance-limited take-off mass; performance-limited landing mass; regulated take-off mass; regulated landing mass.	x	x	x	x	x	
031 02 02 03	**Cargo-compartment limitations**						
LO	Define the following cargo-compartment limitations:	x	x	x	x	x	
LO	Maximum floor load (maximum load per unit of area).	x	x	x	x	x	
LO	Maximum running load (maximum load per unit of fuselage length).	x	x	x	x	x	
031 02 03 00	**Mass calculations**						
031 02 03 01	**Maximum masses for take-off and landing**						
LO	Calculate the maximum mass for take-off (regulated take-off mass) given mass-and-load components and structural/ performance limits.	x	x	x	x		

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the maximum mass for landing (regulated landing mass) given mass-and-load components and structural/ performance limits.	x	x	x	x		
LO	Calculate the allowed mass for take-off.	x	x	x	x		
031 02 03 02	**Allowed traffic load and fuel load**						
LO	Calculate the maximum allowed traffic load and fuel load in order not to exceed the given allowed take-off mass.	x	x	x	x	x	
LO	Calculate 'under load'/'over load' given allowed mass for take-off, operating mass and actual traffic load.	x	x	x	x	x	
031 02 03 03	**Use of standard masses for passengers, baggage and crew**						
LO	Extract the appropriate standard masses for passengers, baggage and crew from relevant documents or operator requirements.	x	x	x	x	x	
LO	Calculate the traffic load by using standard masses.	x	x	x	x	x	
031 03 00 00	**FUNDAMENTALS OF CENTRE-OF-GRAVITY CALCULATIONS**						
031 03 01 00	**Definition of Centre of Gravity (CG)**						
LO	Define and explain the meaning of 'CG'.	x	x	x	x	x	
031 03 02 00	**Conditions of equilibrium (balance of forces and balance of moments)**						
LO	Define 'datum' (reference point), 'moment arm' and 'moment'.	x	x	x	x	x	
LO	Name the conditions of equilibrium.	x	x	x	x	x	
031 03 03 00	**Basic calculations of CG**						
LO	Resolve numerical problems using the principle of equilibrium of forces and moments.	x	x	x	x	x	
031 04 00 00	**MASS-AND-BALANCE DETAILS OF AIRCRAFT**						

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Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
031 04 01 00	**Contents of mass-and-balance documentation**						
031 04 01 01	**Datum, moment arm**						
LO	Name where the datum and moment arms for aircraft can be found.	x	x	x	x	x	
LO	Extract the appropriate data from given documents.	x	x	x	x	x	
031 04 01 02	**CG position as distance from datum**						
LO	Name where the CG position for an aircraft at basic empty mass can be found.	x	x	x	x	x	
LO	Name where the CG limits for an aircraft can be found.	x	x	x	x	x	
LO	Extract the CG limits from given aircraft documents.	x	x	x	x	x	
LO	State the different forms in presenting CG position as distance from datum or other references.	x	x	x	x	x	
031 04 01 03	**CG position as percentage of Mean Aerodynamic Chord (% MAC)** *Remark: Knowledge of the definition of MAC is covered under reference 081 01 01 05.*						
LO	Extract % MAC information from aircraft documents.	x	x				
LO	Explain the principle of using % MAC for the description of the CG position.	x	x				
LO	Calculate the CG position as % MAC.	x	x				
031 04 01 04	**Longitudinal CG limits**						
LO	Extract the appropriate data from given sample documents.	x	x	x	x	x	
031 04 01 05	**Lateral CG limits**						
LO	Extract the appropriate data from given sample documents.			x	x	x	
031 04 01 06	**Details of passenger and cargo compartments**						

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Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Extract the appropriate data (e.g. seating schemes, compartment dimensions and limitations) from given sample documents.	x	x	x	x	x	x
031 04 01 07	**Details of fuel system relevant to mass-and-balance considerations**						
LO	Extract the appropriate data (e.g. fuel-tank capacities and fuel-tank positions) from given sample documents.	x	x	x	x	x	x
031 04 02 00	**Determination of aircraft empty mass and CG position by weighing**						
031 04 02 01	**Weighing of aircraft (general aspects)**						
LO	Explain the general procedure and regulations for weighing of aircraft (conditions, intervals, reasons and requirements for reweighing). *Remark: See the applicable operational requirements.*	x	x	x	x	x	
LO	Extract and interpret entries from/in 'mass (weight) report' of an aircraft.	x	x	x	x	x	
031 04 02 02	**Calculation of mass and CG position of an aircraft using weighing data**						
LO	Calculate the mass and CG position of an aircraft from given reaction forces on jacking points.	x	x	x	x	x	
031 04 03 00	**Extraction of basic empty mass and CG data from aircraft documentation**						
031 04 03 01	**Basic empty mass (BEM) and/or dry operating mass (DOM)**						
LO	Extract values for BEM and/or DOM from given documents.	x	x	x	x	x	
031 04 03 02	**CG position and/or moment at BEM/DOM**						
LO	Extract values for CG position and moment at BEM and/or DOM from given documents.	x	x	x	x	x	
031 04 03 03	**Deviations from standard configuration**						

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Extract values from given documents for deviation from standard configuration as a result of varying crew, optional equipment, optional fuel tanks, etc.	x	x	x	x	x	
031 05 00 00	**DETERMINATION OF CG POSITION**						
031 05 01 00	**Methods**						
031 05 01 01	**Arithmetic method**						
LO	Calculate the CG position of aircraft by using the formula: CG position = sum of moments/total mass.	x	x	x	x	x	
031 05 01 02	**Graphic method**						
LO	Determine the CG position of aircraft by using the loading graphs given in sample documents.	x	x	x	x	x	
031 05 01 03	**Index method**						
LO	Explain the principle of the index method.	x	x	x	x	x	
LO	Define the terms ‘index’, ‘loaded index’ and ‘dry operating index’.	x	x	x	x	x	
LO	State the advantage(s) of the index method.	x	x	x	x	x	
031 05 02 00	**Load and trim sheet**						
031 05 02 01	**General considerations**						
LO	Explain the principle and the purpose of load sheets.	x					
LO	Explain the principle and the purpose of trim sheets.	x					
031 05 02 02	**Load sheet and CG envelope for light aeroplanes and for helicopters**						
LO	Add loading data and calculate masses in a sample load sheet.	x	x	x	x	x	
LO	Calculate moments and CG positions.	x	x	x	x	x	

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Check CG position at zero-fuel mass and take-off mass to be within the CG envelope including last-minute changes, if applicable.	x	x	x	x	x	
031 05 02 03	**Load sheet for large aeroplanes**						
LO	Explain the purpose of load-sheet sections and the methods for establishing 'allowed mass for take-off', 'allowed traffic load' and 'under load'.	x					
LO	Explain the purpose of load-sheet sections and the methods for assessing load distribution.	x					
LO	Explain the purpose of load-sheet sections and methods for cross-checking the actual and limiting mass values.	x					
LO	Calculate and/or complete a sample load sheet.	x					
031 05 02 04	**Trim sheet for large aeroplanes**						
LO	Explain the purpose of the trim sheet and the methods to determine the CG position.	x					
LO	Check that the zero-fuel mass index is within the limits.	x					
LO	Determine the fuel index by using the 'fuel index correction table' and determine the CG position as % MAC.	x					
LO	Check that the take-off mass index is within the limits.	x					
LO	Determine 'stabiliser trim units' for take-off.	x					
LO	Explain the difference between certified and operational CG limits.	x					
031 05 02 05	**Last-minute changes**						
LO	Complete a load and trim sheet for last-minute changes.	x					
031 05 03 01	**Repositioning of CG by shifting the load**						

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the mass to be moved over a given distance, or to/from given compartments, to establish a defined CG position.	x	x	x	x	x	
LO	Calculate the distance to move a given mass to establish a defined CG position.	x	x	x	x	x	
031 05 03 02	**Repositioning of CG by additional load or ballast**						
LO	Calculate the amount of additional load or ballast to be loaded at a given position or compartment to establish a defined CG position.	x	x	x	x	x	
LO	Calculate the loading position or compartment for a given amount of additional load or ballast to establish a defined CG position.	x	x	x	x	x	
031 06 00 00	**CARGO HANDLING**						
031 06 01 00	**Types of cargo (general aspects)**						
LO	Explain the basic idea of typical types of cargo, e.g. containerised cargo, palletised cargo, bulk cargo.	x	x	x	x	x	
031 06 02 00	**Floor-area load and running-load limitations in cargo compartments**						
LO	Calculate the required floor-contact area for a given load to avoid exceeding the maximum permissible floor load of a cargo compartment.	x	x	x	x	x	
LO	Calculate the maximum mass of a container with given floor-contact area to avoid exceeding the maximum permissible floor load of a cargo compartment.	x	x	x	x	x	
LO	Calculate the linear load distribution of a container to avoid exceeding the maximum permissible running load.	x	x	x	x	x	
031 06 03 00	**Securement of load**						

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Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the reasons for having an adequate tie-down of loads.	x	x	x	x	x	
LO	Name the basic methods for securing loads.	x	x	x	x	x	

E. SUBJECT 032 — PERFORMANCE (AEROPLANE)

(1) For theoretical knowledge examination purposes:

'Climb angle' is assumed to be air mass-related.

'Flight-path angle' is assumed to be ground-related.

'Screen height for take-off' is the vertical distance between the take-off surface and the take-off flight path at the end of the take-off distance.

'Screen height for landing' is the vertical distance between the landing surface and the landing flight path from which the landing distance begins.

(2) For mass definitions, please refer to CHAPTER D (SUBJECT 031 — MASS AND BALANCE).

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
032 00 00 00	**PERFORMANCE — AEROPLANES**						
032 01 00 00	**GENERAL**						
032 01 01 00	**Performance legislation**						
032 01 01 01	**Airworthiness requirements according to CS-23 and CS-25**						
LO	Interpret the European Union airworthiness requirements according to CS-23 relating to aeroplane performance.	x	x				
LO	Interpret the European Union airworthiness requirements according to CS-25 relating to aeroplane performance.	x					
LO	Name the general differences between aeroplanes as certified according to CS-23 and CS-25.	x					
032 01 01 02	**Operational regulations**						
LO	Interpret the applicable operational requirements related to aeroplane performance.	x	x				
LO	Name and define the performance classes for commercial air transportation according to the applicable operational requirements.	x	x				
032 01 02 00	**General performance theory**						
032 01 02 01	**Stages of flight**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the following stages of flight: take-off; climbing flight; level flight; descending flight; approach and landing.	x	x				
032 01 02 02	**Definitions, terms and concepts**						
LO	Define 'steady' flight.	x	x				
LO	Resolve the forces during steady climbing and descending flight.	x	x				
LO	Determine the opposing forces during horizontal steady flight.	x	x				
LO	Interpret the 'thrust/power required' and 'thrust/power available' curves.	x	x				
LO	Describe the meaning of 'excess thrust and power' using appropriate graphs.	x	x				
LO	Describe the effect of excess thrust and power on speed and/or climb performance.	x	x				
LO	Calculate the climb gradient from given thrust, drag and aeroplane mass.	x	x				
LO	Explain climb, level flight and descent performance in relation to the combination of thrust/power available and required.	x	x				
LO	Explain the difference between angle and gradient.	x	x				
LO	Define the terms 'climb angle' and 'climb gradient'.	x	x				
LO	Define the terms 'flight-path angle' and 'flight-path gradient'.	x	x				
LO	Define the terms 'descent angle' and 'descent gradient'.	x	x				
LO	Explain the difference between climb/descent angle and flight-path angle.	x	x				
LO	Define 'service' and 'absolute ceiling'.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the terms 'clearway (CWY)' and 'stopway (STW)' according to CS-Definitions.	x	x				
LO	Define the terms: Take-Off Run Available (TORA); Take-Off Distance Available (TODA); Accelerate-Stop Distance Available (ASDA); according to the applicable operational requirements.	x	x				
LO	Define 'screen height' and list its various values.	x	x				
LO	Define the terms 'range' and 'endurance'.	x	x				
LO	Define the aeroplane's 'Specific Fuel Consumption (SFC)'. *Remark: Engine specific fuel consumption is covered in 021.*	x	x				
LO	Define the aeroplane's 'Specific Range (SR)'.	x	x				
032 01 02 03	**Variables influencing performance**						
LO	Name and understand the following factors that affect aeroplane performance, particularly: temperature; air density; wind; aeroplane mass; aeroplane configuration; aeroplane anti-skid system status; aeroplane centre of gravity; aerodrome runway surface; aerodrome runway slope.	x	x				
032 02 00 00	**PERFORMANCE CLASS B — SINGLE-ENGINE AEROPLANES**						
032 02 01 00	**Definitions of speeds used**						
LO	Define the following speeds according to CS-23: stall speeds V_S, V_{S0} and V_{S1}; rotation speed V_R; speed at 50 ft above the take-off surface level; reference speed landing V_{REF}.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 02 02 00	**Effect of variables on single-engine aeroplane performance**						
LO	Explain the effect of the wind component on take-off and landing performance.	x	x				
LO	Determine the regulatory factors for take-off and landing according to the applicable operational requirements.	x	x				
LO	Explain the effects of temperature, wind and altitude on climb performance.	x	x				
LO	Explain the effects of altitude and temperature on cruise performance.	x	x				
LO	Explain the effects of mass, wind and speed on descent performance.	x	x				
032 02 03 00	**Take-off and landing**						
LO	Interpret the take-off and landing requirements according to the applicable operational requirements.	x	x				
LO	Define the following distances: take-off distance; landing distance; ground-roll distance; maximum allowed take-off mass; maximum allowed landing mass.	x	x				
LO	Explain the effect of flap-setting on the ground-roll distance.	x	x				
032 02 04 00	**Climb, cruise and descent**						
LO	Explain the effects of the different recommended power settings on range and endurance.	x	x				
LO	Explain the effects of wind and altitude on maximum endurance speed.	x	x				
032 02 05 00	**Use of aeroplane performance data**						
032 02 05 01	**Take-off**						
LO	Find the minimum or maximum wind component.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Find the take-off distance and ground-roll distance.	x	x				
LO	Find the maximum allowed take-off mass.	x	x				
LO	Find the take-off speed.	x	x				
032 02 05 02	**Climb**						
LO	Find the maximum rate-of-climb speed.	x	x				
LO	Find the time, distance and fuel to climb.	x	x				
LO	Find the rate of climb.	x	x				
032 02 05 03	**Cruise**						
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption.	x	x				
LO	Find range and endurance.	x	x				
LO	Find the difference between still air distance (NAM) and ground distance (NM).	x	x				
032 02 05 04	**Landing**						
LO	Find the minimum or maximum wind component.	x	x				
LO	Find the landing distance and ground-roll distance.	x	x				
032 03 00 00	**PERFORMANCE CLASS B — MULTI-ENGINE AEROPLANES**						
032 03 01 00	**Definitions of terms and speeds**						
LO	Define and explain the following terms: critical engine; speed for best angle of climb (V_X); speed for best rate of climb (V_Y).	x	x				
LO	Explain the effect of the critical engine inoperative on the power required and the total drag.	x	x				
LO	Explain the effect of engine failure on controllability under given conditions.	x	x				
032 03 02 00	**Effect of variables on multi-engine aeroplane performance**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 03 02 01	**Take-off and landing**						
LO	Explain the effect of flap-setting on the ground-roll distance.	x	x				
LO	For both fixed and constant speed propellers, explain the effect of airspeed on thrust during the take-off run.	x	x				
LO	Explain the effect of pressure altitude on performance-limited take-off mass.	x	x				
LO	Explain the effect of runway conditions on the take-off distance.	x	x				
LO	Determine the regulation factors for take-off according to the applicable operational requirements.	x	x				
LO	Explain the percentage of accountability for headwind and tailwind components during take-off and landing calculations.	x	x				
LO	Interpret obstacle clearance at take-off.	x	x				
LO	Explain the effect of selected power settings, flap settings and aeroplane mass on the rate of climb.	x	x				
LO	Describe the effect of engine failure on take-off climb performance.	x	x				
LO	Explain the effect of brake release before take-off power is set on the take-off and accelerate-stop distance.	x	x				
032 03 02 02	**Climb, cruise and descent**						
LO	Explain the effect of CG on fuel consumption.	x	x				
LO	Explain the effect of mass on the speed for best angle and best rate of climb.	x	x				
LO	Explain the effect of mass on the speed for best angle and best rate of descent.	x	x				
LO	Explain the effect of temperature and altitude on fuel flow.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of wind on the maximum range speed and speed for maximum climb angle.	x	x				
LO	Explain the effect of mass, altitude, wind, speed and configuration on glide descent.	x	x				
LO	Describe the various cruise techniques.	x	x				
LO	Describe the effect of loss of engine power on climb and cruise performance.	x	x				
032 03 02 03	**Landing**						
LO	Explain the effect of runway conditions on the landing distance.	x	x				
LO	Determine the regulatory factors for landing according to the applicable operational requirements.	x	x				
032 03 03 00	**Use of aeroplane performance data**						
032 03 03 01	**Take-off**						
LO	Find take-off field-length data.	x	x				
LO	Calculate the field-length limited take-off mass.	x	x				
LO	Find the accelerate-go distance as well the accelerate-stop distance data.	x	x				
LO	Find the ground-roll and take-off distance.	x	x				
LO	Calculate the maximum effort take-off data.	x	x				
LO	Calculate all engine and critical engine-out take-off climb data.	x	x				
LO	Calculate obstacle clearance take-off climb data.	x	x				
032 03 03 02	**Climb**						
LO	Find rate of climb and climb gradient.	x	x				
LO	Calculate single engine service ceiling.	x	x				
LO	Calculate obstacle clearance climb data.	x	x				
032 03 03 03	**Cruise and descent**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption.	x	x				
LO	Calculate range and endurance data.	x	x				
032 03 03 04	**Landing**						
LO	Find landing field-length data.	x	x				
LO	Find landing climb data in the event of balked landing.	x	x				
LO	Find landing distance and ground-roll distance.	x	x				
LO	Find short-field landing distance and ground-roll distance.	x	x				
032 04 00 00	**PERFORMANCE CLASS A — AEROPLANES CERTIFIED ACCORDING TO CS-25 ONLY**						
032 04 01 00	**Take-off**						
LO	Explain the essential forces affecting the aeroplane during take-off.	x					
LO	State the effects of thrust-to-weight ratio and flap-setting on ground roll.	x					
032 04 01 01	**Definitions of terms used**						
LO	Define the terms 'Aircraft Classification Number (ACN)' and 'Pavement Classification Number (PCN)'.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define and explain the following speeds in accordance with CS-25 or CS-Definitions: — reference stall speed (V_{SR}); — reference stall speed in the landing configuration (V_{SR0}); — reference stall speed in a specific configuration (V_{SR1}); — 1-g stall speed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight (V_{S1g}); — minimum control speed with critical engine inoperative (V_{MC}); — minimum control speed on or near the ground (V_{MCG}); — minimum control speed at take-off climb (V_{MCA}); — engine failure speed (V_{EF}); — take-off decision speed (V_1); — rotation speed (V_R); — minimum take-off safety speed (V_{2MIN}); — minimum unstick speed (V_{MU}); — lift-off speed (V_{LOF}); — max brake energy speed (V_{MBE}); — max tyre speed ($V_{Max\ Tyre}$); — reference landing speed (V_{REF}); — minimum control speed, approach and landing (V_{MCL}).	x					
LO	Explain the interdependence between of the above mentioned speeds if there is any.	x					
LO	Define the following distances in accordance with CS-25: take-off run with all engines operating and one engine inoperative; take-off distance with all engines operating and one engine inoperative; accelerate-stop distance with all engines operating and one engine inoperative.	x					
LO	Define the term 'Aeroplane-Specific Fuel Consumption (ASFC)'. *Remark: Engine-specific fuel consumption is covered in subject 021.*	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 04 01 02	**Take-off distances**						
LO	Explain the effects of the following runway (RWY) variables on take-off distances: RWY slope; RWY surface conditions: dry, wet and contaminated; RWY elevation.	x					
LO	Explain the effects of the following aeroplane variables on take-off distances: aeroplane mass; take-off configuration; bleed-air configurations.	x					
LO	Explain the effects of the following meteorological variables on take-off distances: wind; temperature; pressure altitude.	x					
LO	Explain the influence of errors in rotation technique on take-off distance: early and late rotation; too high and too low rotation angle; too high and too low rotation rate.	x					
LO	Explain the take-off distances for specified conditions and configuration for all engines operating and one engine inoperative.	x					
LO	Explain the effect of using clearway on the take-off distance required.	x					
LO	Explain the influence of V_1 and V_{2MIN} on take-off distance.	x					
LO	Explain the time interval allowed for between engine failure and recognition when assessing the TOD.	x					
LO	Explain the effect of a miscalculation of V_1 on the take-off distance required.	x					
032 04 01 03	**Accelerate-stop distance**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the accelerate-stop distance for specified conditions and configuration for all engines operating and one engine inoperative.	x					
LO	Explain the effect of using a stopway on the accelerate-stop distance required.	x					
LO	Explain the effect of miscalculation of V_1 on the accelerate-stop distance required.	x					
LO	Explain the effect of runway slope on the accelerate-stop distance.	x					
LO	Explain the additional time allowance for accelerate-stop distance determination and discuss the deceleration procedure.	x					
LO	Explain the use of brakes, anti-skid, use of reverse thrust, ground spoilers or lift dumpers, brake energy absorption limits, delayed temperature rise and tyre limitations.	x					
032 04 01 04	**Balanced field length concept**						
LO	Define the term 'balanced field length'.	x					
LO	Understand the relationship between take-off distance, accelerate-stop distance and V_1 when using a balanced field.	x					
LO	Describe the applicability of a balanced field length.	x					
032 04 01 05	**Unbalanced field length concept**						
LO	Define the term 'unbalanced field length'.	x					
LO	Describe the applicability of an unbalanced field length.	x					
LO	Explain the effect of a stopway on the allowed take-off mass and appropriate V_1 when using an unbalanced field.	x					
LO	Explain the effect of a clearway on the allowed take-off mass and appropriate V_1 when using an unbalanced field.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 04 01 06	**Runway Length-Limited Take-Off Mass (RLTOM)**						
LO	Define RLTOM for balanced and unbalanced field length.	x					
032 04 01 07	**Take-off climb**						
LO	Define the segments of the actual take-off flight path.	x					
LO	Explain the difference between the flat-rated and non-flat-rated part in performance charts.	x					
LO	Determine the changes in the configuration, power, thrust and speed in the take-off flight-path segments.	x					
LO	Determine the differences in climb-gradient requirements for two, three and four-engine aeroplanes.	x					
LO	State the maximum bank angle when flying at V_2.	x					
LO	Explain the effects of aeroplane and meteorological variables on the take-off climb.	x					
LO	Describe the influence of airspeed selection, acceleration and turns on the climb gradients, best rate-of-climb speed and best angle-of-climb speed.	x					
LO	Determine the climb-limited take-off mass.	x					
032 04 01 08	**Obstacle-limited take-off**						
LO	Describe the operational regulations for obstacle clearance in the net take-off flight path.	x					
LO	Define 'actual and net take-off flight path with one engine inoperative' in accordance with CS-25.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Determine the effects of aeroplane and meteorological variables on the determination of obstacle-limited take-off mass.	x					
LO	Determine the obstacle-limited take-off mass.	x					
032 04 01 09	**Performance-limited take-off mass**						
LO	Define performance-limited take-off mass.	x					
032 04 01 10	**Take-off performance on wet and contaminated runways**						
LO	Explain the differences between the take-off performance determination on a wet or contaminated runway and on a dry runway.	x					
032 04 01 11	**Use of reduced and derated thrust**						
LO	Explain the advantages and disadvantages of using reduced and derated thrust.	x					
LO	Explain the difference between reduced and derated thrust.	x					
LO	Explain when reduced and derated thrust may and may not be used.	x					
LO	Explain the effect of using reduced and derated thrust on take-off performance including take-off speeds, take-off distance, climb performance and obstacle clearance.	x					
LO	Explain the assumed temperature method for determining reduced thrust performance.	x					
032 04 01 12	**Take-off performance using different take-off flap settings**						
LO	Explain the advantages and disadvantages of using different take-off flap settings to optimise the performance-limited take-off mass.	x					
032 04 01 13	**Take-off performance using increased V_2 speeds ('improved climb performance')**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the advantages and disadvantages of using increased V_2 speeds.	x					
LO	Explain under what circumstances this procedure can be used.	x					
032 04 01 14	**Brake-energy and tyre-speed limit**						
LO	Explain the effects on take-off performance of brake-energy and tyre-speed limits.	x					
LO	Explain under which conditions this becomes limiting.	x					
032 04 01 15	**Use of aeroplane flight data**						
LO	Determine the maximum masses that satisfy all the regulations for take-off from the aeroplane performance data sheets.	x					
LO	Determine the relevant speeds for specified conditions and configuration from the aeroplane performance data sheets.	x					
032 04 02 00	**Climb**						
032 04 02 01	**Climb techniques**						
LO	Explain the effect of climbing with constant IAS.	x					
LO	Explain the effect of climbing with constant Mach number.	x					
LO	Explain the correct sequence of climb speeds for jet transport aeroplanes.	x					
LO	Determine the effect on TAS when climbing in and above the troposphere at constant Mach number.	x					
032 04 02 02	**Influence of variables on climb performance**						
LO	Explain the effect of aeroplane mass on the rate of climb (ROC).	x					
LO	Explain the effect of meteorological variables on ROC.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of aeroplane acceleration during a climb with constant IAS or Mach number.	x					
LO	Explain the effect on the operational speed limit when climbing at constant IAS.	x					
032 04 02 03	**Use of aeroplane flight data**						
LO	Explain the term 'cross over altitude' which occurs during the climb speed schedule (IAS–Mach number).	x					
LO	Calculate the time to climb.	x					
032 04 03 00	**Cruise**						
032 04 03 01	**Cruise techniques**						
LO	Define the cruise procedures 'maximum endurance' and 'maximum range'.	x					
032 04 03 02	**Maximum endurance**						
LO	Explain fuel flow in relation to TAS and thrust.	x					
LO	Find the speed for maximum endurance.	x					
032 04 03 03	**Maximum range**						
LO	Define the term 'maximum range'.	x					
032 04 03 04	**Long-range cruise**						
LO	Define the term 'long-range cruise'.	x					
LO	Explain differences between flying the speed for long range and maximum range with regard to fuel-flow and speed stability.	x					
032 04 03 05	**Influence of variables on cruise performance**						
LO	Explain the effect and CG position and actual mass of aircraft on range and endurance.	x					
LO	Explain the effect of altitude on range and endurance.	x					
LO	Explain the effect of meteorological variables on range and endurance.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 04 03 06	**Cruise altitudes**						
LO	Define the term 'optimum altitude'.	x					
LO	Explain the factors which affect the choice of optimum altitude.	x					
LO	Explain the factors which might affect or limit the maximum operating altitude.	x					
LO	Explain the necessity for step climbs.	x					
LO	Describe the buffet onset boundary (BOB).	x					
LO	Analyse the influence of bank angle, mass and 1.3G buffet onset factor on a step climb.	x					
032 04 03 07	**Cost Index (CI)**						
LO	Define the term 'cost index'.	x					
LO	Understand the reason for economical cruise speed.	x					
032 04 03 08	**Use of aeroplane flight data**						
LO	Determine the all-engines operating power settings and speeds from the aeroplane performance data sheets for: maximum range; maximum endurance; high-speed and normal cruise; high and low-speed buffet (speed/Mach number only).	x					
LO	Determine the selection of cruise technique considering cost indexing and passenger requirements against company requirements.	x					
LO	Determine the fuel consumption from the aeroplane performance data sheets for various cruise configurations, holding, approach and transit to an alternate in normal conditions and after an engine failure.	x					
032 04 04 00	**En route one engine inoperative**						
032 04 04 01	**Drift down**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the determination of en route flight path data with one engine inoperative in accordance with CS 25.123.	x					
LO	Determine the minimum obstacle-clearance height prescribed in the applicable operational requirements.	x					
LO	Define the speed during drift down.	x					
LO	Explain the influence of deceleration on the drift-down profiles.	x					
032 04 04 02	**Influence of variables on the en route one engine inoperative performance**						
LO	Identify the factors which affect the en route net flight path.	x					
032 04 04 03	**Use of aeroplane flight data**						
LO	Find one-engine-out service ceiling, range and endurance from given engine inoperative charts.	x					
LO	Find the maximum continuous power/thrust settings from given engine inoperative charts.	x					
032 04 05 00	**Descent**						
032 04 05 01	**Descent techniques**						
LO	Explain the effect of descending at constant Mach number.	x					
LO	Explain the effect of descending at with constant IAS.	x					
LO	Explain the correct sequence of descent speeds for jet transport aeroplanes.	x					
LO	Determine the effect on TAS when descending in and above the troposphere at constant Mach number.	x					
LO	Describe the following limiting speeds for descent: maximum operating speed (V_{MO}); maximum Mach number (M_{MO}).	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of a descent at constant Mach number on the margin to low and high-speed buffet.	x					
032 04 05 02	**Influence of variables on descent performance**						
LO	Explain the influence of mass, configuration and altitude on rate of descent and glide angle.	x					
032 04 05 03	**Use of aeroplane flight data**						
LO	Determine the following information for all-engines operating and one engine inoperative from the aeroplane performance data sheets: descent rates; time and distance for descent; fuel used during descent.	x					
032 04 06 00	**Approach and landing**						
032 04 06 01	**Approach requirements**						
LO	Describe the CS-25 requirements for the approach climb.	x					
LO	Describe the CS-25 requirements for the landing climb.	x					
LO	Explain the effect of temperature and pressure altitude on approach and landing-climb performance.	x					
032 04 06 02	**Landing field-length requirement**						
LO	Describe the landing distance determined according to CS 25.125 ('demonstrated' landing distance).	x					
LO	Recall the landing field-length requirements for dry, wet and contaminated runways in the applicable operational requirements.	x					
LO	Define the 'Landing Distance Available (LDA)'.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
032 04 06 03	**Influence of variables on landing performance**						
LO	Explain the effect of runway slope, surface conditions and wind on the maximum landing mass for a given runway length in accordance with the applicable operational requirements.	x					
LO	Explain the effect on landing distance and maximum allowable landing mass of the following devices affecting: deceleration; reverse; anti-skid; ground spoilers or lift dumpers; autobrakes.	x					
LO	Explain the effect of temperature and pressure altitude on the maximum landing mass for a given runway length.	x					
LO	Explain the effect of hydroplaning on landing distance required.	x					
032 04 06 04	**Quick turnaround limit**						
LO	Define the ‘quick turnaround limits’ and explain their purpose.	x					
032 04 06 05	**Use of aeroplane flight data**						
LO	Determine the field length required for landing with a given landing mass from the aeroplane performance data sheets in accordance with the applicable operational requirements.	x					
LO	Determine the landing and approach climb-limited landing mass from the aeroplane performance data sheets.	x					
LO	Determine the landing-field length-limited landing mass from the aeroplane performance data sheets.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Find the structural-limited landing mass from the aeroplane performance data sheets.	x					
LO	Calculate the maximum allowable landing mass as the lowest of: approach climb and landing climb-limited landing mass; landing-field length-limited landing mass; structural-limited landing mass.	x					
LO	Determine the maximum quick turnaround mass and time under given conditions from the aeroplane performance data sheets.	x					
LO	Determine the limiting landing mass in respect of PCN.	x					

F. SUBJECT 033 — FLIGHT PLANNING AND MONITORING

(1) For mass definitions, please refer to Chapter D.

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
033 00 00 00	**FLIGHT PLANNING AND MONITORING**						
033 01 00 00	**FLIGHT PLANNING FOR VFR FLIGHTS** *Remark: Using training route manual VFR charts or the European Central Question Bank (ECQB) annexes.*						
033 01 01 00	**VFR navigation plan**						
033 01 01 01	**Routes, airfields, heights and altitudes from VFR charts**						
LO	Select routes and altitudes taking the following criteria into account: classification of airspace; controlled airspace; uncontrolled airspace; restricted areas; minimum safe altitude; VFR semicircular rules; conspicuous points; navigation aids.	x	x	x	x	x	
LO	Calculate the minimum pressure or true altitude from minimum grid-area altitude using OAT and QNH.	x	x	x	x	x	
LO	Calculate the vertical and/or horizontal distance and time to climb to a given level or altitude.	x	x	x	x	x	
LO	Calculate the vertical and/or horizontal distance and time to descend from a given level or altitude.	x	x	x	x	x	
LO	Find the frequency and/or identifiers of radio-navigation aids from charts.	x	x	x	x	x	
033 01 01 02	**Courses and distances from VFR charts**						
LO	Choose waypoints in accordance with specified criteria.	x	x	x	x	x	
LO	Calculate, or obtain from the chart, courses and distances.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Find the highest obstacle within a given distance on either side of the course.	x	x	x	x	x	
LO	Find the following data from the chart and transfer them to the navigation plan: waypoints and/or turning points; distances; true/magnetic courses.	x	x	x	x	x	
033 01 01 03	**Aerodrome charts and aerodrome directory**						
LO	Explain the reasons for studying the visual departure procedures and the available approach procedures.	x	x	x	x	x	
LO	Find all visual procedures which can be expected at the departure, destination and alternate airfields.	x	x	x	x	x	
LO	Find the following data from the charts or directory: aerodrome regulations and opening hours; terrain high points and man-made structures; altitudes; courses and radials; helipads (for helicopters only); any other relevant information.	x	x	x	x	x	
033 01 01 04	**Communications and radio-navigation planning data**						
LO	Find the communication frequencies and call signs for the following: control agencies and service facilities; Flight Information Services (FIS); weather information stations; Automatic Terminal Information Service (ATIS).	x	x	x	x	x	
LO	Find the frequency and/or identifier of the appropriate radio-navigation aids.	x	x	x	x	x	
033 01 01 05	**Completion of navigation plan**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Complete the navigation plan with the courses and distances as taken from charts.	x	x	x	x	x	
LO	Find the departure and arrival routes.	x	x	x	x	x	
LO	Determine the position of Top of Climb (ToC) and Top of Descend (ToD) from given appropriate data.	x	x	x	x	x	
LO	Determine variation and calculate magnetic courses.	x	x	x	x	x	
LO	Calculate the True Airspeed (TAS) from given aircraft performance data, altitude and Outside-Air Temperature (OAT).	x	x	x	x	x	
LO	Calculate Wind Correction Angles (WCA) and Drift and Ground Speeds (GS).	x	x	x	x	x	
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields.	x	x	x	x	x	
033 02 00 00	**FLIGHT PLANNING FOR IFR FLIGHTS** *Remark: Using training route manual IFR charts or the ECQB annexes.*						
033 02 01 00	**IFR navigation plan**						
033 02 01 01	**Airways and routes**						
LO	Select the preferred airway(s) or route(s) considering: altitudes and flight levels; standard routes; ATC restrictions; shortest distance; obstacles; any other relevant data.	x		x			x
033 02 01 02	**Courses and distances from en route charts**						
LO	Determine courses and distances.	x		x			x
LO	Determine bearings and distances of waypoints from radio-navigation aids.	x		x			x
033 02 01 03	**Altitudes**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the following minimum altitudes: Minimum En route Altitude (MEA); Minimum Obstacle-Clearance Altitude (MOCA); Minimum Off-Route Altitude (MORA); Grid Minimum Off-Route Altitude (Grid MORA); Maximum Authorised Altitude (MAA); Minimum Crossing Altitude (MCA); Minimum Holding Altitude (MHA).	x		x			x
LO	Extract the following minimum altitudes from the chart(s): Minimum En route Altitude (MEA); Minimum Obstacle-Clearance Altitude (MOCA); Minimum Off-Route Altitude (MORA); Grid Minimum Off-Route altitude (Grid MORA); Maximum Authorised Altitude (MAA); Minimum Crossing Altitude (MCA); Minimum Holding Altitude (MHA).	x		x			x
033 02 01 04	**Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs)**						
LO	Explain the reasons for studying SID and STAR charts.	x		x			x
LO	State the reasons why SID and STAR charts show procedures only in a pictorial presentation style which is not to scale.	x		x			x
LO	Interpret all data and information represented on SID and STAR charts, particularly: routings, distances, courses, radials, altitudes/levels, frequencies, restrictions.	x		x			x
LO	Identify SIDs and STARs which might be relevant to a planned flight.	x		x			x
033 02 01 05	**Instrument-approach charts**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the reasons for being familiar with instrument-approach procedures and appropriate data for departure, destination and alternate airfields.	x		x			x
LO	Select instrument-approach procedures appropriate for departure, destination and alternate airfields.	x		x			x
LO	Interpret all procedures, data and information represented on instrument-approach charts, particularly: courses and radials; distances; altitudes/levels/heights; restrictions; obstructions; frequencies; speeds and times; Decision Altitudes/Heights (DA/H); (DA/H) and Minimum Descent Altitudes/Heights (MDA/H); visibility and Runway Visual Ranges (RVR); approach light systems.	x		x			x
033 02 01 06	**Communications and radio-navigation planning data**						
LO	Find the communication frequencies and call signs for the following: control agencies and service facilities; Flight Information Services (FIS); weather information stations; Automatic Terminal Information Service (ATIS).	x		x			x
LO	Find the frequency and/or identifiers of radio-navigation aids.	x		x			x
033 02 01 07	**Completion of navigation plan**						
LO	Complete the navigation plan with the courses, distances and frequencies taken from charts.	x		x			x
LO	Find the Standard Instrument Departure and Arrival Routes to be flown and/or to be expected.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Determine the position of Top of Climb (ToC) and Top of Descent (ToD) from given appropriate data.	x		x			x
LO	Determine variation and calculate magnetic/true courses.	x		x			x
LO	Calculate True Airspeed (TAS) from given aircraft performance data, altitude and Outside-Air Temperature (OAT).	x		x			x
LO	Calculate Wind Correction Angles (WCA) / Drift and Ground Speeds (GS).	x		x			x
LO	Determine all relevant altitudes/levels, and particularly MEA, MOCA, MORA, MAA, MCA, MRA and MSA.	x		x			x
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields.	x		x			x
033 03 00 00	**FUEL PLANNING**						
033 03 01 00	**General**						
LO	Convert to volume, mass and density given in different units which are commonly used in aviation.	x	x	x	x	x	x
LO	Determine relevant data from the Flight Manual, such as fuel capacity, fuel flow/consumption at different power/ thrust settings, altitudes and atmospheric conditions.	x	x	x	x	x	x
LO	Calculate the attainable flight time/range from given fuel flow/ consumption and available amount of fuel.	x	x	x	x	x	x
LO	Calculate the required fuel from given fuel flow/consumption and required time/range to be flown.	x	x	x	x	x	x
LO	Calculate the required fuel for a VFR flight from given expected meteorological conditions and expected delays under defined conditions.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the required fuel for an IFR flight from given expected meteorological conditions and expected delays under defined conditions.	x		x			x
033 03 02 00	**Pre-flight fuel planning for commercial flights**						
033 03 02 01	**Taxiing fuel**						
LO	Determine the fuel required for engine start and taxiing by consulting the fuel-usage tables and/or graphs from the Flight Manual taking into account all the relevant conditions.	x	x	x	x	x	
033 03 02 02	**Trip fuel**						
LO	Define 'trip fuel' and name the segments of flight for which the trip fuel is relevant.	x	x	x	x	x	
LO	Determine the trip fuel for the flight by using data from the navigation plan and fuel tables and/or graphs from the Flight Manual.	x	x	x	x	x	
033 03 02 03	**Reserve fuel and its components**						
	Contingency fuel						
LO	Explain the reasons for having contingency fuel.	x	x	x	x	x	
LO	State and explain the requirements for contingency fuel according to the applicable operational requirements.	x	x				
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements.	x	x				
LO	State and explain the requirements for contingency fuel according to the applicable operational requirements.			x	x	x	
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for IFR flights.			x			

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for VFR flights in a hostile environment.			x	x	x	
LO	Calculate the contingency fuel by using requirements according to the applicable operational requirements for VFR flights in a non-hostile environment.			x	x	x	
	Alternate fuel						
LO	Explain the reasons and regulations for having alternate fuel and name the segments of flight for which the fuel is relevant.	x	x	x	x	x	
LO	Calculate the alternate fuel in accordance with the applicable operational requirements and relevant data from the navigation plan and the Flight Manual.	x	x				
LO	Calculate the alternate fuel in accordance with the applicable operational requirements and relevant data from the navigation plan and the Flight Manual.			x	x	x	
	Final reserve fuel						
LO	Explain the reasons and regulations for having final reserve fuel.	x	x	x	x	x	
LO	Calculate the final reserve fuel for an aeroplane with piston engines and for an aeroplane with turbine-power units in accordance with the applicable operational requirements and by using relevant data from the Flight Manual.	x	x				
LO	Calculate the final reserve fuel for a VFR flight (by day with reference to visual landmarks) in accordance with the applicable operational requirements and			x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	by using relevant data from the Flight Manual.						
LO	Calculate the final reserve fuel for a IFR flight in accordance with the applicable operational requirements and by using relevant data from the Flight Manual.			x			
	Additional fuel						
LO	Explain the reasons and regulations for having additional fuel.	x	x	x	x	x	
LO	Calculate the additional fuel for an IFR flight without a destination alternate in accordance with the applicable operational requirements for an isolated aerodrome.	x					
LO	Calculate the additional fuel for a flight to an isolated heliport in accordance with the applicable operational requirements.			x	x	x	
033 03 02 04	**Extra fuel**						
LO	Explain the reasons and regulations for having extra fuel in accordance with the applicable operational requirements.	x	x				
LO	Explain the reasons and regulations for having extra fuel in accordance with the applicable operational requirements.			x	x	x	
LO	Calculate the possible extra fuel under given conditions.	x	x	x	x	x	
033 03 02 05	**Calculation of total fuel and completion of the fuel section of the navigation plan (fuel log)**						
LO	Calculate the total fuel required for a flight.	x	x	x	x	x	
LO	Complete the fuel log.	x	x	x	x	x	
033 03 03 00	**Specific fuel-calculation procedures**						
033 03 03 01	**Decision-point procedure**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the reasons and regulations for the decision-point procedure as stated in the applicable operational requirements.	x					
LO	Calculate the contingency fuel and trip fuel required in accordance with the decision-point procedure.	x					
033 03 03 02	**Isolated-aerodrome procedure**						
LO	Explain the basic procedures for an isolated aerodrome as stated in the applicable operational requirements.	x					
LO	Calculate the additional fuel for aeroplanes with reciprocating engines according to the isolated-aerodrome procedures.	x					
LO	Calculate the additional fuel for aeroplanes with turbine engines according to the isolated-aerodrome procedures.	x					
033 03 03 03	**Predetermined point procedure**						
LO	Explain the basic idea of the predetermined-point procedure as stated in the applicable operational requirements.	x					
LO	Calculate the additional fuel for aeroplanes with reciprocating engines according to the predetermined-point procedure.	x					
LO	Calculate the additional fuel for aeroplanes with turbine engines according to the predetermined-point procedure.	x					
033 03 03 04	**Fuel-tankering**						
LO	Explain the basic idea of fuel-tankering procedures.	x					
LO	Explain that there is an optimum fuel quantity to be tankered (as a function of	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	the fuel-price ratio between departure and destination airports and air distance to fly).						
LO	Calculate tankered fuel by using given appropriate graphs, tables and/or data.	x					
033 03 03 05	**Isolated-heliport procedure**						
LO	Explain the basic idea of the isolated-heliport procedures as stated in the applicable operational requirements.			x	x		
LO	Calculate the additional fuel according to the isolated-heliport procedures as stated in the applicable operational requirements for flying IFR.			x			
LO	Calculate the additional fuel according to the isolated-heliport procedures as stated in the applicable operational requirements for flying VFR and navigating by means other than by reference to visual landmarks.			x	x		
033 04 00 00	**PRE-FLIGHT PREPARATION**						
033 04 01 00	**NOTAM briefing**						
033 04 01 01	**Ground facilities and services**						
LO	Check that the ground facilities and services required for the planned flight are available and adequate.	x	x	x	x	x	x
033 04 01 02	**Departure, destination and alternate aerodromes**						
LO	Find and analyse the latest state at the departure, destination and alternate aerodromes, in particular for: opening hours; Work in Progress (WIP); special procedures due to Work in Progress (WIP); obstructions; changes of frequencies for communications, navigation aids and facilities.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
033 04 01 03	**Airway routings and airspace structure**						
LO	Find and analyse the latest en route state for: airway(s) or route(s); restricted, danger and prohibited areas; changes of frequencies for communications, navigation aids and facilities.	x	x	x	x	x	x
033 04 02 00	**Meteorological briefing**						
033 04 02 01	**Extraction and analysis of relevant data from meteorological documents** *Remark: This item is taught and examined in subject 050.*						
033 04 02 02	**Update of navigation plan using the latest meteorological information**						
LO	Confirm the optimum altitude/FL from given wind, temperature and aircraft data.	x	x	x	x	x	x
LO	Confirm true altitudes from given atmospheric data to ensure that statutory minimum clearance is attained.	x	x	x	x	x	x
LO	Confirm magnetic headings and ground speeds.	x	x	x	x	x	x
LO	Confirm the individual leg times and the total time en route.	x	x	x	x	x	x
LO	Confirm the total time en route for the trip to the destination.	x	x	x	x	x	x
LO	Confirm the total time from destination to the alternate airfield.	x	x	x	x	x	x
033 04 02 03	**Update of mass and balance** *Remark: This item is taught and examined in subject 031.*						
033 04 02 04	**Update of performance data** *Remark: This item is taught and examined in subject 032 for aeroplanes and subject 034 for helicopters.*						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
033 04 02 05	**Update of fuel log**						
LO	Calculate the revised fuel data in accordance with the changed conditions.	x	x	x	x	x	x
033 04 03 00	**Point of Equal Time (PET) and Point of Safe Return (PSR)**						
033 04 03 01	**Point of Equal Time (PET)**						
LO	Define 'PET'.	x		x	x		
LO	Explain the basic idea of determination of PET.	x		x	x		
LO	Calculate the position of a PET and the ETA at the PET from given relevant data.	x		x	x		
033 04 03 02	**Point of Safe Return (PSR)**						
LO	Define 'PSR'.	x		x	x		
LO	Explain the basic idea of determination of PSR.	x		x	x		
LO	Calculate the position of a PSR and the ETA at the PSR from given relevant data.	x		x	x		
033 05 00 00	**ICAO FLIGHT PLAN (ATS Flight Plan)**						
033 05 01 00	**Individual Flight Plan**						
033 05 01 01	**Format of Flight Plan**						
LO	State the reasons for a fixed format of an ICAO ATS Flight Plan (FPL).	x	x	x	x	x	x
LO	Determine the correct entries to complete an FPL plus decode and interpret the entries in a completed FPL, particularly for the following: aircraft identification (Item 7); flight rules and type of flight (Item 8); number and type of aircraft and wake-turbulence category (Item 9); equipment (Item 10); departure aerodrome and time (Item 13); route (Item 15);	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	destination aerodrome, total estimated elapsed time and alternate aerodrome (Item 16); other information (Item 18); supplementary information (Item 19).						
033 05 01 02	**Completion of an ATS Flight Plan (FPL)**						
LO	Complete the FPL by using the information from the following: navigation plan; fuel plan; operator's records for basic aircraft information.	x	x	x	x	x	x
033 05 02 00	**Repetitive Flight Plan**						
LO	Explain the difference between an Individual Flight Plan (FPL) and a Repetitive Flight Plan (RPL).	x		x	x		
LO	Explain the basic idea of an RPL and state the general requirements for its use.	x		x	x		
033 05 03 00	**Submission of an ATS Flight Plan (FPL)** *Remark: This item is taught and examined in subject 010.*						
033 06 00 00	**FLIGHT MONITORING AND IN-FLIGHT REPLANNING**						
033 06 01 00	**Flight monitoring**						
033 06 01 01	**Monitoring of track and time**						
LO	Assess deviations from the planned course, headings (by maintaining desired courses) and times.	x	x	x	x	x	x
LO	State the reasons for possible deviations.	x	x	x	x	x	x
LO	Calculate the ground speed by using actual in-flight parameters.	x	x	x	x	x	x
LO	Calculate the expected leg times by using actual flight parameters.	x	x	x	x	x	x
033 06 01 02	**In-flight fuel management**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain why fuel checks must be carried out in flight at regular intervals and why relevant fuel data must be recorded.	x	x	x	x	x	x
LO	Assess deviations of actual fuel consumption from planned consumption.	x	x	x	x	x	x
LO	State the reasons for possible deviations.	x	x	x	x	x	x
LO	Calculate the fuel quantities used, fuel consumption and fuel remaining at navigation checkpoints /waypoints.	x	x	x	x	x	x
LO	Compare the actual with the planned fuel consumption by means of calculation or flight-progress chart.	x	x	x	x	x	x
LO	Assess the remaining range and endurance by means of calculation or flight-progress chart.	x	x	x	x	x	x
033 06 01 03	**Monitoring of primary flight parameters**						
	Explain the methodology for monitoring of primary flight parameters during the application of the procedures requiring a high flight crew workload within a short time frame (including monitoring of primary flight parameters, in particular pitch, thrust and speed).	x	x	x	x	x	x
033 06 02 00	**In-flight replanning in case of deviation from planned data**						
LO	Justify that the commander is responsible that even in case of diversion the remaining fuel is not less than the fuel required to proceed to an aerodrome where a safe landing can be made, with final reserve fuel remaining.	x	x	x	x	x	
LO	Perform in-flight updates, if necessary, based on the results of in-flight monitoring, specifically by: selecting a new destination/ alternate aerodrome;	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	adjusting flight parameters and power settings.						
LO	Explain why, in the case of an in-flight update, the commander has to check the following: the suitability of the new destination and/or alternate aerodrome; meteorological conditions on revised routing and at revised destination and/or alternate aerodrome; the aircraft must be able to land with the prescribed final reserve fuel.	x	x	x	x	x	
LO	Assess the revised destination/ alternate aerodrome landing mass from given latest data.	x	x	x	x	x	

G. SUBJECT 034 — PERFORMANCE (HELICOPTER)

(1) For mass definitions, please refer to Chapter D.

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
034 00 00 00	**PERFORMANCE — HELICOPTER**						
034 01 00 00	**GENERAL**						
034 01 01 00	**Performance legislation**						
034 01 01 01	**Airworthiness requirements**						
LO	Interpret the airworthiness requirements in CS-27 and CS-29 as related to helicopter performance.			x	x	x	
LO	Name the general differences between helicopters as certified according to CS-27 and CS-29.			x	x	x	
034 01 01 02	**Operational regulations**						
LO	State the responsibility to comply with the operational procedures.			x	x	x	
LO	Interpret the European Union regulation on operations.			x	x	x	
LO	Use and interpret diagrams and tables associated with CAT A and CAT B procedures in order to select and develop class 1, 2 and 3 performance profiles according to available heliport size and location (surface or elevated).			x	x		
LO	Use and interpret diagrams and tables associated with CAT B procedures in order to select and develop class-3 single-engine helicopter performance profiles according to available heliport size and location (surface or elevated).					x	
LO	Interpret the charts showing minimum clearances associated with Category A & B procedures.			x	x		
034 01 02 00	**General performance theory**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
034 01 02 01	**Stages of flight**						
LO	Explain the following stages of flight: take-off, climb, level flight, descent, approach and landing.			x	x	x	
LO	Describe the necessity for different take-off and landing procedures.			x	x	x	
034 01 02 02	**Definitions and terms**						
LO	Define the following terms: — Category A; — Category B; — Performance Class 1, 2 and 3; — congested area; — elevated heliport; — helideck; — heliport; — hostile environment; — maximum approved passenger seating configuration; — non-hostile environment; — obstacle; — rotor Radius (R); — take-off mass; — Touchdown and Lift-Off Area (TLOF); — safe forced landing; — speed for best rate of climb (Vy); — never exceed speed (VNE); — velocity landing gear extended (VLE); — velocity landing gear operation (VLO); — cruising speed and maximum cruising speed.			x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the following terms: reported headwind component; Take-off Decision Point (TDP); Defined Point After Take-Off (DPATO) ; Take-Off Distance Required (TODR); Take-Off Distance Available (TODA); Distance Required (DR); Rejected Take-Off Distance Required (RTODR); Rotation Point (RP); Committal Point (CP); Defined Point Before Landing (DPBL); Landing Decision Point (LDP); Landing Distance Available (LDA); Landing Distance Required (LDR); Take-off safety speed (V_1); Take-off safety speed for Cat A rotorcraft (V_{TOSS})(V_2).			x	x		
LO	Understand the meaning and significance of the acronyms AEO and OEI.			x	x		
LO	Define the terms 'climb angle' and 'climb gradient'.			x	x		
LO	Define the terms 'flight-path angle' and 'flight-path gradient'.			x	x		
LO	Define '$V_{maxRange}$' (speed for maximum range) and V_{maxEnd} (speed for maximum endurance).			x	x	x	
LO	Define and calculate the gradient by using power, wind and helicopter mass.			x	x		
LO	Explain the terms 'operational ceiling' and 'absolute ceiling'.			x	x	x	
LO	Explain the term 'service ceiling OEI'.			x	x		
LO	Understand the difference between Hovering In Ground Effect (HIGE) and Hovering out of Ground Effect (HOGE).			x	x	x	
034 01 02 03	**Power required/power available curves**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Understand and interpret the graph power required/power available versus TAS.			x	x	x	
034 01 02 04	**Critical height-velocity graphs**						
LO	Understand and interpret the critical height-velocity graphs.			x	x	x	
034 01 02 05	**Influencing variables on performance**						
LO	Explain how the following factors effect helicopter performance: pressure altitude; humidity; temperature; wind; helicopter mass; helicopter configuration; helicopter CG.			x	x	x	
034 02 00 00	**PERFORMANCE CLASS 3 — SINGLE-ENGINE HELICOPTERS ONLY**						
034 02 01 00	**Effect of variables on single-engine helicopter performance**						
LO	Determine wind component, altitude and temperature for hovering, take-off and landing.			x	x	x	
LO	Explain that operations are only from/to heliports and over such routes, areas and diversions contained in a non-hostile environment where a safe forced landing can be carried out. (Consider the exception: Operations may be conducted in a hostile environment when approved).			x	x	x	
LO	Explain the effect of temperature, wind and altitude on climb, cruise and descent performance.			x	x	x	
034 02 02 00	**Take-off and landing (including hover)**						
LO	Explain the take-off and landing requirements.			x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the maximum allowed take-off and landing mass.			x	x	x	
LO	Explain that mass has to be restricted to HIGE.			x	x	x	
LO	Explain that if HIGE is unlikely to be achieved, then mass must be restricted to HOGE.			x	x	x	
034 02 03 00	**Climb, cruise and descent**						
LO	State that the helicopter must be capable of flying its intended track without flying below the appropriate minimum flight altitude and be able to perform a safe forced landing.			x	x	x	
LO	Explain the effect of altitude on the maximum endurance speed.			x	x	x	
034 02 04 00	**Use of helicopter performance data**						
034 02 04 01	**Take-off (including hover)**						
LO	Find the maximum wind component.			x	x	x	
LO	Find the maximum allowed take-off mass for certain conditions.			x	x	x	
LO	Find the critical height-velocity parameters.			x	x	x	
034 02 04 02	**Climb**						
LO	Find the time, distance and fuel to climb for certain conditions.			x	x	x	
LO	Find the rate of climb under given conditions and the best rate-of-climb speed V_Y.			x	x	x	
034 02 04 03	**Cruise**						
LO	Find the cruising speed and fuel consumption for certain conditions.			x	x	x	
LO	Calculate the range and endurance under given conditions.			x	x	x	
034 02 04 04	**Landing (including hover)**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Find the maximum wind component.			x	x	x	
LO	Find the maximum allowed landing mass for certain conditions.			x	x	x	
LO	Find the critical height-velocity parameters.			x	x	x	
034 03 00 00	**PERFORMANCE CLASS 2**						
	General remark: The LOs for Performance Class 2 are principally identical with those of Performance Class 1. (See 034 04 00 00) Additional LOs are shown below.						
034 03 01 00	**Operations without an assured safe forced landing capability**						
LO	State the responsibility of the operator in order to assure a safe forced landing.			x	x		
034 03 02 00	**Take-off**						
LO	State the climb and other requirements for take-off.			x	x		
034 03 03 00	**Take-off Flight Path**						
LO	State the height above the take-off surface at which at least the requirements for the take-off flight path for Performance Class 1 are to be met.			x	x		
034 03 04 00	**Landing**						
LO	State the requirements for the climb capability for OEI.			x	x		
LO	State the options for a Performance Class 2 operation in case of critical power-unit failure at any point in the approach path.			x	x		
LO	State the limitations for operations to/from a helideck.			x	x		
034 04 00 00	**PERFORMANCE CLASS 1 — HELICOPTERS CERTIFICATED ACCORDING TO CS-29 ONLY**						
034 04 01 00	**Take-off**						
034 04 01 01	**Take-off distances**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effects of the following variables on the flight path and take-off distances: take-off with HIGE or HOGE; take-off procedure; obstacle clearances both laterally and vertically; take-off from non-elevated heliports; take-off from elevated heliports or helidecks; take-off from a Touchdown and Lift-Off Area (TLOF).			x	x		
LO	Explain the effects of the following variables on take-off distances: mass; take-off configuration; bleed-air configurations.			x	x		
LO	Explain the effects of the following meteorological variables on take-off distances: wind; temperature; pressure altitude.			x	x		
LO	Explain the take-off distances for specified conditions and configuration for AEO and OEI.			x	x		
LO	Explain the effect of obstacles on the take-off distance required.			x	x		
LO	Explain the influence of V_1 and V_{TOSS} speeds on the take-off distance.			x	x		
LO	State the assumed reaction time between engine failure and recognition.			x	x		
LO	Explain the effect of calculation of TDP and V_1 on the take-off distance required.			x	x		
LO	Explain that the flight must be carried out visually up to TDP.			x	x		
034 04 01 02	**Rejected take-off distance required**						
LO	Explain the rejected take-off distance required for specified conditions and configuration for AEO and OEI.			x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of calculation of V_1 on the rejected take-off distance required.			x	x		
LO	Explain the time-to-decide allowance (decision time) and deceleration procedure.			x	x		
034 04 01 03	**Landing distance from TDP with V_1 to a complete stop on the ground**						
LO	Understand the relationship of take-off distance and landing distance from TDP with V_1 to a complete ground stop.			x	x		
034 04 01 04	**Take-off climb**						
LO	Define the segments of the take-off flight path.			x	x		
LO	Explain the effect of changes in the configuration on power and speed in the segments.			x	x		
LO	Explain the climb-gradient requirements for OEI.			x	x		
LO	State the minimum altitude over the take-off path when flying at V_1 to V_{TOSS}.			x	x		
LO	Describe the influence of airspeed selection, acceleration and turns on the climb gradient and best rate-of-climb speed.			x	x		
034 04 01 05	**Obstacle-limited take-off**						
LO	Describe the operational regulations for obstacle clearance of the take-off flight path in the departure sector with OEI.			x	x		
034 04 01 06	**Use of helicopter flight data**						
LO	Determine from the helicopter performance data sheets the maximum masses that satisfy all the regulations for take-off.			x	x		
034 04 02 00	**Climb**						
034 04 02 01	**Climb techniques**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of climbing with best rate-of-climb speed (V_Y).			x	x		
LO	Explain the influence of altitude on V_Y.			x	x		
034 04 02 02	**Use of helicopter flight data**						
LO	Find the rate of climb and calculate the time to climb to a given altitude.			x	x		
034 04 03 00	**Cruise**						
034 04 03 01	**Cruise techniques**						
LO	Explain the cruise procedures for 'maximum endurance' and 'maximum range'.			x	x		
034 04 03 02	**Maximum endurance**						
LO	Explain fuel flow in relation to TAS.			x	x		
LO	Explain the speed for maximum endurance.			x	x		
034 04 03 03	**Maximum range**						
LO	Explain the speed for maximum range.			x	x		
034 04 03 04	**Maximum cruise**						
LO	Explain the speed for maximum cruise.			x	x		
034 04 03 05	**Cruise altitudes**						
LO	Explain the factors which might affect or limit the operating altitude.			x	x		
LO	Understand the relation between power setting, fuel consumption, cruising speed and altitude.			x	x		
034 04 03 06	**Use of helicopter flight data**						
LO	Determine the fuel consumption from the helicopter performance data sheets in accordance with altitude and helicopter mass.			x	x		
034 04 04 00	**En route one engine inoperative**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
034 04 04 01	**Requirements for en route flights for OEI**						
LO	State the flight-path clearance requirements.			x	x		
LO	Explain the drift-down techniques.			x	x		
LO	State the reduction in the flight-path width when navigational accuracy can be achieved.			x	x		
034 04 04 02	**Use of helicopter flight data**						
LO	Find the single-engine service ceiling, range and endurance from given engine-inoperative charts.			x	x		
LO	Find the maximum continuous power settings from given engine-inoperative charts.			x	x		
LO	Find the amount of fuel to be jettisoned to reduce helicopter mass.			x	x		
LO	Calculate the relevant parameters for drift-down procedures.			x	x		
034 04 05 00	**Descent**						
034 04 05 01	**Use of helicopter flight data**						
LO	Find the rate of descent and calculate the time to descent to a given altitude.			x	x		
034 04 06 00	**Landing**						
034 04 06 01	**Landing requirements**						
LO	State the requirements for landing.			x	x		
034 04 06 02	**Landing procedures**						
LO	Explain the procedure for critical power-unit failure prior to and after the landing decision point.			x	x		
LO	Explain that the portion of flight after the landing decision point must be carried out visually.			x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the procedures and required obstacle clearances for landings on different heliports/helidecks.			x	x		
034 04 06 03	**Use of helicopter flight data**						
LO	Determine from the helicopter performance data sheets the maximum masses that satisfy all the regulations for landing.			x	x		

H. SUBJECT 040 — HUMAN PERFORMANCE AND LIMITATIONS

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
040 00 00 00	**HUMAN PERFORMANCE**						
040 01 00 00	**HUMAN FACTORS: BASIC CONCEPTS**						
040 01 01 00	**Human factors in aviation**						
040 01 01 01	**Becoming a competent pilot**						
LO	State that competency is based on the knowledge, skill and ability of the individual pilot.	x	x	x	x	x	x
LO	Outline the factors in training that will ensure the future competency of the individual pilot.	x	x	x	x	x	x
040 01 02 00	**Accident statistics**						
LO	Give an estimate of the accident rate in commercial aviation in comparison to other means of transport.	x	x	x	x	x	x
LO	State in general terms the percentage of aircraft accidents which are caused by human factors.	x	x	x	x	x	x
LO	Summarise the accident trend in modern aviation.	x	x	x	x	x	x
LO	Identify the role of accident statistics in developing a strategy for future improvements to flight safety.	x	x	x	x	x	x
040 01 03 00	**Flight safety concepts**						
LO	Explain the three components of the Threat and Error Management (TEM) model.	x	x	x	x	x	x
LO	Explain and give examples of latent threats.	x	x	x	x	x	x
LO	Explain and give examples of environmental threats.	x	x	x	x	x	x
LO	Explain and give examples of organisational threats.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain and give a definition of 'error' according to the TEM model of ICAO Annex 1.	x	x	x	x	x	x
LO	Give examples of different countermeasures which may be used in order to manage threats, errors and undesired aircraft states.	x	x	x	x	x	x
LO	Explain and give examples of procedural error.	x	x	x	x	x	x
LO	Explain and give examples of 'undesired aircraft states'.	x	x	x	x	x	x
LO	Describe and compare the elements of the SHELL model.	x	x	x	x	x	x
LO	Summarise the relevance of the SHELL model to the work in the cockpit.	x	x	x	x	x	x
LO	Analyse the interaction between the various components of the SHELL model.	x	x	x	x	x	x
LO	Explain how the interaction between individual crew members can affect flight safety.	x	x	x	x	x	x
LO	Identify and explain the interaction between flight crew and management as a factor in flight safety.	x	x	x	x	x	x
040 01 04 00	**Safety culture**						
LO	Distinguish between 'open cultures' and 'closed cultures'.	x	x	x	x	x	x
LO	Illustrate how safety culture is reflected in national culture.	x	x	x	x	x	x
LO	Question the established expression 'safety first' in a commercial entity.	x	x	x	x	x	x
LO	Explain James Reason's 'Swiss Cheese Model'.	x	x	x	x	x	x
LO	State the important factors that promote a good safety culture.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Distinguish between 'just culture' and 'non-punitive culture'.	x	x	x	x	x	x
LO	Name the five components which form safety culture (according to James Reason).	x	x	x	x	x	x
040 02 01 00	**Basics of flight physiology**						
040 02 01 01	**The atmosphere**						
LO	State the units used in measuring total and partial pressures of the gases in the atmosphere.	x	x	x	x	x	x
LO	State in terms of % and mm Hg the values of oxygen, nitrogen and other gases present in the atmosphere.	x	x	x	x	x	x
LO	State that the volume percentage of the gases in ambient air will remain constant for all altitudes at which conventional aircraft operate.	x	x	x	x	x	x
LO	State the physiological significance of the following laws: Boyle's Law; Dalton's Law; Henry's Laws; the General Gas Law.	x	x	x	x	x	x
LO	State the ICAO standard temperature at Mean Sea Level and the Standard Temperature Lapse Rate.	x	x	x	x	x	x
LO	State at what approximate altitudes in the standard atmosphere the atmospheric pressure will be ¼, ½ and ¾ of MSL pressure.	x	x	x	x	x	x
LO	State the effects of increasing altitude on the overall pressure and partial pressures of the various gases in the atmosphere.	x	x	x	x	x	x
LO	Explain the differences in gas expansion between alveolar and ambient air when climbing.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the condition required for human beings to be able to survive at any given altitude.	x	x	x	x	x	x
LO	State and explain the importance of partial pressure.	x	x	x	x	x	x
040 02 01 02	**Respiratory and circulatory system**						
LO	List the main components of the respiratory system and their function.	x	x	x	x	x	x
LO	Identify the different volumes of air in the lungs and state the normal respiratory rate.	x	x	x	x	x	x
LO	State how oxygen and carbon dioxide are transported throughout the body.	x	x	x	x	x	x
LO	Explain the process by which oxygen is transferred to the tissues and carbon dioxide is eliminated from the body and the oxygen requirement of tissues.	x	x	x	x	x	x
LO	Explain the role of carbon dioxide in the control and regulation of respiration.	x	x	x	x	x	x
LO	Describe the basic processes of external respiration and internal respiration.	x	x	x	x	x	x
LO	List the factors determining pulse rate.	x	x	x	x	x	x
LO	Name the major components of the circulatory system and describe their function.	x	x	x	x	x	x
LO	State the values for a normal pulse rate and the average cardiac output (heart rate × stroke volume) of an adult at rest.	x	x	x	x	x	x
LO	Name the four chambers of the heart and state the function of the individual chambers.	x	x	x	x	x	x
LO	Differentiate between arteries, veins and capillaries in their structure and function.	x	x	x	x	x	x
LO	State the functions of the coronary arteries and veins.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'systolic' and 'diastolic' blood pressure.	x	x	x	x	x	x
LO	State the normal blood pressure ranges and units of measurement.	x	x	x	x	x	x
LO	State that in an average pilot blood pressure will rise slightly with age as the arteries lose their elasticity.	x	x	x	x	x	x
LO	List the main constituents of the blood and describe their functions.	x	x	x	x	x	x
LO	Stress the function of haemoglobin in the circulatory system.	x	x	x	x	x	x
LO	Define 'anaemia' and state its common causes.	x	x	x	x	x	x
LO	Indicate the effect of increasing altitude on haemoglobin oxygen saturation.	x	x	x	x	x	x
	Hypertension and hypotension						
LO	Define 'hypertension' and 'hypotension'.	x	x	x	x	x	x
LO	List the effects that high and low blood pressure will have on some normal functions of the human body.	x	x	x	x	x	x
LO	State that both hypotension and hypertension may disqualify the pilot from obtaining a medical clearance to fly.	x	x	x	x	x	x
LO	List the factors which can lead to hypertension in an individual.	x	x	x	x	x	x
LO	State the corrective actions that may be taken to reduce high blood pressure.	x	x	x	x	x	x
LO	Stress that hypertension is the major factor of 'strokes' in the general population.	x	x	x	x	x	x
	Coronary artery disease						
LO	Differentiate between 'angina' and 'heart attack'.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the major risk factors for coronary disease.	x	x	x	x	x	x
LO	State the role played by physical exercise in reducing the chances of developing coronary disease.	x	x	x	x	x	x
	Hypoxia						
LO	Define the two major forms of hypoxia (hypoxic and anaemic), and the common causes of both.	x	x	x	x	x	x
LO	State the symptoms of hypoxia.	x	x	x	x	x	x
LO	State why living tissues require oxygen.	x	x	x	x	x	x
LO	State that healthy people are able to compensate for altitudes up to approximately 10 000–12 000 ft.	x	x	x	x	x	x
LO	Name the three physiological thresholds and allocate the corresponding altitudes for each of them.	x	x	x	x	x	x
LO	State the altitude at which short-term memory begins to be affected by hypoxia.	x	x	x	x	x	x
LO	Define the term 'Time of Useful Consciousness' (TUC).	x	x	x	x	x	x
LO	State that TUC varies between individuals, but the approximate values are: a) for a person seated (at rest) *b) for a person moderately active* 20 000 ft a) 30 min *b) 5 min* 30 000 ft a) 1–2 min *b) not required* 35 000 ft a) 30–90 sec *b) not required* 40 000 ft a) 15–20 sec *b) not required*	x	x	x	x	x	x
LO	Explain the dangers of flying above 10 000 ft without using additional oxygen or being in a pressurised cabin.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the factors determining the severity of hypoxia.	x	x	x	x	x	x
LO	State the precautions to be taken when giving blood.	x	x	x	x	x	x
LO	State the equivalent altitudes when breathing ambient air and 100 % oxygen for MSL and approximately 10 000, 30 000 and 40 000 ft.	x	x	x	x	x	x
	Hyperventilation						
LO	Describe the role of carbon dioxide in hyperventilation.	x	x	x	x	x	x
LO	Define the term 'hyperventilation'.	x	x	x	x	x	x
LO	List the factors causing hyperventilation.	x	x	x	x	x	x
LO	State that hyperventilation may be caused by psychological or physiological reasons.	x	x	x	x	x	x
LO	List the signs and symptoms of hyperventilation.	x	x	x	x	x	x
LO	Describe the effects of hyperventilation on muscular coordination.	x	x	x	x	x	x
LO	List the measures which may be taken to counteract hyperventilation.	x	x	x	x	x	x
	Decompression sickness/illness						
LO	State the normal range of cabin pressure altitude in pressurised commercial aircraft and describe its protective function for aircrew and passengers.	x	x	x	x	x	x
LO	Identify the causes of decompression sickness in flight operation.	x	x	x	x	x	x
LO	State how decompression sickness can be prevented.	x	x	x	x	x	x
LO	State the threshold for the onset of decompression sickness in terms of altitude.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the approximate altitude above which decompression sickness is likely to occur.	x	x	x	x	x	x
LO	List the symptoms of decompression sickness.	x	x	x	x	x	x
LO	Indicate how decompression sickness may be treated.	x	x	x	x	x	x
LO	List the vital actions the crew has to perform when cabin pressurisation is lost.	x	x	x	x	x	x
LO	Define the hazards of diving and flying, and give the recommendations associated with these activities.	x	x	x	x	x	x
	Acceleration						
LO	Define 'linear', 'angular' and 'radial acceleration'.	x	x	x	x	x	x
LO	Describe the effects of acceleration on the circulation and blood volume distribution.	x	x	x	x	x	x
LO	List the factors determining the effects of acceleration on the human body.	x	x	x	x	x	x
LO	Describe the measures which may be taken to increase tolerance to positive acceleration.	x	x	x	x	x	x
LO	List the effects of positive acceleration with respect to type, sequence and the corresponding G-load.	x	x	x	x	x	x
	Carbon monoxide						
LO	State how carbon monoxide may be produced.	x	x	x	x	x	x
LO	State how the presence of carbon monoxide in the blood affects the distribution of oxygen.	x	x	x	x	x	x
LO	List the signs and symptoms of carbon-monoxide poisoning.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Indicate how carbon-monoxide poisoning can be treated and countermeasures that can be adopted.	x	x	x	x	x	x
040 02 01 03	**High-altitude environment**						
	Ozone						
LO	State how an increase in altitude may change the proportion of ozone in the atmosphere.	x		x	x		
LO	List the possible harmful effects of ozone.	x		x	x		
	Radiation						
LO	State the sources of radiation at high altitude.	x		x	x		
LO	List the effects of excessive exposure to radiation.	x		x	x		
LO	State the effect of sun storms on the amount of radiation at high altitude.	x		x	x		
LO	List the harmful effects that may result from the extra radiation that may be generated as the result of a sun storm (solar flares).	x		x	x		
LO	List the methods of reducing the effects of extra radiation that may be generated as the result of a sun storm (solar flares).	x		x	x		
	Humidity						
LO	Define the terms 'humidity' and 'relative humidity'.	x		x	x		
LO	List the factors which affect the relative humidity of both the atmosphere and cabin air.	x		x	x		
LO	State the methods of reducing the effects of insufficient humidity.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the physiological effects of dry cabin air on the human body and indicate measures to diminish these effects. Stress the effects that low humidity can have on the efficient functioning of the eye.	x		x	x		
	Extreme temperatures						
LO	Explain the change in the need for oxygen of the human body when exposed to extreme environmental temperatures.	x		x	x		
040 02 02 00	**Man and environment: the sensory system**						
LO	List the different senses.	x	x	x	x	x	x
LO	State the multisensory nature of human perception.	x	x	x	x	x	x
040 02 02 01	**Central, peripheral and autonomic nervous systems**						
LO	Name the main parts of the central nervous system.	x	x	x	x	x	x
LO	State the basic functions of the Central Nervous System (CNS), the Peripheral Nervous System (PNS) and the Autonomic (vegetative) Nervous System (ANS).	x	x	x	x	x	x
LO	Discuss broadly how information is processed by the nervous systems and the role of reflexes.	x	x	x	x	x	x
LO	Define the division of the peripheral nerves into sensory and motor nerves.	x	x	x	x	x	x
LO	State that a nerve impulse is an electrochemical phenomenon.	x	x	x	x	x	x
LO	Define the term ‘sensory threshold’.	x	x	x	x	x	x
LO	Define the term ‘sensitivity’, especially in the context of vision.	x	x	x	x	x	x
LO	Give examples of sensory adaptation.	x	x	x	x	x	x
LO	Define the term ‘habituation’ and state its implication for flight safety.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the biological control systems as neurohormonal processes that are highly self-regulated in the normal environment.	x	x	x	x	x	x
040 02 02 02	**Vision**						
	Functional anatomy						
LO	Name the most important parts of the eye and the pathway to the visual cortex.	x	x	x	x	x	x
LO	State the basic functions of the parts of the eye.	x	x	x	x	x	x
LO	Define ‘accommodation’.	x	x	x	x	x	x
LO	Distinguish between the functions of the rod and cone cells.	x	x	x	x	x	x
LO	Describe the distribution of rod and cone cells in the retina and explain their relevance on vision.	x	x	x	x	x	x
	Visual foveal and peripheral vision						
LO	Explain the terms ‘visual acuity’, ‘visual field’, ‘central vision’, ‘peripheral vision’ and ‘fovea’ and explain their function in the process of vision.	x	x	x	x	x	x
LO	List the factors which may degrade visual acuity and the importance of ‘lookout’.	x	x	x	x	x	x
LO	State the limitations of night vision and the different scanning techniques by both night and day (regularly spaced eye movements each covering an overlapping sector of about 10°).	x	x	x	x	x	x
LO	Explain the adaptation mechanism in vision to cater for reduced and increased levels of illumination.	x	x	x	x	x	x
LO	State the time necessary for the eye to adapt both to dark and bright light.	x	x	x	x	x	x
LO	State the effect of hypoxia and smoking on night vision.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the nature of colour blindness and the significance of the 'blind spot' on the retina in detecting other traffic in flight.	x	x	x	x	x	x
	Binocular and monocular vision						
LO	Distinguish between monocular and binocular vision.	x	x	x	x	x	x
LO	Explain the basis of depth perception and its relevance to flight performance.	x	x	x	x	x	x
LO	List the possible monocular cues for depth perception.	x	x	x	x	x	x
LO	State the problems of vision associated with higher energy blue light and ultraviolet rays.	x	x	x	x	x	x
	Defective vision						
LO	Explain long sightedness, short sightedness and astigmatism.	x	x	x	x	x	x
LO	List the causes of and the precautions that may be taken to reduce the probability of vision loss due to: presbyopia, cataracts, glaucoma.	x	x	x	x	x	x
LO	List the types of sunglasses which could cause perceptional problems in flight.	x	x	x	x	x	x
LO	List the measures which may be taken to protect oneself from flash blindness.	x	x	x	x	x	x
LO	State the possible problems associated with contact lenses.	x	x	x	x	x	x
LO	State the current rules/regulations governing the wearing of corrective spectacles and contact lenses when operating as a pilot.	x	x	x	x	x	x
040 02 02 03	**Hearing**						
	Descriptive and functional anatomy						
LO	State the audible range of the human ear.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the unit of measure for the intensity of sound.	x	x	x	x	x	x
LO	Name the most important parts of the ear and the associated neural pathway.	x	x	x	x	x	x
LO	State the basic functions of the different parts of the auditory system.	x	x	x	x	x	x
LO	Differentiate between the functions of the vestibular apparatus and the cochlea in the inner ear.	x	x	x	x	x	x
LO	State the role of the Eustachian tube in equalising pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	Indicate the effects of colds or flu on the ability to equalise pressure in the above.	x	x	x	x	x	x
	Hearing loss						
LO	Define the main causes of the following hearing defects/loss: 'conductive deafness'; 'Noise-Induced Hearing Loss' (NIHL); 'presbycusis'.	x	x	x	x	x	x
LO	Summarise the effects of environmental noise on hearing.	x	x	x	x	x	x
LO	State the decibel level of received noise that will cause NIHL.	x	x	x	x	x	x
LO	Indicate the factors, other than noise level, which may lead to NIHL.	x	x	x	x	x	x
LO	Identify the potential occupational risks which may cause hearing loss.	x	x	x	x	x	x
LO	List the main sources of hearing loss in the flying environment.	x	x	x	x	x	x
LO	List the precautions that may be taken to reduce the probability of onset of hearing loss.	x	x	x	x	x	x
040 02 02 04	**Equilibrium**						
	Functional anatomy						
LO	List the main elements of the vestibular apparatus.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the functions of the vestibular apparatus on the ground and in flight.	x	x	x	x	x	x
LO	Distinguish between the component parts of the vestibular apparatus in the detection of linear and angular acceleration as well as on gravity.	x	x	x	x	x	x
LO	Explain how the semicircular canals are stimulated.	x	x	x	x	x	x
	Motion sickness						
LO	Describe airsickness and its accompanying symptoms.	x	x	x	x	x	x
LO	Indicate that vibration can cause undesirable human responses because of the resonance of the skull and the eyeballs.	x	x	x	x	x	x
LO	List the causes of motion sickness.	x	x	x	x	x	x
LO	Describe the necessary actions to be taken to counteract the symptoms of motion sickness.	x	x	x	x	x	x
040 02 02 05	**Integration of sensory inputs**						
LO	State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight.	x	x	x	x	x	x
LO	Define the term 'illusion'.	x	x	x	x	x	x
LO	Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons and surface planes.	x	x	x	x	x	x
LO	Relate these illusions to problems that may be experienced in flight and identify the danger attached to them.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the conditions which cause the 'black-hole' effect and 'empty-field myopia'.	x	x	x	x	x	x
LO	Give examples of approach and landing illusions, state the danger involved and give recommendations to avoid or counteract these problems.	x	x	x	x	x	x
LO	State the problems associated with flickering lights (strobe lights, anti-collision lights, etc.).	x	x	x	x	x	x
LO	Give examples of vestibular illusions such as somatogyral (the Leans), Coriolis, somatogravic and G-effect illusions.	x	x	x	x	x	x
LO	Relate the above-mentioned vestibular illusions to problems encountered in flight and state the dangers involved.	x	x	x	x	x	x
LO	List and describe the function of the proprioceptive senses ('seat-of-the-pants' sense).	x	x	x	x	x	x
LO	Relate illusions of the proprioceptive senses to the problems encountered during flight.	x	x	x	x	x	x
LO	State that the 'seat-of-the-pants' sense is completely unreliable when visual contact with the ground is lost or when flying in IMC or poor visual horizon.	x	x	x	x	x	x
LO	Differentiate between vertigo, Coriolis effect and spatial disorientation.	x	x	x	x	x	x
LO	Explain the flicker effect (stroboscopic effect) and discuss the countermeasures.	x	x	x	x	x	x
LO	Explain how spatial disorientation can result from a mismatch in sensory input and information processing.	x	x	x	x	x	x
LO	List the measures to prevent and/or overcome spatial disorientation.	x	x	x	x	x	x
040 02 03 00	**Health and hygiene**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
040 02 03 01	**Personal hygiene**						
LO	Summarise the role of personal hygiene as a factor in human performance.	x	x	x	x	x	x
040 02 03 02	**Body rhythm and sleep**						
LO	Name some internal body rhythms and their relevance to sleep.	x		x	x		
LO	Explain the term ‘circadian rhythm’.	x		x	x		
LO	State the approximate duration of a ‘free-running’ rhythm.	x		x	x		
LO	Explain the significance of the ‘internal clock’ in regulating the normal circadian rhythm.	x		x	x		
LO	State the effect of the circadian rhythm of body temperature on an individual’s performance standard and the effect on an individual’s sleep patterns.	x		x	x		
LO	List and describe the stages of a sleep cycle.	x		x	x		
LO	Differentiate between REM and non-REM sleep.	x		x	x		
LO	Explain the function of sleep and describe the effects of insufficient sleep on performance.	x		x	x		
LO	Explain the simple calculations for the sleep/wake credit/debit situation.	x		x	x		
LO	Explain how sleep debit can become cumulative.	x		x	x		
LO	State the time formula for the adjustment of body rhythms to the new local time scale after crossing time zones.	x		x	x		
LO	State the problems caused by circadian disrhythmia (jet lag) with regard to an individual’s performance and sleep.	x		x	x		
LO	Differentiate between the effects of westbound and eastbound travel.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the interactive effects of circadian rhythm and vigilance on a pilot's performance during flight as the duty day elapses.	x		x	x		
LO	Describe the main effects of lack of sleep on an individual's performance.	x		x	x		
LO	List the possible coping strategies for jet lag.	x		x	x		
040 02 03 03	**Problem areas for pilots**						
	Common minor ailments						
LO	State the role of the Eustachian tube in equalising pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	State that the in-flight environment may increase the severity of symptoms which may be minor while on the ground.	x	x	x	x	x	x
LO	List the negative effects of suffering from colds or flu on flight operations especially with regard to the middle ear, the sinuses, and the teeth.	x	x	x	x	x	x
LO	Indicate the effects of colds or flu on the ability to equalise pressure between the middle ear and the environment.	x	x	x	x	x	x
LO	State when a pilot should seek medical advice from an AME, and when the aeromedical section of an authority should be informed.	x	x	x	x	x	x
LO	Describe the measures to prevent and/or clear problems due to pressure changes during flight.	x	x	x	x	x	x
	Entrapped gases and barotrauma						
LO	Define 'barotrauma'.	x	x	x	x	x	x
LO	Differentiate between otic, sinus, gastrointestinal and aerodontalgia (of the teeth) barotraumas and explain avoidance strategies.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain why the effects of otic barotrauma can be worse in the descent.	x	x	x	x	x	x
	Gastrointestinal upsets						
LO	State the effects of gastrointestinal upsets that may occur during flight.	x	x	x	x	x	x
LO	List the precautions that should be observed to reduce the occurrence of gastrointestinal upsets.	x	x	x	x	x	x
LO	Indicate the major sources of gastrointestinal upsets.	x	x	x	x	x	x
	Obesity						
LO	Define 'obesity'.	x	x	x	x	x	x
LO	State the cause of obesity.	x	x	x	x	x	x
LO	State the harmful effects of obesity on the following: possibility of developing coronary problems; increased chances of developing diabetes; ability to withstand G forces; the development of problems with the joints of the limbs; general circulatory problems; ability to cope with hypoxia and/or decompression sickness.	x	x	x	x	x	x
LO	State the relationship between obesity and Body Mass Index (BMI).	x	x	x	x	x	x
LO	Calculate the BMI of an individual (given weight in kilograms and height in metres) and state whether this BMI indicates that the individual is underweight, overweight, obese or within the normal range of body weight.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the problems associated with Type 2 (mostly adult) diabetes risk factors; insulin resistance; complications (vascular, neurological) and the consequences for the medical licence; pilots are not protected from Type 2 diabetes more than other people.	x	x	x	x	x	x
	Back pain						
LO	Describe the typical back problems (unspecific back pain, slipped disc) that pilots have. Explain also the ways of preventing and treating these problems: good sitting posture; lumbar support; good physical condition; in-flight exercise, if possible; physiotherapy.	x	x	x	x	x	x
	Food hygiene						
LO	Explain the significance of food hygiene with regard to general health.	x	x	x	x	x	x
LO	Stress the importance of and methods to be adopted by aircrew especially when travelling abroad to avoid contaminated food and liquids.	x	x	x	x	x	x
LO	List the major contaminating sources in foodstuffs.	x	x	x	x	x	x
LO	State the major constituents of a healthy diet.	x	x	x	x	x	x
LO	State the measure to avoid hypoglycaemia.	x	x	x	x	x	x
LO	State the role vitamins and trace elements are playing in a healthy diet.	x	x	x	x	x	x
LO	State the importance of adequate hydration.	x	x	x	x	x	x
	Tropical climates						
LO	List the problems associated with operating in tropical climates.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the possible causes/sources of incapacitation in tropical or poorly developed countries with reference to: standards of hygiene; quality of water supply; insectborne diseases; parasitic worms; rabies or other diseases that may be spread by contact with animals; sexually transmitted diseases.	x		x	x		
LO	State the precautions to be taken to reduce the risks of developing problems in tropical areas.	x		x	x		
	Infectious diseases						
LO	State the major infectious diseases that may kill or severely incapacitate individuals.	x	x	x	x	x	x
LO	State which preventative hygienic measures, vaccinations, drugs and other measures reduce the chances of catching these diseases.	x	x	x	x	x	x
LO	State the precautions which must be taken to ensure that disease-carrying insects are not transported between areas.	x	x	x	x	x	x
040 02 03 04	**Intoxication**						
	Tobacco						
LO	State the harmful effects of tobacco on: the respiratory system; the cardiovascular system; the ability to resist hypoxia; the ability to tolerate G forces; night vision.	x	x	x	x	x	x
	Caffeine						
LO	Indicate the level of caffeine dosage at which performance is degraded.	x	x	x	x	x	x
LO	Besides coffee, indicate other beverages containing caffeine.	x	x	x	x	x	x
	Alcohol						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the maximum acceptable limit of alcohol for flight crew according to the applicable regulations.	x	x	x	x	x	x
LO	State the effects of alcohol consumption on: the ability to reason; inhibitions and self-control; vision; the sense of balance and sensory illusions; sleep patterns; hypoxia.	x	x	x	x	x	x
LO	State the effects alcohol may have if consumed together with other drugs.	x	x	x	x	x	x
LO	List the signs and symptoms of alcoholism.	x	x	x	x	x	x
LO	List the factors which may be associated with the development of alcoholism.	x	x	x	x	x	x
LO	Define the 'unit' of alcohol and state the approximate elimination rate from the blood.	x	x	x	x	x	x
LO	State the maximum daily and weekly intake of units of alcohol which may be consumed without causing damage to organs and systems in the body.	x	x	x	x	x	x
LO	Discuss the actions that might be taken if a crew member is suspected of being an alcoholic.	x		x	x		
LO	State the reasons why aviation professions are particularly vulnerable to the excessive use of alcohol.	x		x	x		
	Drugs and self-medication						
LO	State the dangers associated with the use of non-prescription drugs.	x	x	x	x	x	x
LO	State the side effects of common non-prescription drugs used to treat colds, flu, hay fever and other allergies, especially medicines containing antihistamine preparations.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret the rules relevant to using (prescription or non-prescription) drugs that the pilot has not used before.	x	x	x	x	x	x
LO	Interpret the general rule that 'if a pilot is so unwell that they require any medication, then they should consider themselves unfit to fly'.	x	x	x	x	x	x
	Toxic materials						
LO	List those materials present in an aircraft which may, when uncontained, cause severe health problems.	x	x	x	x	x	x
LO	List those aircraft-component parts which if burnt may give off toxic fumes.	x	x	x	x	x	x
040 02 03 05	**Incapacitation in flight**						
LO	State that incapacitation is most dangerous when its onset is insidious.	x	x	x	x	x	x
LO	List the major causes of in-flight incapacitation.	x	x	x	x	x	x
LO	State the importance of crew to be able to recognise and promptly react upon incapacitation of other crew members, should it occur in flight.	x		x	x		
LO	Explain coping methods and procedures.	x	x	x	x	x	x
040 03 00 00	**BASIC AVIATION PSYCHOLOGY**						
040 03 01 00	**Human information processing**						
040 03 01 01	**Attention and vigilance**						
LO	Differentiate between 'attention' and 'vigilance'.	x	x	x	x	x	x
LO	Differentiate between 'selected' and 'divided' attention.	x	x	x	x	x	x
LO	Define 'hypovigilance'.	x	x	x	x	x	x
LO	Identify the factors which may affect the state of vigilance.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the factors that may forestall hypovigilance during flight.	x	x	x	x	x	x
LO	Indicate the signs of reduced vigilance.	x	x	x	x	x	x
LO	Name the factors that affect a person's level of attention.	x	x	x	x	x	x
040 03 01 02	**Perception**						
LO	Name the basis of the perceptual process.	x	x	x	x	x	x
LO	Describe the mechanism of perception ('bottom-up'/'top-down' process).	x	x	x	x	x	x
LO	Illustrate why perception is subjective and state the relevant factors which influence interpretation of perceived information.	x	x	x	x	x	x
LO	Describe some basic perceptual illusions.	x	x	x	x	x	x
LO	Illustrate some basic perceptual concepts.	x	x	x	x	x	x
LO	Give examples where perception plays a decisive role in flight safety.	x	x	x	x	x	x
LO	Stress how persuasive and believable mistaken perception can manifest itself both on an individual and a group.	x	x	x	x	x	x
040 03 01 03	**Memory**						
LO	Explain the link between the types of memory (to include sensory, working/short-term and long-term memories).	x	x	x	x	x	x
LO	Describe the differences between the types of memory in terms of capacity and retention time.	x	x	x	x	x	x
LO	Justify the importance of sensory-store memories in processing information.	x	x	x	x	x	x
LO	State the average maximum number of separate items that may be held in working memory.	x	x	x	x	x	x
LO	Stress how interruption can affect short-term/working memory.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Give examples of items that are important for pilots to hold in working memory during flight.	x	x	x	x	x	x
LO	Describe how the capacity of the working-memory store may be increased.	x	x	x	x	x	x
LO	State the subdivisions of long-term memory and give examples of their content.	x	x	x	x	x	x
LO	Explain that skills are kept primarily in the long-term memory.	x	x	x	x	x	x
LO	Explain amnesia and how it effects memory.	x	x	x	x	x	x
LO	Name the common problems with both the long and short-term memories and the best methods to try to counteract them.	x	x	x	x	x	x
040 03 01 04	**Response selection**						
	Learning principles and techniques						
LO	Explain and distinguish between the following basic forms of learning: classical and operant conditioning (behaviouristic approach); learning by insight (cognitive approach); learning by imitating (modelling).	x	x	x	x	x	x
LO	Find pilot-related examples for each of these learning forms.	x	x	x	x	x	x
LO	State the factors which are necessary for and promote the quality of learning.	x	x	x	x	x	x
LO	Explain ways to facilitate the memorisation of information with the following learning techniques: mnemonics; mental training.	x	x	x	x	x	x
LO	Describe the advantage of planning and anticipation of future actions: define the term 'skills'; state the three phases of learning a skill (Anderson).	x	x	x	x	x	x
LO	Explain the term 'motor programme' or 'mental schema'.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the advantages and disadvantages of mental schemata.	x	x	x	x	x	x
LO	Explain the Rasmussen model which describes the guidance of a pilot's behaviour in different situations.	x	x	x	x	x	x
LO	State the possible problems or risks associated with skill-based, rule-based and knowledge-based behaviour.	x	x	x	x	x	x
LO	Explain the following phases in connection with the acquisition of automated behaviour: cognitive phase; associative phase; automatic phase.	x	x	x	x	x	x
	Motivation						
LO	Define 'motivation'.	x	x	x	x	x	x
LO	Explain the influences of different levels of motivation on performance taking into consideration task difficulty.	x	x	x	x	x	x
LO	Explain the 'Model of human needs' (Maslow) and relate this to aviation.	x	x	x	x	x	x
LO	Explain the relationship between motivation and learning.	x	x	x	x	x	x
LO	Explain the problems of overmotivation, especially in the context of extreme need of achievement.	x	x	x	x	x	x
040 03 02 00	**Human error and reliability**						
040 03 02 01	**Reliability of human behaviour**						
LO	Name and explain the factors which influence human reliability.	x	x	x	x	x	x
040 03 02 02	**Mental models and situation awareness**						
LO	Define the term 'situation awareness'.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the cues which indicate loss of situation awareness and name the steps to regain it.	x	x	x	x	x	x
LO	List the factors which influence one's situation awareness both positively and negatively, and stress the importance of situation awareness in the context of flight safety.	x	x	x	x	x	x
LO	Define the term 'mental model' in relation to a surrounding complex situation.	x	x	x	x	x	x
LO	Describe the advantages/ disadvantages of mental models.	x	x	x	x	x	x
LO	Explain the relationship between personal 'mental models' and the creation of cognitive illusions.	x	x	x	x	x	x
040 03 02 03	**Theory and model of human error**						
LO	Define the term 'error'.	x	x	x	x	x	x
LO	Explain the concept of the 'error chain'.	x	x	x	x	x	x
LO	Differentiate between an isolated error and an error chain.	x	x	x	x	x	x
LO	Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations).	x	x	x	x	x	x
LO	Discuss the above errors and their relevance in flight.	x	x	x	x	x	x
LO	Distinguish between an active and a latent error and give examples.	x	x	x	x	x	x
040 03 02 04	**Error generation**						
LO	Distinguish between internal and external factors in error generation.	x	x	x	x	x	x
LO	Identify possible sources of internal error generation.	x	x	x	x	x	x
LO	Define and discuss the two errors associated with motor programmes.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the three main sources of external error generation in the cockpit.	x	x	x	x	x	x
LO	Give examples to illustrate the following factors in external error generation in the cockpit: ergonomics, economics, social environment.	x	x	x	x	x	x
LO	Name the major goals in the design of human-centred man–machine interfaces.	x	x	x	x	x	x
LO	Define the term 'error tolerance'.	x	x	x	x	x	x
LO	List (and describe) strategies which are used to reduce human error.	x	x	x	x	x	x
040 03 03 00	**Decision-making**						
040 03 03 01	**Decision-making concepts**						
LO	Define the terms 'deciding' and 'decision-making'.	x	x	x	x	x	x
LO	Describe the major factors on which decision-making should be based during the course of a flight.	x	x	x	x	x	x
LO	Describe the main human attributes with regard to decision-making.	x	x	x	x	x	x
LO	Discuss the nature of bias and its influence on the decision-making process.	x	x	x	x	x	x
LO	Describe the main error sources and limits in an individual's decision-making mechanism.	x	x	x	x	x	x
LO	State the factors upon which an individual's risk assessment is based.	x	x	x	x	x	x
LO	Explain the relationship between risk assessment, commitment and pressure of time on decision-making strategies.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the risks associated with dispersion and/or channelised attention during the application of procedures requiring a high workload within a short time frame (e.g. a go-around).	x	x	x	x	x	x
LO	Describe the positive and negative influences exerted by other group members on an individual's decision-making process.	x	x	x	x	x	x
LO	Explain the general idea behind the creation of a model for decision-making based upon: definition of the aim; collection of information; risk assessment; development of options; evaluation of options; decision; implementation; consequences; review and feedback.	x	x	x	x	x	x
040 03 04 00	**Avoiding and managing errors: cockpit management**						
040 03 04 01	**Safety awareness**						
LO	Justify the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks.	x	x	x	x	x	x
LO	Stress the overall importance of constantly and positively striving to monitor for errors and thereby maintaining situation awareness.	x	x	x	x	x	x
040 03 04 02	**Coordination (multi-crew concepts)**						
LO	Name the objectives of the multi-crew concept.	x		x	x		
LO	State and explain the elements of multi-crew concepts.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the concept 'Standard Operating Procedures' (SOPs).	x		x	x		
LO	Illustrate the purpose and procedure of crew briefings.	x		x	x		
LO	Illustrate the purpose and procedure of checklists.	x		x	x		
LO	Describe the function of communication in a coordinated team.	x		x	x		
040 03 04 03	**Cooperation**						
LO	Distinguish between cooperation and coaction.	x		x	x		
LO	Define the term 'group'.	x		x	x		
LO	Illustrate the influence of interdependence in a group.	x		x	x		
LO	List the advantages and disadvantages of team work.	x		x	x		
LO	Explain the term 'synergy'.	x		x	x		
LO	Define the term 'cohesion'.	x		x	x		
LO	Define the term 'groupthink'.	x		x	x		
LO	State the essential conditions for good teamwork.	x		x	x		
LO	Explain the function of role and norm in a group.	x		x	x		
LO	Name the different role patterns which occur in a group situation.	x		x	x		
LO	Explain how behaviour can be affected by the following factors: persuasion, conformity, compliance, obedience.	x		x	x		
LO	Distinguish between status and role.	x		x	x		

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Stress the inherent dangers of a situation where there is a mix of role and status within the cockpit.	x		x	x		
LO	Explain the terms 'leadership' and 'followership'.	x		x	x		
LO	Describe the trans-cockpit authority gradient and its affiliated leadership styles (i.e. autocratic, laissez-faire and synergistic).	x		x	x		
LO	Name the most important attributes of a positive leadership style.	x		x	x		
040 03 04 04	**Communication**						
LO	Explain the function of 'information'.	x	x	x	x	x	x
LO	Define the term 'communication'.	x	x	x	x	x	x
LO	List the most basic components of interpersonal communication.	x	x	x	x	x	x
LO	Explain the advantages of two-way communication as opposed to one-way communication.	x	x	x	x	x	x
LO	Explain Watzlawick's statement 'One cannot not communicate'.	x	x	x	x	x	x
LO	Distinguish between verbal and non-verbal communication.	x	x	x	x	x	x
LO	Name the functions of non-verbal communication.	x	x	x	x	x	x
LO	Describe the general aspects of non-verbal communication.	x	x	x	x	x	x
LO	Describe the advantages/disadvantages of implicit and explicit communication.	x	x	x	x	x	x
LO	State the attributes and possible problems of using 'professional' language.	x	x	x	x	x	x
LO	Name and explain the major obstacles to effective communication.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Give examples of aircraft accidents arising from poor communication.	x	x	x	x	x	x
LO	Explain the difference between intrapersonal and interpersonal conflict.	x	x	x	x	x	x
LO	Describe the escalation process in human conflict.	x	x	x	x	x	x
LO	List the typical consequences of conflicts between crew members.	x	x	x	x	x	x
LO	Explain the following terms as part of the communication practice with regard to preventing or resolving conflicts: inquiry, active listening, advocacy, feedback, metacommunication, negotiation.	x	x	x	x	x	x
040 03 05 00	**Human behaviour**						
040 03 05 01	**Personality, attitude and behaviour**						
LO	Describe the factors which determine an individual’s behaviour.	x	x	x	x	x	x
LO	Define and distinguish between ‘personality’, ‘attitude’ and ‘behaviour’.	x	x	x	x	x	x
LO	State the origin of personality and attitudes.	x	x	x	x	x	x
LO	State that with behaviours good and bad habits can be formed.	x	x	x	x	x	x
LO	Explain how behaviour is generally a product of personality and attitude.	x	x	x	x	x	x
LO	Discuss some effects that personality and attitudes may have on flight crew performance.	x	x	x	x	x	x
040 03 05 02	**Individual differences in personality and motivation**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the individual differences in personality by means of a common trait model (e.g. Eysenck's personality factors) and use it to describe today's ideal pilot.	x	x	x	x	x	x
	Self-concept						
LO	Define the term 'self-concept' and the role it plays in any change of personality.	x	x	x	x	x	x
LO	Explain how a self-concept of underconfidence may lead to an outward show of aggression and self- assertiveness.	x	x	x	x	x	x
	Self-discipline						
LO	Define 'self-discipline' and justify its importance for flight safety.	x	x	x	x	x	x
040 03 05 03	**Identification of hazardous attitudes (error proneness)**						
LO	Summarise examples of attitudes and behaviour (including their signs) which, if prevalent in a crew member, might represent a hazard to flight safety.	x		x	x		
LO	Describe the personality attitude and behaviour patterns of an ideal crew member.	x		x	x		
LO	Summarise how a person's attitude influences their work in the cockpit.	x		x	x		
040 03 06 00	**Human overload and underload**						
040 03 06 01	**Arousal**						
LO	Explain the term 'arousal'.	x	x	x	x	x	x
LO	Describe the relationship between arousal and performance.	x	x	x	x	x	x
LO	Explain the circumstances under which underload may occur and its possible dangers.	x	x	x	x	x	x
040 03 06 02	**Stress**						
LO	Explain the term 'homeostasis'.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the term 'stress' and why stress is a natural human reaction.	x	x	x	x	x	x
LO	State that the physiological response to stress is generated by the 'fight or flight' response.	x	x	x	x	x	x
LO	Describe the function of the Autonomic Nervous System (ANS) in stress response.	x	x	x	x	x	x
LO	Explain the biological reaction to stress by means of the 'General Adaptation Syndrome' (GAS).	x	x	x	x	x	x
LO	Explain the relationship between arousal and stress.	x	x	x	x	x	x
LO	State the relationship between stress and performance.	x	x	x	x	x	x
LO	State the basic categories of stressors.	x	x	x	x	x	x
LO	List and discuss the major environmental sources of stress in the cockpit.	x	x	x	x	x	x
LO	Discuss the concept of 'break point' with regard to stress, overload and performance.	x	x	x	x	x	x
LO	Name the principal causes of domestic stress.	x	x	x	x	x	x
LO	State that the stress experienced as a result of particular demands varies between individuals.	x	x	x	x	x	x
LO	Explain the factors which lead to differences in the levels of stress experienced by individuals.	x	x	x	x	x	x
LO	List the factors influencing the tolerance of stressors.	x	x	x	x	x	x
LO	Explain a simple model of stress.	x	x	x	x	x	x
LO	Explain the relationship between stress and anxiety.	x	x	x	x	x	x
LO	Describe the effects of anxiety on human performance.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the general effect of acute stress on the human system.	x	x	x	x	x	x
LO	Name the three phases of GAS.	x	x	x	x	x	x
LO	Name the symptoms of stress relating to the different phases of GAS.	x	x	x	x	x	x
LO	Describe the relationship between stress, arousal and vigilance.	x	x	x	x	x	x
LO	State the general effect of chronic stress on the human system.	x	x	x	x	x	x
LO	Explain the differences between psychological, psychosomatic and somatic stress reactions.	x	x	x	x	x	x
LO	Name the typical common physiological and psychological symptoms of human overload.	x	x	x	x	x	x
LO	Describe the effects of stress on human behaviour.	x	x	x	x	x	x
LO	Explain how stress is cumulative and how stress from one situation can be transferred to a different situation.	x	x	x	x	x	x
LO	Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future.	x	x	x	x	x	x
LO	Describe the effect of human underload/overload on effectiveness in the cockpit.	x	x	x	x	x	x
LO	List sources and symptoms of human underload.	x	x	x	x	x	x
040 03 06 03	***Intentionally left blank***						
040 03 06 04	***Intentionally left blank***						
040 03 06 05	**Fatigue and stress management**						
LO	Explain the term ‘fatigue’ and differentiate between the two types of fatigue.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the causes for both types.	x	x	x	x	x	x
LO	Identify the symptoms and describe the effects of fatigue.	x	x	x	x	x	x
LO	List the strategies which prevent or delay the onset of fatigue and hypovigilance.	x	x	x	x	x	x
LO	List and describe coping strategies for dealing with stress factors and stress reactions.	x	x	x	x	x	x
LO	Distinguish between short-term and long-term methods of stress management.	x	x	x	x	x	x
LO	Give examples of short-term methods of stress management.	x	x	x	x	x	x
LO	Give examples of long-term methods of coping with stress.	x	x	x	x	x	x
040 03 07 00	**Advanced cockpit automation**						
040 03 07 01	**Advantages and disadvantages**						
LO	Define and explain the basic concept of automation.	x	x	x	x	x	x
LO	List the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situation awareness and crew coordination.	x	x	x	x	x	x
LO	State the advantages and disadvantages of the two components of the man–machine system with regard to information input and processing, decision-making and output activities.	x	x	x	x	x	x
LO	Explain the ‘ironies of automation’.	x	x	x	x	x	x
LO	Give examples of methods to overcome the disadvantages of automation.	x	x	x	x	x	x
040 03 07 02	**Automation complacency**						
LO	State the main weaknesses in the monitoring of automatic systems.	x	x	x	x	x	x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the following terms in connection with automatic systems: passive monitoring; blinkered concentration; confusion; mode awareness.	x	x	x	x	x	x
LO	Give examples of actions which may be taken to counteract ineffective monitoring of automatic systems.	x	x	x	x	x	x
LO	Define ‘complacency’.	x	x	x	x	x	x
040 03 07 03	**Working concepts**						
LO	Analyse the influence of automation on crew communication and describe the potential disadvantages.	x		x	x		
LO	Summarise how the negative effects of automation on pilots may be alleviated.	x	x	x	x	x	x
LO	Interpret the role of automation with respect to flight safety.	x	x	x	x	x	x

I. SUBJECT 050 — METEOROLOGY

The operation of an aircraft is affected by the weather conditions within the atmosphere. The pilot must prove that they fulfil the following objectives in order to complete a safe flight in given meteorological conditions.

(1) Training aims

(i) Knowledge. After completion of the training, the pilot must be able to:
— understand the physical processes in the atmosphere;
— interpret the actual and forecast weather conditions in the atmosphere;
— show understanding of the meteorological hazards and their effects on an aircraft.

(ii) Skills. After completion of the training, the pilot must be able to:
— collect all the weather information which may affect a given flight;
— analyse and evaluate available weather information before flight as well as that collected in flight;
— apply a solution to any problems presented by weather conditions.

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 00 00 00	**METEOROLOGY**						
050 01 00 00	**THE ATMOSPHERE**						
050 01 01 00	**Composition, extent, vertical division**						
050 01 01 01	**Structure of the atmosphere**						
LO	Describe the vertical division of the atmosphere, based on the temperature variations with height.	x	x	x	x	x	x
LO	List the different layers and their main qualitative characteristics.	x	x	x	x	x	x
050 01 01 02	**Troposphere**						
LO	Describe the troposphere.	x	x	x	x	x	x
LO	Describe the main characteristics of the tropopause.	x	x	x	x	x	x
LO	Describe the proportions of the most important gases in the air in the troposphere.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the variations of the flight level and temperature of the tropopause from the poles to the equator.	x	x	x	x	x	x
LO	Describe the breaks in the tropopause along the boundaries of the main air masses.	x	x	x	x	x	x
LO	Indicate the variations of the flight level of the tropopause with the seasons and the variations of atmospheric pressure.	x		x	x		
050 01 01 03	**Stratosphere**						
LO	Describe the stratosphere.	x		x	x		
LO	Describe the main differences of the composition of the air in the stratosphere compared to the troposphere.	x		x	x		
LO	Mention the vertical extent of the stratosphere up to the stratopause.	x		x	x		
LO	Describe the reason for the temperature increase in the ozone layer.	x		x	x		
050 01 02 00	**Air temperature**						
050 01 02 01	**Definition and units**						
LO	Define 'air temperature'.	x	x	x	x	x	x
LO	List the units of measurement of air temperature used in aviation meteorology (Celsius, Fahrenheit, Kelvin). *(Refer to 050 10 01 01)*	x	x	x	x	x	x
050 01 02 02	**Vertical distribution of temperature**						
LO	Describe the mean vertical distribution of temperature up to 20 km.	x	x	x	x	x	x
LO	Mention the general causes of the cooling of the air in the troposphere with increasing altitude.	x	x	x	x	x	x
LO	Calculate the temperature and temperature deviations at specified levels.	x	x	x	x	x	x
050 01 02 03	**Transfer of heat**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain how local cooling or warming processes result in transfer of heat.	x	x	x	x	x	x
LO	Describe radiation.	x	x	x	x	x	x
LO	Describe solar radiation reaching the Earth.	x	x	x	x	x	x
LO	Describe the filtering effect of the atmosphere on solar radiation.	x	x	x	x	x	x
LO	Describe terrestrial radiation.	x	x	x	x	x	x
LO	Explain how terrestrial radiation is absorbed by some components of the atmosphere.	x	x	x	x	x	x
LO	Explain the greenhouse effect due to water vapour and some other gases in the atmosphere.	x	x	x	x	x	x
LO	Explain the effect of absorption and radiation in connection with clouds.	x	x	x	x	x	x
LO	Explain the process of conduction.	x	x	x	x	x	x
LO	Explain the role of conduction in the cooling and warming of the atmosphere.	x	x	x	x	x	x
LO	Explain the process of convection.	x	x	x	x	x	x
LO	Name the situations in which convection occurs.	x	x	x	x	x	x
LO	Explain the process of advection.	x	x	x	x	x	x
LO	Name the situations in which advection occurs.	x	x	x	x	x	x
LO	Describe the transfer of heat by turbulence.	x	x	x	x	x	x
LO	Describe the transfer of latent heat.	x	x	x	x	x	x
050 01 02 04	**Lapse rates**						
LO	Describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value 0.65 °C/100 m or 2 °C/1 000 ft and actual values).	x	x	x	x	x	x
050 01 02 05	**Development of inversions, types of inversions**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the development and types of inversions.	x	x	x	x	x	x
LO	Explain the characteristics of inversions and of an isothermal layer.	x	x	x	x	x	x
LO	Explain the reasons for the formation of the following inversions: ground inversion (nocturnal radiation/ advection), subsidence inversion, frontal inversion, inversion above friction layer, valley inversion.	x	x	x	x	x	x
LO	Explain the reasons for the formation of the following inversions: tropopause inversion.	x		x	x		
050 01 02 06	**Temperature near the Earth's surface, surface effects, diurnal and seasonal variation, effect of clouds, effect of wind**						
LO	Describe how the temperature near the Earth's surface is influenced by seasonal variations.	x	x	x	x	x	x
LO	Explain the cooling and warming of the air on the earth or sea surfaces.	x	x	x	x	x	x
LO	Sketch the diurnal variation of the temperature of the air in relation to the radiation of the sun and of the Earth.	x	x	x	x	x	x
LO	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface.	x	x	x	x	x	x
LO	Distinguish between the influence of low or high clouds and thick or thin clouds.	x	x	x	x	x	x
LO	Explain the influence of the wind on the cooling and warming of the air near the surfaces.	x	x	x	x	x	x
050 01 03 00	**Atmospheric pressure**						
050 01 03 01	**Barometric pressure, isobars**						
LO	Define 'atmospheric pressure'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches). *(Refer to 050 10 01 01)*	x	x	x	x	x	x
LO	Describe the principle of the barometers (mercury barometer, aneroid barometer).	x	x	x	x	x	x
LO	Describe isobars on surface weather charts.	x	x	x	x	x	x
LO	Define 'high', 'low', 'trough', 'ridge', 'wedge', 'col'.	x	x	x	x	x	x
050 01 03 02	**Pressure variation with height, contours (isohypses)**						
LO	Explain the pressure variation with height.	x	x	x	x	x	x
LO	Describe qualitatively the variation of the barometric lapse rate. *Remark: The average value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa, at about 5 500 m/AMSL is 50 ft (15 m) per 1 hPa.*	x	x	x	x	x	x
LO	Describe and interpret contour lines (isohypses) on a constant pressure chart. *(Refer to 050 10 02 03)*	x	x	x	x	x	x
050 01 03 03	**Reduction of pressure to mean sea level, QFF**						
LO	Define 'QFF'.	x	x	x	x	x	x
LO	Explain the reduction of measured pressure to mean sea level, QFF.	x	x	x	x	x	x
LO	Mention the use of QFF for surface weather charts.	x	x	x	x	x	x
050 01 03 04	**Relationship between surface pressure centres and pressure centres aloft**						
LO	Illustrate with a vertical cross section of isobaric surfaces the relationship between surface pressure systems and upper-air pressure systems.	x	x	x	x	x	x
050 01 04 00	**Air density**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 01 04 01	**Relationship between pressure, temperature and density**						
LO	Describe the relationship between pressure, temperature and density.	x	x	x	x	x	x
LO	Describe the vertical variation of the air density in the atmosphere.	x	x	x	x	x	x
LO	Describe the effect of humidity changes on the density of air.	x	x	x	x	x	x
050 01 05 00	**ICAO Standard Atmosphere (ISA)**						
050 01 05 01	**ICAO Standard Atmosphere (ISA)**						
LO	Explain the use of standardised values for the atmosphere.	x	x	x	x	x	x
LO	List the main values of the ISA (mean sea-level pressure, mean sea-level temperature, the vertical temperature lapse rate up to 20 km, height and temperature of the tropopause).	x	x	x	x	x	x
LO	Calculate the standard temperature in Celsius for a given flight level.	x	x	x	x	x	x
LO	Determine a standard temperature deviation by the difference between the given outside-air temperature and the standard temperature.	x	x	x	x	x	x
050 01 06 00	**Altimetry**						
050 01 06 01	**Terminology and definitions**						
LO	Define the following terms and acronyms and explain how they are related to each other: height, altitude, pressure altitude, flight level, level, true altitude, true height, elevation, QNH, QFE, and standard altimeter setting.	x	x	x	x	x	x
LO	Describe the terms 'transition altitude', 'transition level', 'transition layer', 'terrain clearance', 'lowest usable flight level'.	x	x	x	x	x	x
050 01 06 02	**Altimeter settings**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the altimeter settings associated to height, altitude, pressure altitude and flight level.	x	x	x	x	x	x
LO	Describe the altimeter-setting procedures.	x	x	x	x	x	x
050 01 06 03	**Calculations**						
LO	Calculate the different readings on the altimeter when the pilot changes the altimeter setting.	x	x	x	x	x	x
LO	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level.	x	x	x	x	x	x
LO	Derive the reading of the altimeter of an aircraft on the ground when the pilot uses the different settings.	x	x	x	x	x	x
LO	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two flight levels.	x	x	x	x	x	x
LO	Explain the influence of pressure areas on true altitude.	x	x	x	x	x	x
LO	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation.	x	x	x	x	x	x
LO	Calculate the terrain clearance and the lowest usable flight level for given atmospheric temperature and pressure conditions.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Remark: The following rules shall be considered for altimetry calculations: *a) All calculations are based on rounded pressure values to the nearest lower hPa;* *b) The value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa;* *c) To determine the true altitude/height, the following rule of thumb, called the '4 %-rule', shall be used: the altitude/height changes by 4 % for each 10 °C temperature deviation from ISA;* *d) If no further information is given, the deviation of outside-air temperature from ISA is considered to be constantly the same given value in the whole layer;* *e) The elevation of the airport has to be taken into account. The temperature correction has to be considered for the layer between ground and the position of the aircraft.*						
050 01 06 04	**Effect of accelerated airflow due to topography**						
LO	Describe qualitatively how the effect of accelerated airflow due to topography (Bernoulli effect) affects altimetry.	x	x	x	x	x	x
050 02 00 00	**WIND**						
050 02 01 00	**Definition and measurement of wind**						
050 02 01 01	**Definition and measurement**						
LO	Define 'wind'.	x	x	x	x	x	x
LO	State the units of wind direction and speed (kt, m/s, km/h). *(Refer to 050 10 01 01)*	x	x	x	x	x	x
LO	Explain how wind is measured in meteorology.	x	x	x	x	x	x
050 02 02 00	**Primary cause of wind**						
050 02 02 01	**Primary cause of wind, pressure gradient, Coriolis force, gradient wind**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the term 'horizontal pressure gradient'.	x	x	x	x	x	x
LO	Explain how the pressure gradient force acts in relation to the pressure gradient.	x	x	x	x	x	x
LO	Explain how the Coriolis force acts in relation to the wind.	x	x	x	x	x	x
LO	Explain the development of the geostrophic wind.	x	x	x	x	x	x
LO	Indicate how the geostrophic wind flows in relation to the isobars/isohypses in the northern and in the southern hemisphere.	x	x	x	x	x	x
LO	Analyse the effect of changing latitude on the geostrophic-wind speed.	x		x	x		
LO	Explain the gradient wind effect and indicate how the gradient wind differs from the geostrophic wind in cyclonic and anticyclonic circulation.	x	x	x	x	x	x
050 02 02 02	**Variation of wind in the friction layer**						
LO	Describe why and how the wind changes direction and speed with height in the friction layer in the northern and in the southern hemisphere (rule of thumb).	x	x	x	x	x	x
LO	State the surface and air-mass conditions that influence the wind in the friction layer (diurnal variation).	x	x	x	x	x	x
LO	Name the factors that influence the vertical extent of the friction layer.	x	x	x	x	x	x
LO	Explain the relationship between isobars and wind (direction and speed).	x	x	x	x	x	x
	Remark: Approximate value for variation of wind in the friction layer (values to be used in examinations):						

<table>
<tr><th rowspan="2">Syllabus reference</th><th rowspan="2">Syllabus details and associated Learning Objectives</th><th colspan="2">Aeroplane</th><th colspan="3">Helicopter</th><th rowspan="2">IR</th></tr>
<tr><th>ATPL</th><th>CPL</th><th>ATPL/ IR</th><th>ATPL</th><th>CPL</th></tr>
<tr><td></td><td><table>
<tr><td>Type of landscape</td><td>Wind speed in friction layer in % of the geostrophic wind</td><td>The wind in the friction layer blows across the isobars towards the low pressure. Angle between wind direction and isobars.</td></tr>
<tr><td>over water</td><td>ca 70 %</td><td>ca 10°</td></tr>
<tr><td>over land</td><td>ca 50 %</td><td>ca 30°</td></tr>
<tr><td colspan="3">WMO-NO. 266</td></tr>
</table></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>050 02 02 03</td><td>Effects of convergence and divergence</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>LO</td><td>Describe atmospheric convergence and divergence.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Explain the effect of convergence and divergence on the following: pressure systems at the surface and aloft; wind speed; vertical motion and cloud formation (relationship between upper-air conditions and surface pressure systems).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>050 02 03 00</td><td>General global circulation</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>050 02 03 01</td><td>General circulation around the globe</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>LO</td><td>Describe and explain the general global circulation.
(Refer to 050 08 01 01)</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>LO</td><td>Name and sketch or indicate on a map the global distribution of the surface pressure and the resulting wind pattern for all latitudes at low level in January and July.</td><td>x</td><td></td><td>x</td><td>x</td><td></td><td></td></tr>
<tr><td>LO</td><td>Sketch or indicate on a map the westerly and easterly tropospheric winds at high level in January and July.</td><td>x</td><td></td><td>x</td><td>x</td><td></td><td></td></tr>
<tr><td>050 02 04 00</td><td>Local winds</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 02 04 01	**Anabatic and katabatic winds, mountain and valley winds, Venturi effects, land and sea breezes**						
LO	Describe and explain anabatic and katabatic winds.	x	x	x	x	x	x
LO	Describe and explain mountain and valley winds.	x	x	x	x	x	x
LO	Describe and explain the Venturi effect, convergence in valleys and mountain areas.	x	x	x	x	x	x
LO	Describe and explain land and sea breezes, sea-breeze front.	x	x	x	x	x	x
050 02 05 00	**Mountain waves (standing waves, lee waves)**						
050 02 05 01	**Origin and characteristics**						
LO	Describe and explain the origin and formation of mountain waves.	x	x	x	x	x	x
LO	State the conditions necessary for the formation of mountain waves.	x	x	x	x	x	x
LO	Describe the structure and properties of mountain waves.	x	x	x	x	x	x
LO	Explain how mountain waves may be identified by their associated meteorological phenomena.	x	x	x	x	x	x
050 02 06 00	**Turbulence**						
050 02 06 01	**Description and types of turbulence**						
LO	Describe turbulence and gustiness.	x	x	x	x	x	x
LO	List the common types of turbulence (convective, mechanical, orographic, frontal, clear-air turbulence).	x	x	x	x	x	x
050 02 06 02	**Formation and location of turbulence**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the formation of convective turbulence, mechanical and orographic turbulence, frontal turbulence, clear-air turbulence. *(Refer to 050 02 06 03)*	x	x	x	x	x	x
LO	State where turbulence will normally be found (rough-ground surfaces, relief, inversion layers, CB, TS zones, unstable layers).	x	x	x	x	x	x
050 02 06 03	**Clear-Air Turbulence (CAT): Description, cause and location**						
LO	Describe the term CAT.	x	x	x	x	x	x
LO	Explain the formation of CAT. *(Refer to 050 02 06 02)*	x	x	x	x	x	x
LO	State where CAT is found in association with jet streams, in high-level troughs and in other disturbed high-level air flows. *(Refer to 050 09 02 02)*	x		x	x		
050 02 07 00	**Jet streams**						
050 02 07 01	**Description**						
LO	Describe jet streams.	x	x	x	x	x	x
LO	State the defined minimum speed of a jet stream.	x	x	x	x	x	x
LO	State the typical figures for the dimensions of jet streams.	x	x	x	x	x	x
050 02 07 02	**Formation and properties of jet streams**						
LO	Explain the formation and state the heights, the speeds, the seasonal variations of speeds, the geographical positions, the seasonal occurrence and the seasonal movements of the arctic (front) jet stream, the polar front jet stream, the subtropical jet stream, and the tropical (easterly/ equatorial) jet stream.	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 02 07 03	**Location of jet streams and associated CAT areas**						
LO	Sketch or describe where polar front and arctic jet streams are found in the troposphere in relation to the tropopause and to fronts.	x		x	x		
LO	Sketch or describe the isotherms, the isotachs, the pressure surfaces and the movements of air in a cross section of a polar front jet stream.	x		x	x		
LO	Describe and indicate the areas of worst wind shear and CAT.	x		x	x		
050 02 07 04	**Jet stream recognition**						
LO	State how jet streams may be recognised from their associated meteorological phenomena.	x		x	x		
050 03 00 00	**THERMODYNAMICS**						
050 03 01 00	**Humidity**						
050 03 01 01	**Water vapour in the atmosphere**						
LO	Describe humid air.	x	x	x	x	x	x
LO	Describe the significance for meteorology of water vapour in the atmosphere.	x	x	x	x	x	x
LO	Indicate the sources of atmospheric humidity.	x	x	x	x	x	x
050 03 01 02	**Mixing ratio**						
LO	Define 'mixing ratio' and 'saturation mixing ratio'.	x	x	x	x	x	x
LO	Name the unit used in meteorology to express the mixing ratio (g/kg).	x	x	x	x	x	x
LO	Explain the factors influencing the mixing ratio.	x	x	x	x	x	x
LO	Recognise the lines of equal mixing ratio on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Define 'saturation of air by water vapour'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Illustrate with a diagram (T, mixing ratio) the influence of the temperature on the saturation mixing ratio, at constant pressure.	x	x	x	x	x	x
LO	Explain the influence of the pressure on the saturation mixing ratio. *Remark: A simplified diagram (T,P) contains:* *on the x-axis: temperature (T);* *on the y-axis: height corresponding to pressure (P).* *The degree of saturation/mixing ratio and stability/instability are shown as functions of temperature change with height (as lines or curves in the diagram).*	x	x	x	x	x	x
050 03 01 03	**Temperature/dew point, relative humidity**						
LO	Define 'dew point'.	x	x	x	x	x	x
LO	Recognise the dew-point curve on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Define 'relative humidity'.	x	x	x	x	x	x
LO	Explain the factors influencing the relative humidity at constant pressure.	x	x	x	x	x	x
LO	Explain the diurnal variation of the relative humidity.	x	x	x	x	x	x
LO	Describe the relationship between relative humidity, the amount of water vapour and the temperature.	x	x	x	x	x	x
LO	Describe the relationship between temperature and dew point.	x	x	x	x	x	x
LO	Estimate the relative humidity of the air from the difference between dew point and temperature.	x	x	x	x	x	x
050 03 02 00	**Change of state of aggregation**						
050 03 02 01	**Condensation, evaporation, sublimation, freezing and melting, latent heat**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'condensation', 'evaporation', 'sublimation', 'freezing and melting' and 'latent heat'.	x	x	x	x	x	x
LO	List the conditions for condensation/ evaporation.	x	x	x	x	x	x
LO	Explain the condensation process.	x	x	x	x	x	x
LO	Explain the nature of and the need for condensation nuclei.	x	x	x	x	x	x
LO	Explain the effects of condensation on the weather.	x	x	x	x	x	x
LO	List the conditions for freezing/melting.	x	x	x	x	x	x
LO	Explain the process of freezing.	x	x	x	x	x	x
LO	Explain the nature of and the need for freezing nuclei.	x	x	x	x	x	x
LO	Define 'supercooled water'. *(Refer to 050 09 01 01)*	x	x	x	x	x	x
LO	List the conditions for sublimation.	x	x	x	x	x	x
LO	Explain the sublimation process.	x	x	x	x	x	x
LO	Explain the nature of and the need for sublimation nuclei.	x	x	x	x	x	x
LO	Describe the absorption or release of latent heat in each change of state of aggregation.	x	x	x	x	x	x
LO	Explain the influence of atmospheric pressure, the temperature of the air and of the water or ice on the changes of state of aggregation.	x	x	x	x	x	x
LO	Illustrate all the changes of state of aggregation with practical examples.	x	x	x	x	x	x
050 03 03 00	**Adiabatic processes**						
050 03 03 01	**Adiabatic processes, stability of the atmosphere**						
LO	Describe the adiabatic processes.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the adiabatic process in an unsaturated rising or descending air particle.	x	x	x	x	x	x
LO	Explain the variation of temperature with changing altitude.	x	x	x	x	x	x
LO	Explain the changes which take place in mixing ratio with changing altitude.	x	x	x	x	x	x
LO	Explain the changes which take place in relative humidity with changing altitude.	x	x	x	x	x	x
LO	Use the dry-adiabatic and mixing-ratio lines on a simplified diagram (T, P) for a climbing or descending air particle.	x	x	x	x	x	x
LO	Describe the adiabatic process in a saturated rising or descending air particle.	x	x	x	x	x	x
LO	Explain the variation of temperature with changing altitude.	x	x	x	x	x	x
LO	Explain the difference in temperature lapse rate between saturated and unsaturated air.	x	x	x	x	x	x
LO	Explain the influence of different air temperatures on the temperature lapse rate in saturated air.	x	x	x	x	x	x
LO	Use the saturated adiabatic lines on a simplified diagram (T, P) for a climbing or descending air particle.	x	x	x	x	x	x
LO	Find the condensation level, or base of the clouds, on a simplified diagram (T, P).	x	x	x	x	x	x
LO	Explain the static stability of the atmosphere with reference to the adiabatic lapse rates.	x	x	x	x	x	x
LO	Define qualitatively and quantitatively the terms 'stability', 'conditional instability', 'instability' and 'indifferent (neutral)'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain with a sketch on a simplified diagram (T, P) the different possibilities of atmospheric stability: absolute stability, absolute instability, conditional instability and indifferent (neutral).	x	x	x	x	x	x
LO	Illustrate with a sketch of the adiabatic lapse rates and the vertical temperature profile of the atmosphere the effect of an inversion on the vertical motion of air.	x	x	x	x	x	x
LO	Illustrate with a schematic sketch of the saturated adiabatic lapse rate and the vertical temperature profile the instability inside a cumuliform cloud.	x	x	x	x	x	x
LO	Illustrate with a schematic sketch the formation of the subsidence inversion.	x	x	x	x	x	x
LO	Illustrate with a schematic sketch the formation of Foehn.	x	x	x	x	x	x
LO	Explain the effect on the stability of the air caused by advection of air (warm or cold). *Remark: Dry adiabatic lapse rate = 1 °C/100 m or 3 °C/1 000 ft; average value at lower levels for saturated adiabatic lapse rate = 0.6 °C/100 m or 1.8 °C/1 000 ft (values to be used in examinations).*	x	x	x	x	x	x
050 04 00 00	**CLOUDS AND FOG**						
050 04 01 00	**Cloud formation and description**						
050 04 01 01	**Cloud formation**						
LO	Explain cloud formation by adiabatic cooling, conduction, advection and radiation.	x	x	x	x	x	x
LO	Describe cloud formation based on the following lifting processes: unorganised lifting in thin layers and turbulent mixing; forced lifting at fronts or over mountains; free convection.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Determine cloud base and top in a simplified diagram (temperature, pressure, humidity).	x	x	x	x	x	x
LO	Explain the influence of relative humidity on the height of the cloud base.	x	x	x	x	x	x
LO	Illustrate in a thermodynamic diagram the meaning of convective temperature (temperature at which formation of cumulus starts).	x	x	x	x	x	x
LO	List cloud types typical for stable and unstable air conditions.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of clouds.	x	x	x	x	x	x
050 04 01 02	**Cloud types and cloud classification**						
LO	Describe cloud types and cloud classification.	x	x	x	x	x	x
LO	Identify by shape cirriform, cumuliform and stratiform clouds.	x	x	x	x	x	x
LO	Identify by shape and typical level the 10 cloud types (genera).	x	x	x	x	x	x
LO	Describe and identify by shape the following species and supplementary feature: castellanus, lenticularis, fractus, humilis, mediocris, congestus, calvus, capillatus and virga.	x	x	x	x	x	x
LO	Distinguish between low, medium and high-level clouds according to the WMO 'cloud etage' (including heights): for mid latitudes.	x	x	x	x	x	x
LO	Distinguish between low, medium and high-level clouds according to the WMO 'cloud etage' (including heights): for all latitudes.	x		x	x		
LO	Distinguish between ice clouds, mixed clouds and pure-water clouds.	x	x	x	x	x	x
050 04 01 03	**Influence of inversions on cloud development**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the influence of inversions on vertical movements in the atmosphere.	x	x	x	x	x	x
LO	Explain the influence of an inversion on the formation of stratus clouds.	x	x	x	x	x	x
LO	Explain the influence of ground inversion on the formation of fog.	x	x	x	x	x	x
LO	Determine on a simplified diagram the top of a cumulus cloud caused by an inversion.	x	x	x	x	x	x
LO	Describe the role of the tropopause inversion with regard to the formation of clouds.	x		x	x		
050 04 01 04	**Flying conditions in each cloud type**						
LO	Assess the 10 cloud types for icing and turbulence.	x	x	x	x	x	x
050 04 02 00	**Fog, mist, haze**						
050 04 02 01	**General aspects**						
LO	Define 'fog', 'mist' and 'haze' with reference to the WMO standards of visibility range.	x	x	x	x	x	x
LO	Explain the formation of fog, mist and haze in general.	x	x	x	x	x	x
LO	Name the factors contributing in general to the formation of fog and mist.	x	x	x	x	x	x
LO	Name the factors contributing to the formation of haze.	x	x	x	x	x	x
LO	Describe freezing fog and ice fog.	x	x	x	x	x	x
050 04 02 02	**Radiation fog**						
LO	Explain the formation of radiation fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of radiation fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of radiation fog, and its vertical extent.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of radiation fog.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 04 02 03	**Advection fog**						
LO	Explain the formation of advection fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of advection fog.	x	x	x	x	x	x
LO	Describe the different possibilities of advection-fog formation (over land, sea and coastal regions).	x	x	x	x	x	x
LO	Describe the significant characteristics of advection fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of advection fog.	x	x	x	x	x	x
050 04 02 04	**Steam fog**						
LO	Explain the formation of steam fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of steam fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of steam fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of steam fog.	x	x	x	x	x	x
050 04 02 05	**Frontal fog**						
LO	Explain the formation of frontal fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of frontal fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of frontal fog.	x	x	x	x	x	x
LO	Summarise the conditions for the dissipation of frontal fog.	x	x	x	x	x	x
050 04 02 06	**Orographic fog (hill fog)**						
LO	Summarise the features of orographic fog.	x	x	x	x	x	x
LO	Explain the conditions for the development of orographic fog.	x	x	x	x	x	x
LO	Describe the significant characteristics of orographic fog.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Summarise the conditions for the dissipation of orographic fog.	x	x	x	x	x	x
050 05 00 00	**PRECIPITATION**						
050 05 01 00	**Development of precipitation**						
050 05 01 01	**Process of development of precipitation**						
LO	Distinguish between the two following processes by which precipitation is formed.	x	x	x	x	x	x
LO	Summarise the outlines of the ice-crystal process (Wegener-Bergeron-Findeisen).	x	x	x	x	x	x
LO	Summarise the outlines of the coalescence process.	x	x	x	x	x	x
LO	Describe the atmospheric conditions that favour either process.	x	x	x	x	x	x
LO	Explain the development of snow, rain, drizzle and hail.	x	x	x	x	x	x
050 05 02 00	**Types of precipitation**						
050 05 02 01	**Types of precipitation, relationship with cloud types**						
LO	List and describe the types of precipitation given in the TAF and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, freezing rain).	x	x	x	x	x	x
LO	State the ICAO/WMO approximate diameters for cloud, drizzle and rain drops.	x	x	x	x	x	x
LO	State the approximate weights and diameters for hailstones.	x	x	x	x	x	x
LO	Explain the mechanism for the formation of freezing precipitation.	x	x	x	x	x	x
LO	Describe the weather conditions that give rise to freezing precipitation.	x	x	x	x	x	x
LO	Distinguish between the types of precipitation generated in convective and stratiform cloud.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Assign typical precipitation types and intensities to different clouds.	x	x	x	x	x	x
050 06 00 00	**AIR MASSES AND FRONTS**						
050 06 01 00	**Air masses**						
050 06 01 01	**Description, classification and source regions of air masses**						
LO	Define the term 'air mass'.	x	x	x	x	x	x
LO	Describe the properties of the source regions.	x	x	x	x	x	x
LO	Summarise the classification of air masses by source regions.	x	x	x	x	x	x
LO	State the classifications of air masses by temperature and humidity at source.	x	x	x	x	x	x
LO	State the characteristic weather in each of the air masses.	x	x	x	x	x	x
LO	Name the three main air masses that affect Europe.	x	x	x	x	x	x
LO	Classify air masses on a surface weather chart.	x	x	x	x	x	x
	Remark: Names and abbreviations of air masses used in examinations: first letter: humidity continental (c), maritime (m), second letter: type of air mass Arctic (A), Polar (P), Tropical (T), Equatorial (E), third letter: temperature *cold (c),* *warm (w).*						
050 06 01 02	**Modifications of air masses**						
LO	List the environmental factors that affect the final properties of an air mass.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain how maritime and continental tracks modify air masses.	x	x	x	x	x	x
LO	Explain the effect of passage over cold or warm surfaces.	x	x	x	x	x	x
LO	Explain how air-mass weather is affected by the season, the air-mass track and by orographic and thermal effects over land.	x	x	x	x	x	x
LO	Assess the tendencies of the stability for an air mass and describe the typical resulting air-mass weather including the hazards for aviation.	x	x	x	x	x	x
050 06 02 00	**Fronts**						
050 06 02 01	**General aspects**						
LO	Describe the boundaries between air masses (fronts).	x	x	x	x	x	x
LO	Define 'front and frontal surface (frontal zone)'.	x	x	x	x	x	x
LO	Name the global frontal systems (polar front, arctic front).	x	x	x	x	x	x
LO	State the approximate seasonal latitudes and geographic positions of the polar front and the arctic front.	x	x	x	x	x	x
050 06 02 02	**Warm front, associated clouds and weather**						
LO	Define a 'warm front'.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at warm fronts.	x	x	x	x	x	x
LO	Describe the structure, slope and dimensions of a warm front.	x	x	x	x	x	x
LO	Sketch a cross section of a warm front showing weather, cloud and aviation hazards.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 06 02 03	**Cold front, associated clouds and weather**						
LO	Define a 'cold front'.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at cold fronts.	x	x	x	x	x	x
LO	Describe the structure, slope and dimensions of a cold front.	x	x	x	x	x	x
LO	Sketch a cross section of a cold front showing weather, cloud and aviation hazards.	x	x	x	x	x	x
050 06 02 04	**Warm sector, associated clouds and weather**						
LO	Define 'fronts and air masses associated with the warm sector'.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather in the warm sector.	x	x	x	x	x	x
LO	Sketch a cross section of a warm sector showing weather, cloud and aviation hazards.	x	x	x	x	x	x
050 06 02 05	**Weather behind the cold front**						
LO	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather behind the cold front.	x	x	x	x	x	x
050 06 02 06	**Occlusions, associated clouds and weather**						
LO	Define the term 'occlusion'.	x	x	x	x	x	x
LO	Define a 'cold occlusion'.	x	x	x	x	x	x
LO	Define a 'warm occlusion'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion.	x	x	x	x	x	x
LO	Explain the seasonal differences in the weather at occlusions.	x	x	x	x	x	x
LO	Sketch a cross section of cold and warm occlusions showing weather, cloud and aviation hazards.	x	x	x	x	x	x
LO	On a sketch illustrate the development of an occlusion and the movement of the occlusion point.	x	x	x	x	x	x
050 06 02 07	**Stationary front, associated clouds and weather**						
LO	Define a 'stationary or quasi-stationary front'.	x	x	x	x	x	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a stationary or quasi-stationary front.	x	x	x	x	x	x
050 06 02 08	**Movement of fronts and pressure systems, life cycle**						
LO	Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression.	x	x	x	x	x	x
LO	State the rules for predicting the direction and the speed of movement of fronts.	x	x	x	x	x	x
LO	Explain the difference between the speed of movement of cold and warm fronts.	x	x	x	x	x	x
LO	State the rules for predicting the direction and the speed of movement of frontal depressions.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe, with a sketch if required, the genesis, development and life cycle of a frontal depression with associated cloud and rain belts.	x	x	x	x	x	x
050 06 02 09	**Changes of meteorological elements at a frontal wave**						
LO	Sketch a plan and a cross section of a frontal wave (warm front, warm sector and cold front) and illustrate the changes of pressure, temperature, surface wind and wind in the vertical axis.	x	x	x	x	x	x
050 07 00 00	**PRESSURE SYSTEMS**						
050 07 01 00	**The principal pressure areas**						
050 07 01 01	**Location of the principal pressure areas**						
LO	Identify or indicate on a map the principal global high-pressure and low-pressure areas in January and July.	x		x	x		
LO	Explain how these pressure areas are formed.	x		x	x		
LO	Explain how the pressure areas move with the seasons.	x		x	x		
050 07 02 00	**Anticyclone**						
050 07 02 01	**Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence**						
LO	List the different types of anticyclones.	x	x	x	x	x	x
LO	Describe the effect of high-level convergence in producing areas of high pressure at ground level.	x	x	x	x	x	x
LO	Describe air-mass subsidence, its effect on the environmental lapse rate, and the associated weather.	x	x	x	x	x	x
LO	Describe the formation of warm and cold anticyclones.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the formation of ridges and wedges. *(Refer to 050 08 03 02)*	x	x	x	x	x	x
LO	Describe the properties of and the weather associated with warm and cold anticyclones.	x	x	x	x	x	x
LO	Describe the properties of and the weather associated with ridges and wedges.	x	x	x	x	x	x
LO	Describe the blocking anticyclone and its effects.	x	x	x	x	x	x
050 07 03 00	**Non-frontal depressions**						
050 07 03 01	**Thermal, orographic, polar and secondary depressions; troughs**						
LO	Describe the effect of high-level divergence in producing areas of low pressure at ground level.	x	x	x	x	x	x
LO	Describe the formation and properties of thermal, orographic (lee lows), polar and secondary depressions.	x	x	x	x	x	x
LO	Describe the formation, the properties and the associated weather of troughs.	x	x	x	x	x	x
050 07 04 00	**Tropical revolving storms**						
050 07 04 01	**Characteristics of tropical revolving storms**						
LO	State the conditions necessary for the formation of tropical revolving storms.	x		x	x		
LO	Explain how a tropical revolving storm moves during its life cycle.	x		x	x		
LO	Name the stages of the development of tropical revolving storms (tropical disturbance, tropical depression, tropical storm, severe tropical storm, tropical revolving storm).	x		x	x		
LO	Describe the meteorological conditions in and near a tropical revolving storm.	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the approximate dimensions of a tropical revolving storm.	x		x	x		
050 07 04 02	**Origin and local names, location and period of occurrence**						
LO	List the areas of origin and occurrence of tropical revolving storms, and their specified names (hurricane, typhoon, tropical cyclone).	x		x	x		
LO	State the expected times of occurrence of tropical revolving storms in each of the source areas, and their approximate frequency.	x		x	x		
050 08 00 00	**CLIMATOLOGY**						
050 08 01 00	**Climatic zones**						
050 08 01 01	**General circulation in the troposphere and lower stratosphere**						
LO	Describe the general tropospheric and low stratospheric circulation. *(Refer to 050 02 03 01)*	x		x	x		
050 08 01 02	**Climatic classification**						
LO	Name the world climate groups according to Koeppen's classification.	x		x	x		
LO	Describe the characteristics of the tropical rain climate, the dry climate, the mid-latitude climate (warm temperate rain climate), the subarctic climate (cold snow-forest climate) and the snow climate (polar climate).	x		x	x		
LO	Explain how the seasonal movement of the sun generates the transitional climate zones.	x		x	x		
LO	Describe the typical weather in the tropical transitional climate (savannah climate) and in the temperate transitional climate (Mediterranean climate).	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the typical locations of each major climatic zone.	x		x	x		
050 08 02 00	**Tropical climatology**						
050 08 02 01	**Cause and development of tropical showers and thunderstorms: humidity, temperature, tropopause**						
LO	State the conditions necessary for the formation of tropical rain showers and thunderstorms (mesoscale convective complex, cloud clusters).	x		x	x		
LO	Describe the characteristics of tropical squall lines.	x		x	x		
LO	Explain the formation of convective cloud structures caused by convergence at the boundary of the NE and SE trade winds (Intertropical Convergence Zone (ITCZ)).	x		x	x		
LO	State the typical figures for tropical surface air temperatures and humidities, and heights of the zero-degree isotherm.	x		x	x		
050 08 02 02	**Seasonal variations of weather and wind, typical synoptic situations**						
LO	Describe the seasonal variations of weather and winds, and describe the typical synoptic situations.	x		x	x		
LO	Indicate on a map the trade winds (tropical easterlies) and describe the associated weather.	x		x	x		
LO	Indicate on a map the doldrums and describe the associated weather.	x		x	x		
LO	Indicate on a sketch the latitudes of subtropical high (horse latitudes) and describe the associated weather.	x		x	x		
LO	Indicate on a map the major monsoon winds. *(Refer to 050 08 02 04 for a description of the weather)*	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 08 02 03	**Intertropical Convergence Zone (ITCZ), weather in the ITCZ, general seasonal movement**						
LO	Identify or indicate on a map the positions of the ITCZ in January and July.	x		x	x		
LO	Explain the seasonal movement of the ITCZ.	x		x	x		
LO	Describe the weather and winds at the ITCZ.	x		x	x		
LO	Explain the variations in weather that are found at the ITCZ.	x		x	x		
LO	Explain the flight hazards associated with the ITCZ.	x		x	x		
050 08 02 04	**Monsoon, sandstorms, cold-air outbreaks**						
LO	Define in general the term 'monsoon'.	x		x	x		
LO	Describe the major monsoon conditions. *(Refer to 050 08 02 02)*	x		x	x		
LO	Explain how trade winds change character after a long track and become monsoon winds.	x		x	x		
LO	Explain the formation of the SW/NE monsoon over West Africa and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Explain the formation of the SW/NE monsoon over India and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Explain the formation of the monsoon over the Far East and northern Australia and describe the weather, stressing the seasonal differences.	x		x	x		
LO	Describe the formation and properties of sandstorms.	x		x	x		
LO	Indicate when and where outbreaks of cold polar air can enter subtropical weather systems.	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name well-known examples of polar-air outbreaks (Blizzard, Pampero).	x		x	x		
050 08 02 05	**Easterly waves**						
LO	Describe and explain the formation of easterly waves, the associated weather and the duration of the weather activity.	x		x	x		
LO	Describe and explain the global distribution of easterly waves.	x		x	x		
LO	Explain the effect of easterly waves on tropical weather systems.	x		x	x		
050 08 03 00	**Typical weather situations in the mid-latitudes**						
050 08 03 01	**Westerly situation (westerlies)**						
LO	Identify on a weather chart the typical westerly situation with travelling polar front waves.	x	x	x	x	x	x
LO	Describe the typical weather in the region of the travelling polar front waves including the seasonal variations.	x	x	x	x	x	x
LO	State the differences between the northern and the southern hemisphere (roaring forties).	x		x	x		
050 08 03 02	**High-pressure area**						
LO	Describe the high-pressure zones with the associated weather.	x	x	x	x	x	x
LO	Identify on a weather chart the high-pressure regions.	x	x	x	x	x	x
LO	Describe the weather associated with wedges in the polar air. *(Refer to 050 07 02 01)*	x	x	x	x	x	x
050 08 03 03	**Flat-pressure pattern**						
LO	Identify on a surface weather chart the typical flat-pressure pattern.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the weather associated with a flat-pressure pattern.	x	x	x	x	x	x
050 08 03 04	**Cold-air pool (cold-air drop)**						
LO	Define ‘cold-air pool’.	x	x	x	x	x	x
LO	Describe the formation of a cold-air pool.	x	x	x	x	x	x
LO	Describe the characteristics of a cold-air pool with regard to dimensions, duration of life, geographical position, seasons, movements, weather activities and dissipation.	x	x	x	x	x	x
LO	Identify cold-air pools on weather charts.	x	x	x	x	x	x
LO	Explain the problems and dangers of cold-air pools for aviation.	x	x	x	x	x	x
050 08 04 00	**Local winds and associated weather**						
050 08 04 01	**Foehn, Mistral, Bora, Scirocco, Ghibli and Khamsin**						
LO	Describe the classical mechanism for the development of Foehn winds (including Chinook).	x	x	x	x	x	x
LO	Describe the weather associated with Foehn winds.	x	x	x	x	x	x
LO	Describe the formation of, the characteristics of, and the weather associated with the Mistral, the Bora, the Scirocco, the Ghibli and the Khamsin.	x	x	x	x	x	x
050 08 04 02	**Harmattan**						
LO	Describe the Harmattan wind and the associated visibility problems.	x		x	x		
050 09 00 00	**FLIGHT HAZARDS**						
050 09 01 00	**Icing**						
050 09 01 01	**Conditions for ice accretion**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Summarise the general conditions under which ice accretion occurs on aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle; possibility of sublimation).	x	x	x	x	x	x
LO	Indicate the general weather conditions under which ice accretion in Venturi carburettor occurs.	x	x	x	x	x	x
LO	Explain the general weather conditions under which ice accretion on airframe occurs.	x	x	x	x	x	x
LO	Explain the formation of supercooled water in clouds, rain and drizzle. *(Refer to 050 03 02 01)*	x	x	x	x	x	x
LO	Explain qualitatively the relationship between the air temperature and the amount of supercooled water.	x	x	x	x	x	x
LO	Explain qualitatively the relationship between the type of cloud and the size and number of the droplets in cumuliform and stratiform clouds.	x	x	x	x	x	x
LO	Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation.	x	x	x	x	x	x
LO	Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, outside clouds and precipitation.	x	x	x	x	x	x
LO	Describe the different factors influencing the intensity of icing: air temperature, amount of supercooled water in a cloud or in precipitation, amount of ice crystals in the air, speed of the aircraft, shape (thickness) of the airframe parts (wings, antennas, etc.).	x	x	x	x	x	x
LO	Explain the effects of topography on icing.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the higher concentration of water drops in stratiform orographic clouds.	x	x	x	x	x	x
050 09 01 02	**Types of ice accretion**						
LO	Define 'clear ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of clear ice.	x	x	x	x	x	x
LO	Explain the formation of the structure of clear ice with the release of latent heat during the freezing process.	x	x	x	x	x	x
LO	Describe the aspect of clear ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Define 'rime ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of rime ice.	x	x	x	x	x	x
LO	Describe the aspects of rime ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Define 'mixed ice'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of mixed ice.	x	x	x	x	x	x
LO	Describe the aspects of mixed ice: appearance, weight, solidity.	x	x	x	x	x	x
LO	Describe the possible process of ice formation in snow conditions.	x	x	x	x	x	x
LO	Define 'hoar frost'.	x	x	x	x	x	x
LO	Describe the conditions for the formation of hoar frost.	x	x	x	x	x	x
LO	Describe the aspects of hoar frost: appearance, solidity.	x	x	x	x	x	x
050 09 01 03	**Hazards of ice accretion, avoidance**						
LO	State the ICAO qualifying terms for the intensity of icing. *(See ICAO ATM Doc 4444)*	x	x	x	x	x	x
LO	Describe, in general, the hazards of icing.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Assess the dangers of the different types of ice accretion.	x	x	x	x	x	x
LO	Describe the position of the dangerous zones of icing in fronts, in stratiform and cumuliform clouds, and in the different precipitation types.	x	x	x	x	x	x
LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: recognition of the dangerous zones, choice of appropriate track and altitude.	x	x	x	x	x	x
050 09 02 00	**Turbulence**						
050 09 02 01	**Effects on flight, avoidance**						
LO	State the ICAO qualifying terms for the intensity of turbulence. *(See ICAO ATM Doc 4444)*	x	x	x	x	x	x
LO	Describe the effects of turbulence on an aircraft in flight.	x	x	x	x	x	x
LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: choice of appropriate track and altitude.	x	x	x	x	x	x
050 09 02 02	**Clear-Air Turbulence (CAT): effects on flight, avoidance**						
LO	Describe the effects on flight caused by CAT. *(Refer to 050 02 06 03)*	x		x	x		
LO	Indicate the possibilities of avoidance: in the flight planning: weather briefing, choice of track and altitude; during flight: choice of appropriate track and altitude.	x		x	x		
050 09 03 00	**Wind shear**						
050 09 03 01	**Definition of wind shear**						
LO	Define 'wind shear' (vertical and horizontal).	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'low-level wind shear'.	x	x	x	x	x	x
050 09 03 02	**Weather conditions for wind shear**						
LO	Describe the conditions, where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief).	x	x	x	x	x	x
050 09 03 03	**Effects on flight, avoidance**						
LO	Describe the effects on flight caused by wind shear.	x	x	x	x	x	x
LO	Indicate the possibilities of avoidance: in the flight planning; during flight.	x	x	x	x	x	x
050 09 04 00	**Thunderstorms**						
050 09 04 01	**Conditions for and process of development, forecast, location, type specification**						
LO	Name the cloud types which indicate the development of thunderstorms.	x	x	x	x	x	x
LO	Describe the different types of thunderstorms, their location, the conditions for and the process of development, and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms).	x	x	x	x	x	x
050 09 04 02	**Structure of thunderstorms, life history**						
LO	Describe and sketch the stages of the life history of a thunderstorm: initial, mature and dissipating stage.	x	x	x	x	x	x
LO	Assess the average duration of thunderstorms and their different stages.	x	x	x	x	x	x
LO	Describe supercell storm: initial, supercell, tornado and dissipating stage.	x	x	x	x	x	x
LO	Summarise the flight hazards of a fully developed thunderstorm.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Indicate on a sketch the most dangerous zones in and around a thunderstorm.	x	x	x	x	x	x
050 09 04 03	**Electrical discharges**						
LO	Describe the basic outline of the electric field in the atmosphere.	x	x	x	x	x	x
LO	Describe the electrical potential differences in and around a thunderstorm.	x	x	x	x	x	x
LO	Describe and asses the 'St. Elmo's fire' weather phenomenon.	x	x	x	x	x	x
LO	Describe the development of lightning discharges.	x	x	x	x	x	x
LO	Describe the effect of lightning strike on aircraft and flight execution.	x	x	x	x	x	x
050 09 04 04	**Development and effects of downbursts**						
LO	Define the term 'downburst'.	x	x	x	x	x	x
LO	Distinguish between macroburst and microburst.	x	x	x	x	x	x
LO	State the weather situations leading to the formation of downbursts.	x	x	x	x	x	x
LO	Describe the process of development of a downburst.	x	x	x	x	x	x
LO	Give the typical duration of a downburst.	x	x	x	x	x	x
LO	Describe the effects of downbursts.	x	x	x	x	x	x
050 09 04 05	**Thunderstorm avoidance**						
LO	Explain how the pilot can anticipate each type of thunderstorms: pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar and by airborne weather radar *(Refer to 050 10 01 04),* use of the stormscope (lightning detector).	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms.	x	x	x	x	x	x
050 09 05 00	**Tornadoes**						
050 09 05 01	**Properties and occurrence**						
LO	Define the 'tornado'.	x	x	x	x	x	x
LO	Describe the formation of a tornado.	x		x	x		
LO	Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement and wind speed (including Fujita scale).	x		x	x		
LO	Compare the occurrence of tornadoes in Europe with the occurrence in other locations, especially in the United States of America.	x		x	x		
LO	Compare the dimensions and properties of tornadoes and dust devils.	x		x	x		
050 09 06 00	**Inversions**						
050 09 06 01	**Influence on aircraft performance**						
LO	Explain the influence of inversions on the aircraft performance.	x	x	x	x	x	x
LO	Compare the flight hazards during take-off and approach associated to a strong inversion alone and to a strong inversion combined with marked wind shear.	x	x	x	x	x	x
050 09 07 00	**Stratospheric conditions**						
050 09 07 01	**Influence on aircraft performance**						
LO	Summarise the advantages of stratospheric flights.	x		x	x		
LO	List the influences of the phenomena associated with the lower stratosphere (wind, temperature, air density, turbulence).	x		x	x		
050 09 08 00	**Hazards in mountainous areas**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 09 08 01	**Influence of terrain on clouds and precipitation, frontal passage**						
LO	Describe the influence of a mountainous terrain on cloud and precipitation.	x	x	x	x	x	x
LO	Describe the effects of the Foehn.	x	x	x	x	x	x
LO	Describe the influence of a mountainous area on a frontal passage.	x	x	x	x	x	x
050 09 08 02	**Vertical movements, mountain waves, wind shear, turbulence, ice accretion**						
LO	Describe the vertical movements, wind shear and turbulence typical of mountain areas.	x	x	x	x	x	x
LO	Indicate in a sketch of a chain of mountains the turbulent zones (mountain waves, rotors).	x	x	x	x	x	x
LO	Explain the influence of relief on ice accretion.	x	x	x	x	x	x
050 09 08 03	**Development and effect of valley inversions**						
LO	Describe the formation of valley inversion due to katabatic winds.	x	x	x	x	x	x
LO	Describe the valley inversion formed by warm winds aloft.	x	x	x	x	x	x
LO	Describe the effects of a valley inversion for an aircraft in flight.	x	x	x	x	x	x
050 09 09 00	**Visibility-reducing phenomena**						
050 09 09 01	**Reduction of visibility caused by precipitation and obscurations**						
LO	Describe the reduction of visibility caused by precipitation: drizzle, rain, snow.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by obscurations: fog, mist, haze, smoke, volcanic ash.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the reduction of visibility caused by obscurations: sand (SA), dust (DU).	x		x	x		
LO	Describe the differences between ground visibility, flight visibility, slant visibility and vertical visibility when an aircraft is above or within a layer of haze or fog.	x	x	x	x	x	x
050 09 09 02	**Reduction of visibility caused by other phenomena**						
LO	Describe the reduction of visibility caused by: low drifting and blowing snow.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: low drifting and blowing dust and sand.	x		x	x		
LO	Describe the reduction of visibility caused by: dust storm (DS) and sandstorm (SS).	x		x	x		
LO	Describe the reduction of visibility caused by: icing (windshield).	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: the position of the sun relative to the visual direction.	x	x	x	x	x	x
LO	Describe the reduction of visibility caused by: the reflection of sun's rays from the top of the layers of haze, fog and clouds.	x	x	x	x	x	x
050 10 00 00	**METEOROLOGICAL INFORMATION**						
050 10 01 00	**Observation**						
050 10 01 01	**Surface observations**						
LO	Define 'surface wind'.	x	x	x	x	x	x
LO	Describe the meteorological measurement of surface wind.	x	x	x	x	x	x
LO	List the ICAO units for the wind direction and speed used in METARs (kt, m/s, km/h). *(Refer to 050 02 01 01)*	x	x	x	x	x	x
LO	Define 'gusts', as given in METARs.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Distinguish wind given in METARs and wind given by the control tower for take-off and landing.	x	x	x	x	x	x
LO	Define 'visibility'.	x	x	x	x	x	x
LO	Describe the meteorological measurement of visibility.	x	x	x	x	x	x
LO	Define 'prevailing visibility'.	x	x	x	x	x	x
LO	Define 'ground visibility'.	x	x	x	x	x	x
LO	List the units used for visibility (m, km).	x	x	x	x	x	x
LO	Define 'runway visual range'.	x	x	x	x	x	x
LO	Describe the meteorological measurement of runway visual range.	x	x	x	x	x	x
LO	Indicate where the transmissometers/ forward-scatter meters are placed on the airport.	x	x	x	x	x	x
LO	List the units used for runway visual range (m).	x	x	x	x	x	x
LO	List the different possibilities to transmit information to pilots about runway visual range.	x	x	x	x	x	x
LO	Compare visibility and runway visual range.	x	x	x	x	x	x
LO	Indicate the means of observation of present weather.	x	x	x	x	x	x
LO	Indicate the means of observing clouds: type, amount, height of base (ceilometers) and top.	x	x	x	x	x	x
LO	List the clouds considered in meteorological reports, and how they are indicated in METARs (TCU, CB).	x	x	x	x	x	x
LO	Define 'oktas'.	x	x	x	x	x	x
LO	Define 'cloud base'.	x	x	x	x	x	x
LO	Define 'ceiling'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the unit and the reference level used for information about cloud base (ft).	x	x	x	x	x	x
LO	Define 'vertical visibility'.	x	x	x	x	x	x
LO	Explain briefly how and when vertical visibility is measured.	x	x	x	x	x	x
LO	Name the unit used for vertical visibility (ft).	x	x	x	x	x	x
LO	Indicate the means of observation of air temperature (thermometer).	x	x	x	x	x	x
LO	List the units used for air temperature (Celsius, Fahrenheit, Kelvin). *(Refer to 050 01 02 01)*	x	x	x	x	x	x
LO	Indicate the means of observation of relative humidity (hygrometer and psychrometer) and dew-point temperature (calculation).	x	x	x	x	x	x
LO	Name the units of relative humidity (%) and dew-point temperature (Celsius, Fahrenheit).	x	x	x	x	x	x
LO	Indicate the means of observation of atmospheric pressure (mercury and aneroid barometer).	x	x	x	x	x	x
LO	List the units of atmospheric pressure (hPa, inches). *(Refer to 050 01 03 01)*	x	x	x	x	x	x
050 10 01 02	**Radiosonde observations**						
LO	Describe the principle of radiosondes.	x	x	x	x	x	x
LO	Describe and interpret the sounding by radiosonde given on a simplified T-P diagram.	x	x	x	x	x	x
050 10 01 03	**Satellite observations**						
LO	Describe the basic outlines of satellite observations.	x	x	x	x	x	x
LO	Name the main uses of satellite pictures in aviation meteorology.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the different types of satellite imagery.	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights:						
	location of clouds (distinguish between stratiform and cumuliform clouds).	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights: location of fronts.	x	x	x	x	x	x
LO	Interpret qualitatively the satellite pictures in order to get useful information for the flights: location of jet streams.	x		x	x		
050 10 01 04	**Weather-radar observations** ***(Refer to 050 09 04 05)***						
LO	Describe the basic principle and the type of information given by a ground weather radar.	x	x	x	x	x	x
LO	Interpret ground weather radar images.	x	x	x	x	x	x
LO	Describe the basic principle and the type of information given by airborne weather radar.	x	x	x	x	x	x
LO	Describe the limits and the errors of airborne weather radar information.	x	x	x	x	x	x
LO	Interpret typical airborne weather radar images.	x	x	x	x	x	x
050 10 01 05	**Aircraft observations and reporting**						
LO	Describe routine air report and special air report.	x	x	x	x	x	x
LO	State the obligation of a pilot to prepare air reports.	x	x	x	x	x	x
LO	Name the weather phenomena to be stated in a special air report.	x	x	x	x	x	x
050 10 02 00	**Weather charts**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 10 02 01	**Significant weather charts**						
LO	Decode and interpret significant weather charts (low, medium and high level).	x	x	x	x	x	x
LO	Describe from a significant weather chart the flight conditions at designated locations and/or along a defined flight route at a given flight level.	x	x	x	x	x	x
050 10 02 02	**Surface charts**						
LO	Recognise the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high and low-pressure areas.	x	x	x	x	x	x
LO	Determine from surface weather charts the wind direction and speed.	x	x	x	x	x	x
050 10 02 03	**Upper-air charts**						
LO	Define ‘constant-pressure chart’.	x	x	x	x	x	x
LO	Define ‘isohypse (contour line)’. *(Refer to 050 01 03 02)*	x	x	x	x	x	x
LO	Define ‘isotherm’.	x	x	x	x	x	x
LO	Define ‘isotach’.	x	x	x	x	x	x
LO	Describe forecast upper-wind and temperature charts.	x	x	x	x	x	x
LO	For designated locations and/or routes determine from forecast upper-wind and temperature charts, if necessary by interpolation, the spot/average values for outside-air temperature, temperature deviation from ISA, wind direction and wind speed.	x	x	x	x	x	x
LO	Name the most common flight levels corresponding to the constant pressure charts.	x	x	x	x	x	x
050 10 03 00	**Information for flight planning**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
050 10 03 01	**Aviation weather messages**						
LO	Describe, decode and interpret the following aviation weather messages (given in written and/or graphical format): METAR, SPECI, TREND, TAF, SIGMET, AIRMET, GAMET, special air report, volcanic ash advisory information.	x	x	x	x	x	x
LO	Describe, decode and interpret the tropical cyclone advisory information in written and graphical form.	x		x	x		
LO	Describe the general meaning of MET REPORT and SPECIAL REPORT.	x	x	x	x	x	x
LO	List, in general, the cases when a SIGMET and an AIRMET are issued.	x	x	x	x	x	x
LO	Describe, decode (by using a code table) and interpret the following messages: Runway State Message (as written in a METAR), GAFOR. *Remark: For Runway State Message and GAFOR, refer to the Air Navigation Plan European Region Doc 7754.*	x	x	x	x	x	x
050 10 03 02	**Meteorological broadcasts for aviation**						
LO	Describe the meteorological content of broadcasts for aviation:						
	— VOLMET, ATIS;	x	x	x	x	x	x
	— HF-VOLMET.	x		x	x		
050 10 03 03	**Use of meteorological documents**						
LO	Describe meteorological briefing and advice.	x	x	x	x	x	x
LO	List the information that a flight crew can receive from meteorological services for pre-flight planning and apply the content of this information on a designated flight route.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the meteorological information that a flight crew can receive from flight information services during flight and apply the content of this information for the continuation of the flight.	x	x	x	x	x	x
050 10 03 04	**Meteorological warnings**						
LO	Describe and interpret aerodrome warnings and wind-shear warnings and alerts.	x	x	x	x	x	x
050 10 04 00	**Meteorological services**						
050 10 04 01	**World area forecast system and meteorological offices**						
LO	Name the main objectives of the world area forecast system: world area forecast centres (upper-air forecasts).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: meteorological offices (aerodrome forecasts, briefing documents).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: meteorological watch offices (SIGMET, AIRMET).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: aeronautical meteorological stations (METAR, MET reports).	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: volcanic ash advisory centres.	x	x	x	x	x	x
LO	Name the main objectives of the world area forecast system: tropical cyclone advisory centres.	x		x	x		
050 10 04 02	**International organisations**						
LO	Describe briefly the following organisations and their chief activities: International Civil Aviation Organization (ICAO) *(Refer to subject 010);* World Meteorological Organization (WMO).	x	x	x	x	x	x

J. SUBJECT 061 — GENERAL NAVIGATION

For the purposes of theoretical knowledge examinations, orthomorphic and conformal charts are taken as being the same type of chart.

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
060 00 00 00	**NAVIGATION**						
061 00 00 00	**GENERAL NAVIGATION**						
061 01 00 00	**BASICS OF NAVIGATION**						
061 01 01 00	**The solar system**						
061 01 01 01	**Earth's orbit, seasons and apparent movement of the sun**						
LO	State that the solar system consists of the Sun, a number of planets of which the Earth is one, and a large number of asteroids and comets.	x	x	x	x	x	
LO	State that Kepler's first law explains that the planets revolve in elliptical orbits with the Sun at one focus. Each planet has its orbital period.	x	x	x	x	x	
LO	State that Kepler's second law explains the variation in the speed of a planet in its orbit. Each planet revolves so that its radius vector sweeps out equal areas in equal intervals of time.	x	x	x	x	x	
LO	State that the highest speed of the Earth in its orbit is when the Earth is closest to the Sun (perihelion).	x	x	x	x	x	
LO	State that the lowest speed of the Earth in its orbit is when the Earth is furthest away from the Sun (aphelion).	x	x	x	x	x	
LO	Explain in which direction the Earth rotates on its axis.	x	x	x	x	x	
LO	Explain that the axis of rotation of the Earth is inclined to its orbital path around the Sun at an angle of about 66,5 degrees.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the term 'ecliptic' and 'plane of the ecliptic'. Ecliptic is the apparent path of the Sun around the Earth. The plane of the ecliptic is inclined to the plane of the equator at an angle of approximately 23,5 degrees. The inclination of the polar axis to the plane of the ecliptic is the reason for the seasons.	x	x	x	x	x	
LO	Explain that the Earth completes one orbit around the Sun in approximately 365,25 days.	x	x	x	x	x	
LO	Describe the effect of the inclination of the Earth's rotation axis to the plane of its orbit around the Sun, being the seasons and variation of sunrise and sunset with latitude and time of the year.	x	x	x	x	x	
LO	Define the terms 'apparent Sun' and 'mean Sun' and state their relationship.	x	x	x	x	x	
LO	Define the 'celestial equator'. It is the projection of the Earth's equator onto the celestial sphere.	x	x	x	x	x	
LO	Define the term 'declination'. Declination is the angular distance of a celestial body north or south of the celestial equator.	x	x	x	x	x	
LO	State that the mean Sun is conceived to move eastward along the celestial equator at a rate that provides a uniform measure of time equal to the average time reckoned from the true Sun.	x	x	x	x	x	
LO	Define the 'polar circles', the 'tropic of Cancer' and the 'tropic of Capricorn'.	x	x	x	x	x	
LO	Explain summer and winter solstice.	x	x	x	x	x	
LO	Explain the terms 'spring and autumn equinox'.	x	x	x	x	x	
LO	Explain at which time of the year the duration of daylight changes at the highest rate.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the relationship between the declination of the Sun, latitude and the period of daylight.	x	x	x	x	x	
LO	State that the perihelion occurs early January and aphelion occurs early July.	x	x	x	x	x	
LO	Illustrate the position of the Earth relative to the Sun with respect to the seasons and months of the year.	x	x	x	x	x	
LO	Define 'zenith'. The point on the sky vertically overhead an observer.	x	x	x	x	x	
061 01 02 00	**The Earth**						
061 01 02 01	**Great circle, small circle, rhumb line**						
LO	State that the Earth is not a true sphere. It is flattened slightly at the poles. The value for flattening is 1/298.	x	x	x	x	x	
LO	Given the Earth flattening and either the semimajor or semiminor axis in NM/km, calculate the distance of the other axis.	x	x	x	x	x	
LO	State that the Earth may be described as an 'ellipsoid' or 'oblate spheroid'.	x	x	x	x	x	
LO	Explain that the Equator has its plane perpendicular to the Earth's axis and divides the Earth into the northern and southern hemisphere.	x	x	x	x	x	
LO	Given that the distance of the circumference of the Earth is 40 000 km or approximately 21 600 NM, calculate the approximate Earth diameter or Earth radius.	x	x	x	x	x	
LO	Define a 'great circle' in relation to the surface of a sphere.	x	x	x	x	x	
LO	Describe the 'geometric properties' of a great circle, including vertex.	x	x	x	x	x	
LO	Define a 'small circle' in relation to the surface of a sphere.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define a 'rhumb line'. A line which cuts all meridians at the same angle.	x	x	x	x	x	
061 01 02 02	**Convergency, conversion angle**						
LO	Explain the term 'convergency of meridians' between two positions.	x	x	x	x	x	
LO	Explain how the value of convergency can be determined using calculation.	x	x	x	x	x	
LO	The formula to calculate convergency between two positions relatively close to each other is: convergency = difference of longitude × sin (mean latitude).	x	x	x	x	x	
LO	Calculate the value of convergency between two stated positions.	x	x	x	x	x	
LO	Explain that the difference between great-circle track and rhumb-line track at a specified position is called conversion angle.	x	x	x	x	x	
LO	State that over short distances and out-of-polar regions the average great-circle true track is approximately equal to the rhumb-line true track between two positions.	x	x	x	x	x	
LO	Explain how the value of conversion angle can be calculated as half the value of convergency.	x	x	x	x	x	
LO	Calculate the great-circle track and rhumb-line track angle at specified position involving calculations of convergency and conversion angle.	x	x	x	x	x	
061 01 02 03	**Latitude, difference of latitude**						
LO	Define 'geographic latitude' as the angle between the plane of the equator and the local plumb line on the ellipsoid.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'geocentric latitude' as the angle between the plane of the equator and a line from the position to the centre of the Earth.	x	x	x	x	x	
LO	State that the maximum difference between geographic and geocentric latitude occurs at altitude of 45 degrees.	x	x	x	x	x	
LO	Describe a parallel of latitude as a small circle connecting all positions on the Earth with the same latitude.	x	x	x	x	x	
LO	Calculate the difference of latitude between two given positions lat/long.	x	x	x	x	x	
LO	State that the 1-degree difference of latitude equals 60 nautical miles.	x	x	x	x	x	
LO	Convert the difference of latitude to distance.	x	x	x	x	x	
LO	Calculate the mean latitude between two positions.	x	x	x	x	x	
061 01 02 04	**Longitude, difference of longitude**						
LO	Describe a meridian as a semigreat circle, which runs north and south from pole to pole.	x	x	x	x	x	
LO	Explain that the meridians and their anti-meridian complete a great circle.	x	x	x	x	x	
LO	State that the Greenwich meridian is also known as the prime meridian.	x	x	x	x	x	
LO	Define 'longitude' as the angle measured at the polar axis between the plane of the prime meridian and the local meridian.	x	x	x	x	x	
LO	Explain that the Greenwich anti-meridian is the maximum longitude possible, namely 180° east–west.	x	x	x	x	x	
LO	Calculate the difference of longitude between two given positions lat/long.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name examples of great circles on the surface of the Earth.	x	x	x	x	x	
LO	Name examples of small circles on the surface of the Earth.	x	x	x	x	x	
LO	Define a 'rhumb line'. A line intersecting all meridians at the same angle.	x	x	x	x	x	
LO	Explain the geometrical properties of a rhumb line. Parallels and meridians are special cases of rhumb lines.	x	x	x	x	x	
061 01 02 05	**Use of latitude and longitude coordinates to locate any specific position**						
LO	Explain that along the equator a difference of longitude of 1° equals a distance of 60 NM.	x	x	x	x	x	
LO	Explain that because the meridians converge towards the poles, the distance between meridians will decrease with increase in latitude.	x	x	x	x	x	
LO	State that the Earth's distance along a parallel of latitude is also known as departure.	x	x	x	x	x	
LO	Calculate the Earth's distance between two meridians along a parallel of latitude (departure) using the following formula: distance = difference of longitude × 60 × cosine latitude.	x	x	x	x	x	
LO	Given a position lat/long, distances travelled north–south in NM/km and distances travelled east–west in NM/km along a parallel of latitude. Calculate the new position.	x	x	x	x	x	
LO	Given two positions on same meridian (or one on the anti-meridian), calculate the distance.	x	x	x	x	x	
061 01 03 00	**Time and time conversions**						
061 01 03 01	**Apparent time**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the principles of zone time.	x	x	x	x	x	
LO	Explain that, because the Earth rotates on its axis from west to east, the celestial bodies appear to revolve around the Earth from east to west.	x	x	x	x	x	
LO	Define and explain the term 'transit'. Explain that transit means that a celestial body crosses the observer's meridian.	x	x	x	x	x	
LO	Explain that the time period of a 'day' is the elapsed time between two successive transits of a heavenly body.	x	x	x	x	x	
LO	Explain that the term 'sidereal day' is the time measured with reference to a fixed point on the celestial sphere.	x	x	x	x	x	
LO	State that if the day is measured by the apparent passage of the Sun, the length of a day will vary.	x	x	x	x	x	
LO	Explain the reason for the variation in the length of an apparent day, being a combination of the variation in the Earth's orbital speed around the Sun and the inclination of the Earth's rotation axis to the plane of the ecliptic.	x	x	x	x	x	
LO	Illustrate that, since both the direction of rotation of the Earth around its axis and its orbital rotation around the Sun are the same, the Earth must rotate through more than 360° to produce successive transits.	x	x	x	x	x	
LO	State that the period between two successive transits of the Sun is called an apparent solar day, and that the time based on this is called apparent time.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that in order to have a constant measurement of time, which will still have the solar day as a basis, the average length of an apparent solar day is taken. This average day is called mean solar day. It is divided into 24 hours of mean time.	x	x	x	x	x	
LO	State that the mean Sun is a fictitious Sun orbiting along the plane of the equator at a constant angular velocity that provides a uniform measure of time.	x	x	x	x	x	
LO	State that the time between two successive transits of the mean Sun over a meridian is constant.	x	x	x	x	x	
LO	Explain that the difference between apparent time and mean time is defined as the 'equation of time'.	x	x	x	x	x	
LO	State that the time of orbital revolution of the Earth in 1 year around the Sun is approximately 365 ¼ calendar days.	x	x	x	x	x	
LO	State that the calendar year is 365 days and every 4th year a leap year with 366 days and 3 leap years are suppressed every 4 centuries.	x	x	x	x	x	
LO	State that time can also be measured in arc since, in one day of mean solar time, the mean Sun is imagined to travel in a complete circle round the Earth, a motion of 360° in 24 hours.	x	x	x	x	x	
LO	Illustrate the relationship between time and arc along the equator.	x	x	x	x	x	
LO	Deduce conversion values for arc to time and visa versa.	x	x	x	x	x	
061 01 03 02	**Universal Time Coordinated (UTC)**						
LO	State that the Greenwich meridian is selected as standard meridian, and that LMT at the Greenwich meridian is equal to Greenwich mean time (GMT).	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that UTC is based on atomic time and GMT on the Earth's rotation, but in practice they are considered as the same.	x	x	x	x	x	
LO	State that the conversion factor between LMT and UTC is arc (change of longitude) converted to time.	x	x	x	x	x	
LO	Convert arc to time.	x	x	x	x	x	
LO	Convert time to arc.	x	x	x	x	x	
LO	Convert between UTC and LMT.	x	x	x	x	x	
061 01 03 03	**Local Mean Time (LMT)**						
LO	State that the beginning of the local mean day at any location is when the mean Sun is in transit with the anti-meridian. This is known as midnight or 0000 hours LMT.	x	x	x	x	x	
LO	State that when the mean Sun is in transit with the location's meridian, it is noon or 1200 hours LMT.	x	x	x	x	x	
LO	State that the LMT at locations at different longitudes varies by an amount corresponding to the change in longitude.						
061 01 03 04	**Standard times (STs)**						
LO	State that standard time is the time used by a particular country (or part of a country) determined by the government of that particular country.	x	x	x	x	x	
LO	State that some countries use summer time (daylight saving time).	x	x	x	x	x	
LO	State that conversion from UTC to standard time and visa versa is usually done using extracts from the air almanac published in appropriate documents.	x	x	x	x	x	
LO	Given appropriate documents, convert from UTC to ST of a specific country and from ST of a specific country to UTC.	x	x	x	x	x	
061 01 03 05	**Dateline**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect on the LMT when approaching the 180° meridian line from either side.	x	x	x	x	x	
LO	State that the dateline does not follow exactly the 180° east–west meridian.	x	x	x	x	x	
LO	Explain that when crossing the anti-meridian of Greenwich, one day is lost or gained depending on the direction of travel.	x	x	x	x	x	
LO	State that the dateline is the actual place where the change is made and, although mainly at the 180° meridian, there are some slight divergences in order to avoid countries being divided by the dateline.	x	x	x	x	x	
LO	State that when calculating times, the dateline is automatically taken into account by doing all conversions via UTC.	x	x	x	x	x	
LO	Calculate conversions of LMT and GMT/UTC and ST for cases involving the international dateline.	x	x	x	x	x	
061 01 03 06	**Determination of sunrise (SR), sunset (SS) and civil twilight**						
LO	State that SR or SS is when the Sun's upper edge is at the observer's horizon. State how atmospheric refraction affects this apparent sighting.	x	x	x	x	x	
LO	Explain that SR and SS occur at different times on the same meridian depending on the latitude for a given day.	x	x	x	x	x	
LO	Explain that SR will occur earlier and SS will occur later with increase in altitude.	x	x	x	x	x	
LO	State that the times for SR and SS given in the air almanac are calculated for the Greenwich meridian.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain that at the spring and autumn equinox, SR and SS occur approximately at the same time at all latitudes.	x	x	x	x	x	
LO	State that, except in high latitudes, the times of SR and SS at any place change only a little each day. So, for all places of the same latitude, SR or SS will occur at approximately the same LMT.	x	x	x	x	x	
LO	State that the reason for the variation of the duration of daylight and night throughout the year is the inclination of the Earth's rotation axis to the ecliptic.	x	x	x	x	x	
LO	State that SR and SS times are tabulated against specified dates and latitudes.	x	x	x	x	x	
LO	State that at equator SR is always close to 0600 LMT and SS close to 1800 LMT (within 15 minutes).	x	x	x	x	x	
LO	Calculate examples of SR and SS at mean sea level in LMT, ST or UTC, given SR and SS tables, latitudes and longitude of the place in question and the date.	x	x	x	x	x	
LO	Given SR or SS time in UTC or ST for a given position, calculate SR or SS for another position on the same latitude in UTC or ST.	x	x	x	x	x	
LO	Explain the meaning of the term 'twilight'.	x	x	x	x	x	
LO	Define the 'duration of evening civil twilight'. The time from sunset to the time when the centre of the Sun is 6° below the horizon.	x	x	x	x	x	
LO	Define the 'duration of morning civil twilight'. The time from the point when the centre of the Sun is 6° below the horizon to the time of sunrise.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the beginning of morning civil twilight and the end of evening civil twilight has been tabulated in UTC, valid for the prime meridian, with latitude and date as the entering argument. It may be taken to be LMT for any other meridian.	x	x	x	x	x	
LO	Calculate examples of twilight in UTC and ST given a twilight table, latitude and longitude of the place in question and the date.	x	x	x	x	x	
LO	Determine the duration of morning and evening civil twilight.	x	x	x	x	x	
LO	Explain the effect of declination and latitude on the duration of twilight.	x	x	x	x	x	
061 01 04 00	**Directions**						
061 01 04 01	**True north**						
LO	State that all meridians run in north–south direction, and that the true-north direction is along any meridian towards the geographic north pole.	x	x	x	x	x	
LO	State that true directions are measured clockwise as an angle in degrees from true north (TN).	x	x	x	x	x	
061 01 04 02	**Terrestrial magnetism: magnetic north, inclination and variation**						
LO	State that a freely suspended compass needle will turn to the direction of the local magnetic field. The direction of the horizontal component of this field is the direction of magnetic north (MN).	x	x	x	x	x	
LO	State that the magnetic poles do not coincide with the geographic poles.	x	x	x	x	x	
LO	State that the magnetic variation varies as a function of time due to the movement of the northern magnetic pole.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'magnetic dip or inclination'. The angle between the horizontal and the total component of the magnetic field.	x	x	x	x	x	
LO	State that the angle of inclination at the magnetic poles is 90°.	x	x	x	x	x	
LO	Explain that the accuracy of the compass depends on the strength of the horizontal component of the Earth's magnetic field.	x	x	x	x	x	
LO	State that, in the polar areas, the horizontal component of the Earth's magnetic field is too weak to permit the use of a magnetic compass.	x	x	x	x	x	
061 01 04 03	**Compass deviation, compass north**						
LO	State that, in a direct-reading compass, the magnetic element will align along a magnetic field. This direction is called compass north (CN) and is the direction 000° on the compass rose. The field is the resultant of the Earth's magnetic field and the magnetic field of the aircraft.	x	x	x	x	x	
LO	State that the effect of the aircraft magnetism on the compass changes with different headings, as well as with different latitudes.	x	x	x	x	x	
LO	State that the angle between magnetic north and compass north is called deviation (DEV) and is given in degrees east (+ or E) or west (– or W) of the magnetic north.	x	x	x	x	x	
LO	State that deviation is kept to a minimum by compass swinging.	x	x	x	x	x	
061 01 04 04	**Isogonals, relationship between true and magnetic north**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the angle between the true north and magnetic north is called variation (VAR) being measured in degrees east (+ or E) or west (– or W) of the true north.	x	x	x	x	x	
LO	Define an 'isogonal line'. A line joining positions of equal variation.	x	x	x	x	x	
LO	Convert between compass, magnetic and true directions.	x	x	x	x	x	
061 01 04 05	**Gridlines, isogrives**						
LO	Explain the purpose of a grid north (GN) based on a suitable meridian on a polar stereographic chart (reference or datum meridian).	x		x	x		
LO	Explain that the gridlines or the grid meridians are drawn on the chart parallel to the reference meridian.	x		x	x		
LO	State that the angle between the grid north (GN) and true north (TN) is called grid convergence being measured in degrees east (+ or E) if GN is west of TN or west (– or W) if GN is east of TN.	x		x	x		
LO	State that the angle between the grid north (GN) and magnetic north (MN) is called grivation (griv) being measured in degrees east (+ or E) or west (– or W) of the grid north.	x		x	x		
LO	State that a line joining points, which have the same grivation, is called an isogriv.	x		x	x		
LO	Convert between compass, magnetic, true and grid directions.	x		x	x		
061 01 05 00	**Distance**						
061 01 05 01	**Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres, feet**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the 'nautical mile'. A distance being equal to 1 852 km.	x	x	x	x	x	
LO	In map/charts, distance between two positions is measured along a meridian at mean latitude, where 1 minute of latitude presents 1 NM.	x	x	x	x	x	
LO	State that when dealing with heights and altitudes the unit used is metres or feet subject to the choice of individual States.	x	x	x	x	x	
061 01 05 02	**Conversion from one unit to another**						
LO	Convert between the following units: nautical miles (NM), statute miles (SM), kilometres (km), metres (m) and feet (ft).	x	x	x	x	x	
061 01 05 03	**Relationship between nautical miles and minutes of latitude and minutes of longitude**						
LO	State that horizontal distances are calculated in metres, kilometres and nautical miles.	x	x	x	x	x	
LO	Given two positions or latitude/longitude difference, calculate the distance.	x	x	x	x	x	
LO	Given two positions on the same latitude and distance between the two positions in km or NM, calculate the difference of longitude between the two positions.	x	x	x	x	x	
LO	Flying a rhumb-line true track of 090, 180, 270 and 360 degrees given an initial geographical position, flight time and ground speed, calculate the new geographic position.	x	x	x	x	x	
061 02 00 00	**MAGNETISM AND COMPASSES**						
061 02 01 00	**Knowledge of the principles of the direct-reading (standby) compass**						
061 02 01 01	**The use of this compass**						
LO	Direct-reading compass (DRC).	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret the indications on a DRC, given an indication on the compass, deviation or deviation table and variation.	x	x	x	x	x	
061 02 01 02	**Serviceability tests**						
LO	State the pre-flight serviceability check of the DRC, such as: — general condition; — check indication is within the limits.	x	x	x	x	x	
LO	State that the serviceability test consists of comparing the DRC indication to another reference (e.g. other compass system or runway direction).	x	x	x	x	x	
LO	State that the compass should be checked when carrying magnetic freight or freight with a large ferrous metal content.	x	x	x	x	x	
061 02 01 03	**Situations requiring a compass swing**						
LO	State the occurrences when a compass swing may be required: if transferred to another base involving a large change in latitude; major changes in aircraft equipment; aircraft hit by lightning; aircraft parked in the same direction for a long period of time; when a new compass is fitted; at any time when the compass or recorded deviation is suspect; when specified in the aircraft maintenance schedule.	x	x	x	x	x	
061 03 00 00	**CHARTS**						
061 03 01 00	**General properties of miscellaneous types of projections**						
LO	Define the term 'conformal'. At any given point on the chart, distortions (as a result of the projection) in east–west direction must be the same as in north–south direction. The meridians and parallels must cut each other at right angles.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that on a conformal chart the angles measured on the chart are the same as on the Earth.	x	x	x	x	x	
LO	State that different chart projections are used, depending on the application and area of use involved.	x	x	x	x	x	
LO	State that all charts, although they have been developed mathematically, are designated as projections.	x	x	x	x	x	
LO	State that the following projection surfaces are used when projecting charts: plane, cylindrical, conical.	x	x	x	x	x	
LO	Define the 'scale' of a chart. The ratio of the chart length compared to the Earth's distance that it represents.	x	x	x	x	x	
LO	Use the scale of a chart to calculate particular distances.	x	x	x	x	x	
LO	Calculate scale given chart length and Earth distance.	x	x	x	x	x	
LO	Define the term 'chart convergency'. The angle between two given meridians on the chart.	x	x	x	x	x	
LO	Define 'parallel of origin'. The parallel where the projection surface touches the surface of the reduced Earth.	x	x	x	x	x	
061 03 01 01	**Direct Mercator**						
LO	State that the direct Mercator is a cylindrical projection. The parallel of origin is the equator.	x	x	x	x	x	
LO	State that the convergency on the chart is 0°.	x	x	x	x	x	
LO	State that the scale increases with increasing distance from the equator.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that on a direct Mercator: scale at any latitude = scale at the equator × secant latitude (1/cosine latitude).	x	x	x	x	x	
LO	Given the scale at one latitude, calculate the scale at different latitudes.	x	x	x	x	x	
LO	Given a chart length at one atitude, show that it represents a different Earth distance at other latitudes.	x	x	x	x	x	
061 03 01 02	**Lambert conformal conic**						
LO	State that the Lambert conformal chart is based on a conical projection. Only Lambert conformal charts mathematically produced with two standard parallels will be considered.	x	x	x	x	x	
LO	Define the term 'standard parallel'. The latitudes where the cone cuts the reduced Earth.	x	x	x	x	x	
LO	State that at the parallel of origin, Earth convergency is equal to chart convergency.	x	x	x	x	x	
LO	State that the parallel of origin is close to the mean latitude between the standard parallels.	x	x	x	x	x	
LO	Explain the scale variation throughout the charts as follows: the scale indicated on the chart will be correct at the standard parallels; the scale will increase away from the parallel of origin; the scale within the standard parallels differs by less than 1 % from the scale stated on the chart.	x	x	x	x	x	
LO	Define the term 'constant of cone/convergency factor'. The ratio between the top angle of the unfolded cone and 360°, or sine of the parallel of origin.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Chart convergency = difference of longitude × constant of cone.	x	x	x	x	x	
LO	Given appropriate data, calculate initial, final or rhumb-line tracks between two positions (lat/long).	x	x	x	x	x	
LO	Given two positions (lat/long) and information to determine convergency between the two positions, calculate the parallel of origin.	x	x	x	x	x	
LO	Given a Lambert chart, determine the parallel of origin, or constant of cone.	x	x	x	x	x	
LO	Given constant of cone or parallel of origin, great-circle track at one position and great-circle track at another position, calculate the difference of longitude between the two positions.	x	x	x	x	x	
061 03 01 03	**Polar stereographic**						
LO	State that the polar stereographic projection is based on a plane projection, and state that the parallel of the origin is the pole.	x		x	x		
LO	State that chart convergency = difference of longitude.	x		x	x		
LO	State that the scale is increasing with increasing distance from the pole.	x		x	x		
LO	Given two positions (lat/long), rhumb-line true track or initial/final great-circle true track, calculate the missing track angles.	x		x	x		
LO	Calculate the chart scale at a specific latitude when difference of longitude and chart distance along the parallel of longitude are given.	x		x	x		
061 03 02 00	**The representation of meridians, parallels, great circles and rhumb lines**						
061 03 02 01	**Direct Mercator**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that meridians are straight parallel lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are straight lines parallel to the equator.	x	x	x	x	x	
LO	State that a straight line on the chart is a rhumb line.	x	x	x	x	x	
LO	State that the great circle is a line convex to the nearest pole.	x	x	x	x	x	
LO	For great-circle track angle calculations over short distances, the conversion angle may be calculated by the formula: conversion angle = ½ × difference of longitude × sin mean latitude.	x	x	x	x	x	
LO	Given rhumb-line true track between two positions (lat/long), calculate initial or final great-circle true track.	x	x	x	x	x	
061 03 02 02	**Lambert conformal conic**						
LO	State that meridians are straight lines, which cut parallels of latitudes at right angles.	x	x	x	x	x	
LO	State that parallels of latitude are arcs of concentric circles.	x	x	x	x	x	
LO	State that great circles are curved lines concave towards the parallels of origin.	x	x	x	x	x	
LO	State that for short distances the great circle is approximately a straight line.	x	x	x	x	x	
061 03 02 03	**Polar stereographic**						
LO	State that meridians are straight lines radiating from the pole, which cut parallels of latitudes at right angles.	x		x	x		
LO	State that parallels of latitude are concentric circles, and in this projection the distance apart increases away from the pole.	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that great circles are approximately straight lines close to the pole. The exact great circle being concave to the pole.	x		x	x		
061 03 03 00	**The use of current aeronautical charts**						
061 03 03 01	**Plotting positions**						
LO	Enter the position on a chart using range and bearing from a VOR DME station, and derive geographical coordinates.	x	x	x	x	x	
LO	Enter the positions on a chart using geographical coordinates and derive tracks and distances.	x	x	x	x	x	
LO	Plot DME ranges on an aeronautical chart and derive geographical coordinates.	x	x	x	x	x	
LO	Describe the methods used to provide information on chart scale. Use the chart scales stated and beware of the limitations of the stated scale for each projection.	x	x	x	x	x	
061 03 03 02	**Methods of indicating scale and relief**						
LO	Describe the methods of representing relief and demonstrate the ability to interpret data.	x	x	x	x	x	
061 03 03 03	**Conventional signs**						
LO	Interpret conventional signs and symbols on ICAO and other most frequently used charts.	x	x	x	x	x	
061 03 03 04	**Measuring tracks and distances**						
LO	Given two positions, measure the track and the distance between them.	x	x	x	x	x	
061 03 03 05	**Plotting bearings**						
LO	Resolve bearings of an NDB station for plotting on an aeronautical chart.	x	x	x	x	x	
LO	Resolve radials from VOR stations for plotting on an aeronautical chart.	x	x	x	x	x	
061 04 00 00	**DEAD RECKONING (DR) NAVIGATION**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
061 04 01 00	**Basis of dead reckoning**						
LO	Explain the triangle of velocities, e.g. true heading/TAS, W/V, and true track/GS.	x	x	x	x	x	
061 04 01 01	**Track**						
LO	Explain the concept of vectors including adding together or splitting in two directions.	x	x	x	x	x	
061 04 01 02	**Heading (compass, magnetic, true, grid)**						
LO	Calculate (compass, magnetic, true, grid) heading from given appropriate data.	x	x	x	x	x	
061 04 01 03	**Wind velocity**						
LO	Calculate wind velocity from given appropriate data.	x	x	x	x	x	
061 04 01 04	**Airspeed (IAS, CAS, TAS, Mach number)**						
LO	Calculate TAS from IAS/CAS and Mach number from given appropriate data.	x	x	x	x	x	
061 04 01 05	**Ground speed**						
LO	Calculate ground speed from given appropriate data.	x	x	x	x	x	
061 04 01 06	**ETA**						
LO	Calculate ETA, flying time from distance, and GS.	x	x	x	x	x	
LO	Calculate revised directional data for heading, track, course and W/V, e.g. true, magnetic, compass and grid from given appropriate data.	x	x	x	x	x	
061 04 01 07	**Drift, wind correction angle**						
LO	Calculate drift and wind correction angle from given appropriate data.	x	x	x	x	x	
061 04 02 00	**Use of the navigational computer**						
061 04 02 01	**Speed**						
LO	Given appropriate data, determine speed.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
061 04 02 02	**Time**						
LO	Given appropriate data, determine time.	x	x	x	x	x	
061 04 02 03	**Distance**						
LO	Given appropriate data, determine distance.	x	x	x	x	x	
061 04 02 04	**Fuel consumption**						
LO	Calculation of fuel used/fuel flow/flying time.	x	x	x	x	x	
061 04 02 05	**Conversions**						
LO	Conversion between kilograms/pounds/ litres/U.S. gallons/imperial gallons.	x	x	x	x	x	
LO	Conversion of distances. Kilometres/nautical miles/statute miles.	x	x	x	x	x	
LO	Conversion of distances. Feet/metres.	x	x	x	x	x	
LO	Conversion of volumes and weight of fuel using density in mass per unit volume.	x	x	x	x	x	
061 04 02 06	**Airspeed**						
LO	Calculation of airspeed problems including IAS/EAS/CAS/TAS/ and Mach number from given appropriate data.	x	x	x	x	x	
061 04 02 07	**Wind velocity**						
LO	Given appropriate data, determine wind velocity.	x	x	x	x	x	
061 04 02 08	**True altitude**						
LO	Given appropriate data, determine true altitude/indicated altitude/density altitude.	x	x	x	x	x	
061 04 03 00	**The triangle of velocities**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Solve problems to determine: heading; ground speed; wind direction and speed; track/course; drift angle/wind correction angle; head/tail/crosswind components.	x	x	x	x	x	
061 04 04 00	**Determination of DR position**						
061 04 04 01	**Confirmation of flight progress (DR)**						
LO	Describe the role and purpose of DR navigation.	x	x	x	x	x	
LO	Demonstrate mental DR techniques.	x	x	x	x	x	
LO	Define 'speed factor'. Speed divided by 60, used for mental flight-path calculations.	x	x	x	x	x	
LO	Calculate head/tailwind component.	x	x	x	x	x	
LO	Calculate wind correction angle (WCA) using the formula: WCA = XWC (crosswind component)/SF (speed factor)	x	x	x	x	x	
LO	Distance, speed and time calculations.	x	x	x	x	x	
LO	Demonstrate DR position graphically and by means of a DR computer.	x	x	x	x	x	
LO	Given any four of the parts of the triangle of velocities, calculate the other two.	x	x	x	x	x	
LO	Apply the validity of wind triangle symbols correctly. Heading vector one arrow, track/course vector two arrows, and W/V vector three arrows.	x	x	x	x	x	
061 04 04 02	**Lost procedures**						
LO	Describe course of action when lost.	x	x	x	x	x	
061 04 05 00	**Measurement of DR elements**						
061 04 05 01	**Calculation of altitude, adjustments, corrections, errors**						
	Remark: For questions involving height calculation, 30 ft/hpa is to be used unless another figure is specified in the question.						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate True Altitude (T ALT) from given indicated altitude, airfield elevation, Static-Air Temperature (SAT)/Outside-Air Temperature (OAT) and QNH/QFE.	x	x	x	x	x	
LO	Calculate indicated altitude from given T ALT, airfield elevation, SAT/OAT and QNH/QFE.	x	x	x	x	x	
LO	Calculate density altitude from given pressure altitude and SAT/OAT.	x	x	x	x	x	
LO	Calculate density altitude from given airfield elevation, SAT/OAT and QNH/QFE.	x	x	x	x	x	
061 04 05 02	**Determination of temperature**						
LO	Define 'OAT/SAT'. The temperature of the surrounding air.	x	x	x	x	x	
LO	Define 'Ram-Air Temperature (RAT)/ Total-Air Temperature (TAT)/ Indicated Outside-Air Temperature (IOAT)'. The temperature measured by the temperature probe affected by friction and compressibility.	x	x	x	x	x	
LO	Define 'ram rise'. The increase of temperature at the temperature probe due to friction and compressibility.	x	x	x	x	x	
LO	RAT (TAT, IOAT) = OAT (SAT) + ram rise.	x	x	x	x	x	
LO	Explain the difference in using OAT/SAT compared to RAT/TAT/IOAT in airspeed calculations.	x	x	x	x	x	
061 04 05 03	**Determination of appropriate speed**						
LO	Explain the relationship between: IAS, CAS, EAS, and TAS.	x	x	x	x	x	
LO	Calculate TAS from given IAS/CAS, OAT/SAT and pressure inputs.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate CAS from given TAS, OAT/SAT and pressure inputs.	x	x	x	x	x	
061 04 05 04	**Determination of Mach number**						
LO	Calculate Mach number from given TAS and OAT/SAT.	x	x	x	x	x	
061 05 00 00	**IN-FLIGHT NAVIGATION**						
061 05 01 00	**Use of visual observations and application to in-flight navigation**						
LO	Describe what is meant by the term 'map reading'.	x	x	x	x	x	
LO	Define the term 'visual checkpoint'.	x	x	x	x	x	
LO	Discuss the general features of a visual checkpoint and give examples.	x	x	x	x	x	
LO	State that the evaluation of the differences between DR positions and actual position can refine flight performance and navigation.	x	x	x	x	x	
LO	Establish fixes on navigational charts by plotting visually derived intersecting lines of position.	x	x	x	x	x	
LO	Describe the use of a single observed position line to check flight progress.	x	x	x	x	x	
LO	Describe how to prepare and align a map/chart for use in visual navigation.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe visual-navigation techniques including: use of DR position to locate identifiable landmarks; identification of charted features/ landmarks; factors affecting the selection of landmarks; an understanding of seasonal and meteorological effects on the appearance and visibility of landmarks; selection of suitable landmarks; estimation of distance from landmarks from successive bearings; estimation of the distance from a landmark using an approximation of the sighting angle and the flight altitude.	x	x	x	x	x	
LO	Describe the action to be taken if there is no visual checkpoint available at a scheduled turning point.	x	x	x	x	x	
LO	Understanding the difficulties and limitations that may be encountered in map reading in some geographical areas due to the nature of terrain, lack of distinctive landmarks or lack of detailed and accurate charted data.	x	x	x	x	x	
LO	State the function of contour lines on a topographical chart.	x	x	x	x	x	
LO	Indicate the role of 'layer tinting' (colour gradient) in relation to the depiction of topography on a chart.	x	x	x	x	x	
LO	Using the contours shown on a chart, describe the appearance of a significant feature.	x	x	x	x	x	
LO	Understand that in areas of snow and ice from horizon to horizon and where the sky is covered with a uniform layer of clouds so that no shadows are cast, the horizon disappears, causing earth and sky to blend.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
061 05 02 00	**Navigation in climb and descent**						
061 05 02 01	**Average airspeed**						
LO	Average TAS used for climb problems is calculated at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	Average TAS used for descent problems is calculated at the altitude 1/2 of the descent altitude.	x	x	x	x	x	
061 05 02 02	**Average wind velocity (WV)**						
LO	WV used for climb problems is the WV at the altitude 2/3 of the cruising altitude.	x	x	x	x	x	
LO	WV used for descent problems is the WV at the altitude 1/2 of the descent altitude.	x	x	x	x	x	
LO	Calculate the average climb/descent GS from given TAS at various altitudes, WV at various altitudes and true track.	x	x	x	x	x	
LO	Calculate the flying time and distance during climb/descent from given average rate of climb/descent and using average GS.	x	x	x	x	x	
LO	Calculate the rate of descent on a given glide-path angle using the following formulae: valid for 3°-glide path: rate of descent = (GS (ground speed) × 10) / 2 rate of descent = SF (speed factor) × glide-path angle × 100	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate the rate of climb/descent in order to reach a certain position at a given altitude.	x	x	x	x	x	
LO	Given speed, rate of climb/descent and altitude, calculate the distance required in order to reach a position at a given altitude.	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Given speed, distance to go and altitude to climb/descent, calculate the rate of climb/descent.	x	x	x	x	x	
LO	State the effect on TAS and Mach number when climbing/descending with a constant CAS.						
061 05 02 03	**Ground speed/distance covered during climb or descent**						
LO	State that most Aircraft Operating Handbooks supply graphical material to calculate climb and descent problems.	x	x	x	x	x	
LO	Given distance, speed and present altitude, calculate the rate of climb/ descent in order to reach a certain position at a given altitude.	x	x	x	x	x	
LO	Given speed, rate of climb/descent and altitude, calculate the distance required in order to reach a certain position at a given altitude.	x	x	x	x	x	
061 05 02 04	**Gradients versus rate of climb/descent**						
LO	Calculate climb/descent gradient (ft/NM, % and degrees), GS or vertical speed according to the following formulae: Vertical speed (feet/min) = (ground speed (kt) × gradient (feet/NM)) / 60	x	x	x	x	x	
LO	Gradient in % = altitude difference (feet) × 100 / ground difference (feet).	x	x	x	x	x	
LO	Gradient in degrees = Arctg (Altitude difference (feet) / ground distance (feet)).	x	x	x	x	x	
LO	Rate of climb/descent (feet/min) = gradient (%) × GS (kt).	x	x	x	x	x	
LO	State that it is necessary to determine the position of the aircraft accurately before commencing descent in order to ensure safe ground clearance.	x	x	x	x	x	
061 05 03 00	**Navigation in cruising flight, use of fixes to revise navigation data**						
061 05 03 01	**Ground-speed revision**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate revised ground speed to reach a waypoint at a specific time.	x	x	x	x	x	
LO	Calculate the average ground speed based on two observed fixes.	x	x	x	x	x	
LO	Calculate the distance to the position passing abeam an NDB station by timing from the position with a relative bearing of 045/315 to the position abeam (relative bearing 090/270).	x	x	x	x	x	
061 05 03 02	**Off-track corrections**						
LO	Calculate the track-error angle at a given course from A to B and an off- course fix, using the one-in-sixty rule.	x	x	x	x	x	
LO	Calculate the heading change at an off-course fix to directly reach the next waypoint using the one-in-sixty rule.	x	x	x	x	x	
LO	Calculate the average drift angle based upon an off-course fix observation.	x	x	x	x	x	
061 05 03 03	**Calculation of wind speed and direction**						
LO	Calculate the average wind speed and direction based on two observed fixes.	x	x	x	x	x	
061 05 03 04	**Estimated Time of Arrival (ETA) revisions**						
LO	Calculate ETA revisions based upon observed fixes and revised ground speed.	x	x	x	x	x	
061 05 04 00	**Flight log**						
LO	Given relevant flight-plan data, calculate the missing data.	x	x	x	x	x	
LO	Enter the revised navigational en route data, for the legs concerned, into the flight log (e.g. updated wind and ground speed, and correspondingly losses or gains in time and fuel consumption).	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Enter, in the progress of flight, at checkpoint or turning point, the 'actual time over' and the 'estimated time over' for the next checkpoint into the flight log.	x	x	x	x	x	

K. SUBJECT 062 — RADIO NAVIGATION

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
060 00 00 00	**NAVIGATION**						
062 00 00 00	**RADIO NAVIGATION**						
062 01 00 00	**BASIC RADIO PROPAGATION THEORY**						
062 01 01 00	**Basic principles**						
062 01 01 01	**Electromagnetic waves**						
LO	State that radio waves travel at the speed of light, being approximately 300 000 km/s or 162 000 NM/s.	x	x	x	x	x	x
LO	Define a ‘cycle’. A complete series of values of a periodical process.	x	x	x	x	x	x
LO	Define ‘Hertz (Hz)’. 1 Hertz is 1 cycle per second.	x	x	x	x	x	x
062 01 01 02	**Frequency, wavelength, amplitude, phase angle**						
LO	Define ‘frequency’. The number of cycles occurring in 1 second in a radio wave expressed in Hertz (Hz).	x	x	x	x	x	x
LO	Define ‘wavelength’. The physical distance travelled by a radio wave during one cycle of transmission.	x	x	x	x	x	x
LO	Define ‘amplitude’. The maximum deflection in an oscillation or wave.	x	x	x	x	x	x
LO	State that the relationship between wavelength and frequency is: wavelength (λ) = speed of light (c) / frequency (f); or λ (meters) = 300 000 / kHz.	x	x	x	x	x	x
LO	Define ‘phase’. The fraction of one wavelength expressed in degrees from 000° to 360°.	x	x	x	x	x	x
LO	Define ‘phase difference/shift’. The angular difference between the corresponding points of two cycles of equal wavelength, which is measurable in degrees.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
062 01 01 03	**Frequency bands, sidebands, single sideband**						
LO	List the bands of the frequency spectrum for electromagnetic waves: Very Low Frequency (VLF): 3–30 kHz; Low Frequency (LF): 30–300 kHz; Medium Frequency (MF): 300–3 000 kHz; High Frequency (HF): 3–30 MHz; Very High Frequency (VHF): 30–300 MHz; Ultra High Frequency (UHF): 300–3 000 MHz; Super High Frequency (SHF): 3–30 GHz; Extremely High Frequency (EHF): 30–300 GHz.	x	x	x	x	x	x
LO	State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands.	x	x	x	x	x	x
LO	State that HF VOLMET and HF two-way communication use a single sideband.	x	x	x	x	x	x
LO	State that a radio signal may be classified by three symbols in accordance with the ITU Radio Regulation, Volume 1: e.g. A1A. The first symbol indicates the type of modulation of the main carrier; The second symbol indicates the nature of the signal modulating the main carrier; The third symbol indicates the nature of the information to be transmitted.	x	x	x	x	x	x
062 01 01 04	**Pulse characteristics**						
LO	Define the following terms as associated with a pulse string: pulse length, pulse power, continuous power.	x	x	x	x	x	x
062 01 01 05	**Carrier, modulation**						
LO	Define 'carrier wave'. The radio wave acting as the carrier or transporter.	x	x	x	x	x	x
LO	Define 'keying'. Interrupting the carrier wave to break it into dots and dashes.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'modulation'. The technical term for the process of impressing and transporting information by radio waves.	x	x	x	x	x	x
062 01 01 06	**Kinds of modulation (amplitude, frequency, pulse, phase)**						
LO	Define 'amplitude modulation'. The information that is impressed onto the carrier wave by altering the amplitude of the carrier.	x	x	x	x	x	x
LO	Define 'frequency modulation'. The information that is impressed onto the carrier wave by altering the frequency of the carrier.	x	x	x	x	x	x
LO	Describe 'pulse modulation'. A modulation form used in radar by transmitting short pulses followed by larger interruptions.	x	x	x	x	x	x
LO	Describe 'phase modulation'. A modulation form used in GPS where the phase of the carrier wave is reversed.	x	x	x	x	x	x
062 01 02 00	**Antennas**						
062 01 02 01	**Characteristics**						
LO	Define 'antenna'. A wave-type transducer for the process of converting a line AC into a free electromagnetic wave.	x	x	x	x	x	x
LO	State that the simplest type of antenna is a dipole which is a wire of length equal to one-half of the wavelength.	x	x	x	x	x	x
LO	State that in a wire which is fed with an AC (alternating current), some of the power will radiate into space.	x	x	x	x	x	x
LO	State that in a wire parallel to the wire fed with an AC but remote from it, an AC will be induced.	x	x	x	x	x	x
LO	State that an electromagnetic wave always consists of an oscillating electric (E) and an oscillating magnetic (H) field which propagates at the speed of light.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the (E) and (H) fields are perpendicular to each other. The oscillations are perpendicular to the propagation direction and are in-phase.	x	x	x	x	x	x
LO	State that the electric field is parallel to the wire and the magnetic field is perpendicular to it.	x	x	x	x	x	x
062 01 02 02	**Polarisation**						
LO	State that the polarisation of an electromagnetic wave describes the orientation of the plane of oscillation of the electrical component of the wave with regard to its direction of propagation.	x	x	x	x	x	x
LO	State that in linear polarisation the plane of oscillation is fixed in space, whereas in circular (eliptical) polarisation the plane is rotating.	x	x	x	x	x	x
LO	Explain the difference between horizontal and vertical polarisation in the dependence of the alignment of the dipole.	x	x	x	x	x	x
062 01 02 03	**Types of antennas**						
LO	List and describe the common different kinds of directional antennas: loop antenna used in old ADF receivers; parabolic antenna used in weather radars; slotted planar array used in more modern weather radars; helical antenna used in GPS transmitters.	x	x	x	x	x	x
062 01 03 00	**Wave propagation**						
062 01 03 01	**Structure of the ionosphere**						
LO	State that the ionosphere is the ionised component of the Earth's upper atmosphere from 60 to 400 km above the surface, which is vertically structured in three regions or layers.	x	x	x	x	x	x
LO	State that the layers in the ionosphere are named D, E and F layers, and their depth varies with time.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that electromagnetic waves refracted from the E and F layers of the ionosphere are called sky waves.	x	x	x	x	x	x
062 01 03 02	**Ground waves**						
LO	Define 'ground or surface waves'. The electromagnetic waves travelling along the surface of the Earth.	x	x	x	x	x	x
062 01 03 03	**Space waves**						
LO	Define 'space waves'. The electromagnetic waves travelling through the air directly from the transmitter to the receiver.	x	x	x	x	x	x
062 01 03 04	**Propagation with the frequency bands**						
LO	State that radio waves in VHF, UHF, SHF and EHF propagate as space waves.	x	x	x	x	x	x
LO	State that radio waves in VLF, LF, MF and HF propagate as surface/ground waves and sky waves.	x	x	x	x	x	x
062 01 03 05	**Doppler principle**						
LO	State that Doppler effect is the phenomenon that the frequency of an electromagnetic wave will increase or decrease if there is relative motion between the transmitter and the receiver.	x	x	x	x	x	x
LO	State that the frequency will increase if the transmitter and receiver are converging, and will decrease if they are diverging.	x	x	x	x	x	x
062 01 03 06	**Factors affecting propagation**						
LO	Define 'skip distance'. The distance between the transmitter and the point on the surface of the Earth where the first sky return arrives.	x	x	x	x	x	x
LO	State that skip zone/dead space is the distance between the limit of the surface wave and the sky wave.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe 'fading'. When a receiver picks up the sky signal and the surface signal, the signals will interfere with each other causing the signals to be cancelled out.	x	x	x	x	x	x
LO	State that radio waves in the VHF band and above are limited in range as they are not reflected by the ionosphere and do not have a surface wave.	x	x	x	x	x	x
LO	Describe the physical phenomena reflection, refraction, diffraction, absorption and interference.	x	x	x	x	x	x
062 02 00 00	**RADIO AIDS**						
062 02 01 00	**Ground D/F**						
062 02 01 01	**Principles**						
LO	Describe the use of a Ground Direction Finder.	x	x	x	x	x	x
LO	Explain why the service provided is subdivided as: — VHF direction finding (VDF) — UHF direction finding (UDF).	x	x	x	x	x	x
LO	Explain the limitation of range because of the path of the VHF signal.	x	x	x	x	x	x
LO	Describe the operation of the VDF in the following general terms: radio waves emitted by the radio-telephony (R/T) equipment of the aircraft; special directional antenna; determination of the direction of the incoming signal; ATC display.	x	x	x	x	x	x
062 02 01 02	**Presentation and interpretation**						
LO	Define the term 'QDM'. The magnetic bearing to the station.	x	x	x	x	x	x
LO	Define the term 'QDR'. The magnetic bearing from the station.	x	x	x	x	x	x
LO	Define the term 'QUJ'. The true bearing to the station.	x	x	x	x	x	x
LO	Define the term 'QTE'. The true bearing from the station.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain that by using more than one ground station, the position of an aircraft can be determined and transmitted to the pilot.	x	x	x	x	x	x
062 02 01 03	**Coverage and range**						
LO	Use the formula: 1.23 × √transmitter height in feet + 1.23 × √receiver height in feet, to calculate the range in NM.	x	x	x	x	x	x
062 02 01 04	**Errors and accuracy**						
LO	Explain why synchronous transmissions will cause errors.	x	x	x	x	x	x
LO	Describe the effect of 'multipath signals'.	x	x	x	x	x	x
LO	Explain that VDF information is divided into the following classes according to ICAO Annex 10: class A: accurate to a range within ± 2°; class B: accurate to a range within ± 5°; class C: accurate to a range within ± 10°; class D: accurate to less than class C.	x	x	x	x	x	x
062 02 02 00	**Non-Directional Beacon (NDB)/ Automatic Direction Finder (ADF)**						
062 02 02 01	**Principles**						
LO	Define the acronym 'NDB'. Non-Directional Beacon.	x	x	x	x	x	x
LO	Define the acronym 'ADF'. Automatic Direction Finder.	x	x	x	x	x	x
LO	State that the NDB is the ground part of the system.	x	x	x	x	x	x
LO	State that the ADF is the airborne part of the system.	x	x	x	x	x	x
LO	State that the NDB operates in the LF and MF frequency bands.	x	x	x	x	x	x
LO	The frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is 190–1 750 kHz.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define a 'locator beacon'. An LF/MF NDB used as an aid to final approach usually with a range, according to ICAO Annex 10, of 10–25 NM.	x	x	x	x	x	x
LO	Explain the difference between NDBs and locator beacons.	x	x	x	x	x	x
LO	Explain which beacons transmit signals suitable for use by an ADF.	x	x	x	x	x	x
LO	State that certain commercial radio stations transmit within the frequency band of the NDB.	x	x	x	x	x	x
LO	Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave.	x	x	x	x	x	x
LO	Describe the use of NDBs for navigation.	x	x	x	x	x	x
LO	Describe the procedure to identify an NDB station.	x	x	x	x	x	x
LO	Interpret the term 'cone of silence' in respect of an NDB.	x	x	x	x	x	x
LO	State that an NDB station emits a NON/A1A or a NON/A2A signal.	x	x	x	x	x	x
LO	State the function of the Beat Frequency Oscillator (BFO).	x	x	x	x	x	x
LO	State that in order to identify a NON/A1A NDB, the BFO circuit of the receiver has to be activated.	x	x	x	x	x	x
LO	State that the NDB emitting NON/A1A gives rise to erratic indications of the bearing while the station is identifying.	x	x	x	x	x	x
LO	Explain that on modern aircraft the BFO is activated automatically.	x	x	x	x	x	x
062 02 02 02	**Presentation and interpretation**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the types of indicators in common use: electronic navigation display; Radio Magnetic Indicator (RMI); fixed card ADF (radio compass); moving card ADF.	x	x	x	x	x	x
LO	Describe the indications given on RMI, fixed card and moving card ADF displays.	x	x	x	x	x	x
LO	Given a display, interpret the relevant ADF information.	x	x	x	x	x	x
LO	Calculate the true bearing from the compass heading and relative bearing.	x	x	x	x	x	x
LO	Convert the compass bearing into magnetic bearing and true bearing.	x	x	x	x	x	x
LO	Describe how to fly the following in-flight ADF procedures according to ICAO Doc 8168, Volume 1: homing and tracking, and explain the influence of wind; interceptions; procedural turns; holding patterns.	x	x	x	x	x	x
062 02 02 03	**Coverage and range**						
LO	State that the power limits the range of an NDB.	x	x	x	x	x	x
LO	Explain the relationship between power and range.	x	x	x	x	x	x
LO	State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land.	x	x	x	x	x	x
LO	Describe the propagation path of NDB radio waves with respect to the ionosphere and the Earth's surface.	x	x	x	x	x	x
LO	Explain that interference between sky and ground waves at night leads to 'fading'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established during approach according to ICAO Doc 8168 as within ± 5°.	x	x	x	x	x	x
LO	State that there is no warning indication of NDB failure.	x	x	x	x	x	x
062 02 02 04	**Errors and accuracy**						
LO	Define 'quadrantal error'. The distortion of the incoming signal from the NDB station by reradiation from the airframe. This is corrected for during installation of the antenna.	x	x	x	x	x	x
LO	Explain 'coastal refraction'. As a radio wave travelling over land crosses the coast, the wave speeds up over water and the wave front bends.	x	x	x	x	x	x
LO	Define 'night/twilight effect'. The influence of sky waves and ground waves arriving at the ADF receiver with a difference of phase and polarisation which introduce bearing errors.	x	x	x	x	x	x
LO	State that interference from other NDB stations on the same frequency may occur at night due to sky-wave contamination.	x	x	x	x	x	x
062 02 02 05	**Factors affecting range and accuracy**						
LO	State that there is no coastal refraction error when: the propagation direction of the wave is 90° to the coastline; the NDB station is sited on the coastline.	x	x	x	x	x	x
LO	State that coastal refraction error increases with increased incidence.	x	x	x	x	x	x
LO	State that night effect predominates around dusk and dawn.	x	x	x	x	x	x
LO	Define 'multipath propagation of the radio wave (mountain effect)'.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that static emission energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.	x	x	x	x	x	x
062 02 03 00	**VOR and Doppler VOR**						
062 02 03 01	**Principles**						
LO	Explain the operation of VOR using the following general terms: reference phase; variable phase; phase difference.	x	x	x	x	x	x
LO	State that the frequency band allocated to VOR according to ICAO Annex 10 is VHF and the frequencies used are 108.0–117.975 MHz.	x	x	x	x	x	x
LO	State that frequencies within the allocated VOR range which have an odd number in the first decimal place, are used by ILS.	x	x	x	x	x	x
LO	State that the following types of VOR are in operation: Conventional VOR (CVOR): a first-generation VOR station emitting signals by means of a rotating antenna; Doppler VOR (DVOR): a second-generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle; en route VOR for use by IFR traffic; Terminal VOR (TVOR): a station with a shorter range used as part of the approach and departure structure at major airports; Test VOR (VOT): a VOR station emitting a signal to test VOR indicators in an aircraft.	x	x	x	x	x	x
LO	Describe how ATIS information is transmitted on VOR frequencies.	x	x	x	x	x	x
LO	List the three main components of VOR airborne equipment: the antenna, the receiver, the indicator.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the identification of a VOR in terms of Morse-code letters, continuous tone or dots (VOT), tone pitch, repetition rate and additional plain text.	x	x	x	x	x	x
LO	State that according to ICAO Annex 10, a VOR station has an automatic ground monitoring system.	x	x	x	x	x	x
LO	State that the VOR monitoring system monitors change in measured radial and reduction in signal strength.	x	x	x	x	x	x
LO	State that failure of the VOR station to stay within the required limits can cause the removal of identification and navigation components from the carrier or radiation to cease.	x	x	x	x	x	x
062 02 03 02	**Presentation and interpretation**						
LO	Read off the radial on a Radio Magnetic Indicator (RMI).	x	x	x	x	x	x
LO	Read off the angular displacement in relation to a preselected radial on an HSI or CDI.	x	x	x	x	x	x
LO	Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR considering also the heading of the aircraft.	x	x	x	x	x	x
LO	Interpret VOR information as displayed on HSI, CDI and RMI.	x	x	x	x	x	x
LO	Describe the following in-flight VOR procedures as in ICAO Doc 8168, Volume 1: tracking, and explain the influence of wind when tracking; interceptions; procedural turns; holding patterns.	x	x	x	x	x	x
LO	State that when converting a radial into a true bearing, the variation at the VOR station has to be taken into account.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
062 02 03 03	**Coverage and range**						
LO	Describe the range with respect to the transmitting power and radio signal.	x	x	x	x	x	x
LO	Calculate the range using the formula: 1.23 × √transmitter height in feet + 1.23 × √receiver height in feet.	x	x	x	x	x	x
062 02 03 04	**Errors and accuracy**						
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established on a VOR track when flying approach procedures according to ICAO Doc 8168 as within half-full scale deflection of the required track.	x	x	x	x	x	x
LO	State that due to reflections from terrain, radials can be bent and lead to wrong or fluctuating indications, which is called 'scalloping'.	x	x	x	x	x	x
LO	State that DVOR is less sensitive to site error than CVOR.	x	x	x	x	x	x
062 02 04 00	**DME**						
062 02 04 01	**Principles**						
LO	State that DME operates in the UHF band between 960–1215 MHz according to ICAO Annex 10.	x	x	x	x	x	x
LO	State that the system comprises two basic components: the aircraft component, the interrogator; the ground component, the transponder.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the principle of distance measurement using DME in terms of: pulse pairs; fixed frequency division of 63 MHz; propagation delay; 50-microsecond delay time; irregular transmission sequence; search mode; tracking mode; memory mode.	x	x	x	x	x	x
LO	State that the distance measured by DME is slant range.	x	x	x	x	x	x
LO	Illustrate that a position line using DME is a circle with the station at its centre.	x	x	x	x	x	x
LO	Describe how the pairing of VHF and UHF frequencies (VOR/DME) enables the selection of two items of navigation information from one frequency setting.	x	x	x	x	x	x
LO	Describe, in the case of co-location, the frequency pairing and identification procedure.	x	x	x	x	x	x
LO	Explain that depending on the configuration, the combination of a DME distance with a VOR radial can determine the position of the aircraft.	x	x	x	x	x	x
LO	Explain that military TACAN stations may be used for DME information.	x	x	x	x	x	x
062 02 04 02	**Presentation and interpretation**						
LO	Explain that when identifying a DME station co-located with a VOR station, the identification signal with the higher-tone frequency is the DME which idents approximately every 40seconds.	x	x	x	x	x	x
LO	Calculate ground distance from given slant range and altitude.	x	x	x	x	x	x
LO	Describe the use of DME to fly a DME arc in accordance with ICAO Doc 8168, Volume 1.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that a DME system may have a ground speed read-out combined with the DME read-out.	x	x	x	x	x	x
062 02 04 03	**Coverage and range**						
LO	Explain why a ground station can generally respond to a maximum of 100 aircraft.	x	x	x	x	x	x
LO	Explain which aircraft will be denied a DME range first when more than 100 interrogations are being made.	x	x	x	x	x	x
062 02 04 04	**Errors and accuracy**						
LO	State that the error of the DME 'N' according to ICAO Annex 10 should not exceed ± 0.25 NM + 1.25 % of the distance measured. For installations installed after 1 January 1989, the total system error should not exceed 0.2 NM DME 'P'.	x	x	x	x	x	x
062 02 04 05	**Factors affecting range and accuracy**						
LO	State that the ground speed read-out combined with DME is only correct when tracking directly to or from the DME station.	x	x	x	x	x	x
LO	State that, close to the station, the ground speed read-out combined with DME is less than the actual ground speed.	x	x	x	x	x	x
062 02 05 00	**ILS**						
062 02 05 01	**Principles**						
LO	Name the three main components of an ILS: the localiser (LLZ); the glide path (GP); range information (markers or DME).	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the site locations of the ILS components: the localiser antenna should be located on the extension of the runway centre line at the stop-end; The glide-path antenna should be located 300 metres beyond the runway threshold, laterally displaced approximately 120 metres to the side of the runway centre line.	x		x			x
LO	Explain that marker beacons produce radiation patterns to indicate predetermined distances from the threshold along the ILS glide path.	x		x			x
LO	Explain that marker beacons are sometimes replaced by a DME paired with the LLZ frequency.	x		x			x
LO	State that in the ILS frequency assigned band 108.0–111.975 MHz, only frequencies which have an odd number in the first decimal, are ILS frequencies.	x		x			x
LO	State that the LLZ operates in the 108,0–111.975 MHz VHF band, according to ICAO Annex 10.	x		x			x
LO	State that the GP operates in the UHF band.	x		x			x
LO	Describe the use of the 90-Hz and the 150-Hz signals in the LLZ and GP transmitters/ receivers, stating how the signals at the receivers vary with angular deviation.	x		x			x
LO	Draw the radiation pattern with respect to the 90-Hz and 150-Hz signals.	x		x			x
LO	Describe how the UHF glide-path frequency is selected automatically by being paired with the LLZ frequency.	x		x			x
LO	Explain the term 'Difference of Depth of Modulation (DDM)'.	x		x			x
LO	State that the difference in the modulation depth increases with displacement from the centre line.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that both the LLZ and the GP antenna radiate side lobes (false beams) which could give rise to false centre-line and false glide-path indication.	x		x			x
LO	Explain that the back beam from the LLZ antenna may be used as a published 'non-precision approach'.	x		x			x
LO	State that according to ICAO Annex 10 the nominal glide path is 3°.	x		x			x
LO	Name the frequency, modulation and identification assigned to all marker beacons according to ICAO Annex 10: all marker beacons operate on 75-MHz carrier frequency. The modulation frequencies are: outer marker: 400 Hz; middle marker: 1 300 Hz; inner marker: 3 000 Hz. The audio frequency modulation (for identification) is the continuous modulation of the audio frequency and is keyed as follows: outer marker: 2 dashes per second continuously; middle marker: a continuous series of alternate dots and dashes; inner marker: 6 dots per second continuously.	x		x			x
LO	State that according to ICAO Doc 8168, the final-approach area contains a fix or facility that permits verification of the ILS glide path–altimeter relationship. The outer marker or DME is usually used for this purpose.	x		x			x
062 02 05 02	**Presentation and interpretation**						
LO	Describe the ILS identification regarding frequency and Morse code and/or plain text.	x		x			x
LO	Calculate the rate of descent for a 3°-glide-path angle given the ground speed of the aircraft and using the formula: Rate of Descent (ROD) in ft/min = (ground speed in kt × 10) / 2.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the rate of descent using the following formula when flying any glide-path angle: ROD ft/min = *Speed Factor (SF)* × glide-path angle × 100.	x		x			x
LO	Interpret the markers by sound, modulation, and frequency.	x		x			x
LO	State that the outer-marker cockpit indicator is coloured blue, the middle marker amber, and the inner marker white.	x		x			x
LO	State that in accordance with ICAO Annex 10, an ILS installation has an automatic ground monitoring system.	x		x			x
LO	State that the LLZ and GP monitoring system monitors any shift in the LLZ and GP mean course line or reduction in signal strength.	x		x			x
LO	State that a failure of either the LLZ or the GP to stay within the predetermined limits will cause: removal of identification and navigation components from the carrier; radiation to cease; a warning to be displayed at the designated control point.	x		x			x
LO	State that an ILS receiver has an automatic monitoring function.	x		x			x
LO	Describe the circumstances in which warning flags will appear for both the LLZ and the GP: absence of the carrier frequency; absence of the 90 and 150-Hz modulation simultaneously; the percentage modulation of either the 90 or 150-Hz signal reduced to 0.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret the indications on a Course Deviation Indicator (CDI) and a Horizontal Situation Indicator (HSI): full-scale deflection of the CDI needle corresponds to approximately 2,5° displacement from the ILS centre line; full-scale deflection on the GP corresponds to approximately 0,7° from the ILS GP centre line.	x		x			x
LO	Interpret the aircraft's position in relation to the extended runway centre line on a back-beam approach.	x		x			x
LO	Explain the setting of the course pointer of an HSI for front-beam and back-beam approaches.	x		x			x
062 02 05 03	**Coverage and range**						
LO	Sketch the standard coverage area of the LLZ and GP with angular sector limits in degrees and distance limits from the transmitter in accordance with ICAO Annex 10: LLZ coverage area is 10° on either side of the centre line to a distance of 25 NM from the runway, and 35° on either side of the centre line to a distance of 17 NM from the runway; — GP coverage area is 8° on either side of the centre line to a distance of minimum 10 NM from the runway.	x		x			x
062 02 05 04	**Errors and accuracy**						
LO	Explain that ILS approaches are divided into facility performance categories defined in ICAO Annex 10.	x		x			x
LO	Define the following ILS operation categories: Category I, Category II, Category IIIA, Category IIIB, Category IIIC.	x		x			x
LO	Explain that all Category-III ILS operations guidance information is provided from the coverage limits of the facility to, and along, the surface of the runway.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain why the accuracy requirements are progressively higher for CAT I, CAT II and CAT III ILS.	x		x			x
LO	State the vertical-accuracy requirements above the threshold for CAT I, II and III for the signals of the ILS ground installation.	x		x			x
LO	Explain the following in accordance with ICAO Doc 8168: the accuracy the pilot has to fly the ILS localiser to be considered established on an ILS track is within the half-full scale deflection of the required track; the aircraft has to be established within the half-scale deflection of the LLZ before starting descent on the GP; the pilot has to fly the ILS GP to a maximum of half-scale fly-up deflection of the GP in order to stay in protected airspace.	x		x			x
LO	State that if a pilot deviates by more than half-scale deflection on the LLZ or by more than half-course fly-up deflection on the GP, an immediate missed approach should be executed because obstacle clearance may no longer be guaranteed.	x		x			x
LO	Describe ILS beam bends. Deviations from the nominal position of the LLZ and GP respectively. They are ascertained by flight test.	x		x			x
LO	Explain multipath interference. Reflections from large objects within the ILS coverage area.	x		x			x
062 02 05 05	**Factors affecting range and accuracy**						
LO	Define the 'ILS-critical area'. An area of defined dimensions about the LLZ and GP antennas where vehicles, including aircraft, are excluded during all ILS operations.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the 'ILS-sensitive area'. An area extending beyond the critical area where the parking and/or movement of vehicles, including aircraft, is controlled to prevent the possibility of unacceptable interference to the ILS signal during ILS operations.	x		x			x
LO	Describe the effect of FM broadcast stations that transmit on frequencies just below 108 MHz.	x		x			x
062 02 06 00	**Microwave Landing System (MLS)**						
062 02 06 01	**Principles**						
LO	Explain the principle of operation: horizontal course guidance during the approach; vertical guidance during the approach; horizontal guidance for departure and missed approach; DME (DME/P) distance; transmission of special information regarding the system and the approach conditions.	x		x			x
LO	State that MLS operates in the S band on 200 channels.	x		x			x
LO	Explain the reason why MLS can be installed at airports on which, as a result of the effects of surrounding buildings and/or terrain, ILS siting is difficult.	x		x			x
062 02 06 02	**Presentation and interpretation**						
LO	Interpret the display of airborne equipment designed to continuously show the position of the aircraft in relation to a preselected course and glide path along with distance information, during approach and departure.	x		x			x
LO	Explain that segmented approaches can be carried out with a presentation with two cross bars directed by a computer which has been programmed with the approach to be flown.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Illustrate that segmented and curved approaches can only be executed with DME-P installed.	x		x			x
LO	Explain why aircraft are equipped with a Multimode Receiver (MMR) in order to be able to receive ILS, MLS and GPS.	x		x			x
LO	Explain why MLS without DME-P gives an ILS lookalike straight-line approach.	x		x			x
062 02 06 03	**Coverage and range**						
LO	Describe the coverage area for the approach direction as being within a sector of ± 40° of the centre line out to a range of 20 NM from the threshold (according to ICAO Annex 10).	x		x			x
062 02 06 04	**Error and accuracy**						
LO	State the 95 % lateral and vertical accuracy within 20 NM (37 km) of the MLS approach reference datum and 60 ft above the MLS datum point (according to ICAO Annex 10).	x		x			x
062 03 00 00	**RADAR**						
062 03 01 00	**Pulse techniques and associated terms**						
LO	Name the different applications of radar with respect to ATC, MET observations and airborne weather radar.	x	x	x	x	x	x
LO	Describe the pulse technique and echo principle on which primary radar systems are based.	x	x	x	x	x	x
LO	Explain the relationship between the maximum theoretical range and the Pulse Repetition Frequency (PRF).	x	x	x	x	x	x
LO	Calculate the maximum theoretical unambiguous range if the PRF is given using the formula: $\text{Range in km} = \dfrac{300\ 000}{\text{PRF} \times 2}$	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Calculate the PRF if the maximum theoretical unambiguous range of the radar is given using the formula: $\text{PRF}=\frac{300000}{\text{range(km)}\times 2}$	x	x	x	x	x	x
LO	Explain that pulse length defines the minimum theoretical range of a radar.	x	x	x	x	x	x
LO	Explain the need to harmonise the rotation speed of the antenna, the pulse length and the pulse repetition frequency for range.	x	x	x	x	x	x
LO	Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display: atmospheric conditions: superrefraction and subrefraction; attenuation with distance; condition and size of the reflecting surface.	x	x	x	x	x	x
062 03 02 00	**Ground radar**						
062 03 02 01	**Principles**						
LO	Explain that primary radar provides bearing and distance of targets.	x		x	x		x
LO	Explain that primary ground radar is used to detect aircraft that are not equipped with a secondary radar transponder.	x		x	x		x
LO	Explain why Moving Target Indicator (MTI) is used.	x		x	x		x
062 03 02 02	**Presentation and interpretation**						
LO	State that modern ATC systems use computer-generated display.	x		x	x		x
LO	Explain that the radar display enables the ATS controller to provide information, surveillance or guidance service.	x		x	x		x
062 03 03 00	**Airborne weather radar**						
062 03 03 01	**Principles**						
LO	List the two main tasks of the weather radar in respect of weather and navigation.	x		x	x		x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the wavelength (approx. 3 cm) and frequency of most AWRs (approx. 9 GHz).	x		x	x		x
LO	Explain how the antenna is attitude-stabilised in relation to the horizontal plane using the aircraft's attitude reference system.	x		x	x		x
LO	Explain that older AWRs have two different radiation patterns which can be produced by a single antenna, one for mapping (cosecant-squared) and the other for weather (pencil/cone-shaped).	x		x	x		x
LO	Describe the cone-shaped pencil beam of about 3° to 5° beam width used for weather depiction.	x		x	x		x
LO	Explain that in modern AWRs a single radiation pattern is used for both mapping and weather with the scanning angle being changed between them.	x		x	x		x
062 03 03 02	**Presentation and interpretation**						
LO	Explain the functions of the following different modes on the radar control panel: off/on switch; function switch, with WX, WX+T and MAP modes; gain-control setting (auto/manual); tilt/autotilt switch.	x		x	x		x
LO	Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red and magenta) indicating the increasing intensity of precipitation.	x		x	x		x
LO	Illustrate the use of azimuth-marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm or to a landmark on the screen.	x		x	x		x
062 03 03 03	**Coverage and range**						
LO	Explain how the radar is used for weather detection and for mapping (range, tilt and gain, if available).	x		x	x		x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
062 03 03 04	**Errors, accuracy, limitations**						
LO	Explain why AWR should be used with extreme caution when on the ground.	x		x	x		x
062 03 03 05	**Factors affecting range and accuracy**						
LO	Explain the danger of the area behind heavy rain (shadow area) where no radar waves will penetrate.	x		x	x		x
LO	Explain why the tilt setting should be higher when the aircraft descends to a lower altitude.	x		x	x		x
LO	Explain why the tilt setting should be lower when the aircraft climbs to a higher altitude.	x		x	x		x
LO	Explain why a thunderstorm may not be detected when the tilt is set too high.	x		x	x		x
062 03 03 06	**Application for navigation**						
LO	Describe the navigation function of the radar in the mapping mode.	x		x	x		x
LO	Describe the use of the weather radar to avoid a thunderstorm (Cb).	x		x	x		x
LO	Explain how turbulence (not CAT) can be detected by a modern weather radar.	x		x	x		x
LO	Explain how windshear can be detected by a modern weather radar.	x		x	x		x
062 03 04 00	**Secondary surveillance radar and transponder**						
062 03 04 01	**Principles**						
LO	Explain that the Air Traffic Control (ATC) system is based on the replies provided by the airborne transponders in response to interrogations from the ATC secondary radar.	x	x	x	x	x	x
LO	Explain that the ground ATC secondary radar uses techniques which provide the ATC with information that cannot be acquired by the primary radar.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain that an airborne transponder provides coded-reply signals in response to interrogation signals from the ground secondary radar and from aircraft equipped with TCAS.	x	x	x	x	x	x
LO	Explain the advantages of SSR over a primary radar.	x	x	x	x	x	x
062 03 04 02	**Modes and codes**						
LO	Explain that the interrogator transmits its interrogations in the form of a series of pulses.	x	x	x	x	x	x
LO	Name and explain the interrogation modes: Mode A and C; Intermode: • Mode A/C/S all call, • Mode A/C only all call; Mode S: • Mode S only all call, • broadcast (no reply elicited), • selective.	x	x	x	x	x	x
LO	State that the interrogation frequency is 1 030 MHz and the reply frequency is 1 090 MHz.	x	x	x	x	x	x
LO	Explain that the decoding of the time between the interrogation pulses determines the operating mode of the transponder: Mode A: transmission of aircraft transponder code; Mode C: transmission of aircraft pressure altitude; Mode S: aircraft selection and transmission of flight data for the ground surveillance.	x	x	x	x	x	x
LO	State that the ground interrogation signal is transmitted in the form of pairs of pulses P1 and P3 for Mode A and C, and that a control pulse P2 is transmitted following the first interrogation pulse P1.	x	x	x	x	x	x
LO	Explain that the interval between P1 and P3 determines the mode of interrogation, Mode A or C.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the radiated amplitude of P2 from the side lobes and from the main lobe is different.	x	x	x	x	x	x
LO	State that Mode-A designation is a sequence of four digits which can be manually selected from 4 096 available codes.	x	x	x	x	x	x
LO	State that in Mode-C reply the pressure altitude is reported in 100-ft increments.	x	x	x	x	x	x
LO	State that in addition to the information pulses provided, a Special Position Identification (SPI) pulse can be transmitted but only as a result of a manual selection (IDENT).	x	x	x	x	x	x
LO	Explain the need for compatibility of Mode S with Mode A and C.	x	x	x	x	x	x
LO	Explain that Mode-S transponders receive interrogations from other Mode-S transponders and SSR ground stations.	x	x	x	x	x	x
LO	State that Mode-S surveillance protocols implicitly use the principle of selective addressing.	x	x	x	x	x	x
LO	Explain that every aircraft will have been allocated an ICAO Aircraft Address which is hard-coded into the airframe (Mode-S address).	x	x	x	x	x	x
LO	Explain that the ICAO Aircraft Address consists of 24 bits (therefore more than 16 000 000 possible codes) allocated by the registering authority of the State in which the aircraft is registered.	x	x	x	x	x	x
LO	Explain that this (24-bit) address is included in all Mode-S transmissions, so that every interrogation can be directed to a specific aircraft, preventing multiple replies.	x	x	x	x	x	x
LO	State that the ground interrogation signal is transmitted in the form of P1, P3 and P4 pulses for Mode S.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret the following Mode-S terms: selective addressing; mode 'all call'; selective call.	x	x	x	x	x	x
LO	State that Mode-S interrogation contains either: aircraft address; all call address; broadcast address.	x	x	x	x	x	x
LO	Mode A/C/S all-call consists of 3 pulses: P1, P3 and the long P4. A control pulse P2 is transmitted following P1 to suppress responses from aircraft in the side lobes of the interrogation antenna.	x	x	x	x	x	x
LO	Mode A/C only all-call consists of 3 pulses: P1, P3 and the short P4.	x	x	x	x	x	x
LO	State that there are 25 possible Mode-S reply forms.	x	x	x	x	x	x
LO	State that the reply message consists of a preamble and a data block.	x	x	x	x	x	x
LO	State that the Aircraft Address shall be transmitted in any reply except in Mode-S only all-call reply.	x	x	x	x	x	x
LO	Explain that Mode S can provide enhanced vertical tracking, using a 25-feet altitude increment.	x	x	x	x	x	x
LO	Explain how SSR can be used for ADS B.	x	x	x	x	x	x
062 03 04 03	**Presentation and interpretation**						
LO	Explain how an aircraft can be identified by a unique code.	x	x	x	x	x	x
LO	Illustrate how the following information is presented on the radar screen: pressure altitude; flight level; flight number or aircraft registration; ground speed.	x	x	x	x	x	x
LO	Name and interpret the codes 7700, 7600 and 7500.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Interpret the selector modes: OFF, Standby, ON (mode A), ALT (mode A and C), and TEST.	x	x	x	x	x	x
LO	Explain the function of the emission of a Special Position Identification (SPI) pulse after pushing the IDENT button in the aircraft.	x	x	x	x	x	x
	ELEMENTARY SURVEILLANCE						
LO	Explain that the elementary surveillance provides the ATC controller with the aircraft's position, altitude and identification.	x	x	x	x	x	x
LO	State that the elementary surveillance needs Mode-S transponders with Surveillance Identifier (SI) code capacity and the automatic reporting of aircraft identification, known as ICAO Level 2s.	x	x	x	x	x	x
LO	State that the SI code must correspond to the aircraft identification specified in item 7 of the ICAO flight plan or to the registration marking.	x	x	x	x	x	x
LO	State that only the ICAO identification format is compatible with the ATS ground system.	x	x	x	x	x	x
LO	State that Mode-S-equipped aircraft with a maximum mass in excess of 5 700 kg or a maximum cruising true airspeed capability in excess of 250 kt must operate with transponder antenna diversity.	x	x	x	x	x	x
LO	Describe the different types of communication protocols (A, B, C and D).	x	x	x	x	x	x
LO	Explain that elementary surveillance is based on Ground-Initiated Comm-B protocols.	x	x	x	x	x	x
	ENHANCED SURVEILLANCE						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that enhanced surveillance consists of the extraction of additional aircraft parameters known as Downlink Aircraft Parameters (DAP) consisting of: magnetic heading; indicated airspeed; Mach number; vertical rate; roll angle; track angle rate; true track angle; ground speed; selected altitude.	x	x	x	x	x	x
LO	Explain that the controller’s information is improved by providing actual aircraft-derived data such as magnetic heading, indicated airspeed, vertical rate and selected altitude.	x	x	x	x	x	x
LO	Explain that the automatic extraction of an aircraft’s parameters, and their presentation to the controller, will reduce their R/T workload and will free them to concentrate on ensuring the safe and efficient passage of air traffic.	x	x	x	x	x	x
LO	Explain that the reduction in radio-telephony between the air traffic controllers and the pilots will reduce pilot workload and remove a potential source of error.	x	x	x	x	x	x
062 03 04 04	**Errors and accuracy**						
LO	Explain the following disadvantages of SSR (Mode A/C): code garbling of aircraft less than 1.7 NM apart measured in the vertical plane perpendicular to and from the antenna; ‘fruiting’ which results from the reception of replies caused by interrogations from other radar stations.	x	x	x	x	x	x
062 04 00 00	***INTENTONALLY LEFT BLANK***						
062 05 00 00	**AREA NAVIGATION SYSTEMS, RNAV/FMS**						
062 05 01 00	**General philosophy and definitions**						
062 05 01 01	**Basic RNAV (B-RNAV), Precision RNAV (P-RNAV), RNP-PNAV**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'Area Navigation' (RNAV) (ICAO Annex 11). A method of navigation permitting aircraft operations on any desired track within the coverage of station-referenced navigation signals, or within the limits of a self-contained navigation system.	x		x			x
LO	State that Basic RNAV (B-RNAV) systems require RNP 5.	x		x			x
LO	State that Precision RNAV (P-RNAV) systems require RNP 1.	x		x			x
062 05 01 02	**Principles of 2D RNAV, 3D RNAV and 4D RNAV**						
LO	State that a 2D-RNAV system is able to navigate in the horizontal plane only.	x		x			x
LO	State that a 3D-RNAV system is able to navigate in the horizontal plane and in addition has a guidance capability in the vertical plane.	x		x			x
LO	State that a 4D-RNAV system is able to navigate in the horizontal plane, has a guidance capability in the vertical plane and in addition has a timing function.	x		x			x
062 05 01 03	**Required Navigation Performance (RNP) in accordance with ICAO Doc 9613**						
LO	State that RNP is a concept that applies to navigation performance within an airspace.	x		x			x
LO	The RNP type is based on the navigation performance accuracy to be achieved within anairspace.	x		x			x
LO	State that RNP X requires a navigation performance accuracy of ± X NM both lateral and longitudinal 95 % of the flying time (RNP 1 requires a navigation performance of ± 1 NM both lateral and longitudinal 95 % of the flying time).	x		x			x
LO	State that RNAV equipment is one requirement in order to receive approval to operate in an RNP environment.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that RNAV equipment operates by automatically determining the aircraft's position.	x		x			x
LO	State the advantages of using RNAV techniques over more conventional forms of navigation: establishment of more direct routes permitting a reduction in flight distance; establishment of dual or parallel routes to accommodate a greater flow of en route traffic; establishment of bypass routes for aircraft overflying high-density terminal areas; establishment of alternatives or contingency routes either on a planned or ad hoc basis; establishment of optimum locations for holding patterns; reduction in the number of ground navigation facilities.	x		x			x
LO	State that RNP may be specified for a route, a number of routes, an area, volume of airspace, or any airspace of defined dimensions.	x		x			x
LO	State that airborne navigation equipment uses inputs from navigational systems such as VOR/DME, DME/DME, GNSS, INS and IRS.	x		x			x
LO	State that aircraft equipped to operate to RNP 1 and better, should be able to compute an estimate of its position error, depending on the sensors being used and time elapsed.	x		x			x
LO	Indicate navigation-equipment failure.	x		x			x
062 05 02 00	**Simple 2D RNAV** *Info: First generation of radio-navigation systems allowing the flight crew to select a phantom waypoint on the RNAV panel and select a desired track to fly inbound to the waypoint.*						
062 05 02 01	**Flight-deck equipment**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	The control unit allows the flight crew to: tune the VOR/DME station used to define the phantom waypoint; define the phantom waypoint as a radial and distance (DME) from the selected VOR/DME station; select the desired magnetic track to follow inbound to the phantom waypoint; select between an en route mode, an approach mode of operation and the basic VOR/DME mode of operation.	x		x			x
LO	Track guidance is shown on the HSI/CDI.	x		x			x
062 05 02 02	**Navigation computer, VOR/DME navigation**						
LO	The navigation computer of the simple 2D-RNAV system computes the navigational problems by simple sine and cosine mathematics, solving the triangular problems.	x		x			x
062 05 02 03	**Navigation computer input/output**						
LO	State that the following input data to the navigation computer is: the actual VOR radial and DME distance from the selected VOR station; the radial and distance to phantom waypoint; the desired magnetic track inbound to the phantom waypoint.	x		x			x
LO	State the following output data from the navigation computer: desired magnetic track to the phantom waypoint shown on the CDI at the course pointer; distance from the present position to the phantom waypoint; deviations from the desired track as follows: • in en route mode, full-scale deflection on the CDI is 5 NM; • in approach mode, full-scale deflection on the CDI is 1 ¼ NM; • in VOR/DME mode, full-scale deflection on the CDI is 10°.	x		x			x
LO	State that the system is limited to operate within the range of the selected VOR/DME station.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
062 05 03 00	**4D RNAV** *Info: The next generation of area navigation equipment allowed the flight crew to navigate on any desired track within the coverage of VOR/DME stations.*						
062 05 03 01	**Flight-deck equipment**						
LO	State that in order to give the flight crew control over the required lateral guidance functions, RNAV equipment should at least be able to perform the following functions: display present position in latitude/ longitude or as distance/bearing to the selected waypoint; select or enter the required flight plan through the Control and Display Unit (CDU); review and modify navigation data for any part of a flight plan at any stage of flight and store sufficient data to carry out the active flight plan; review, assemble, modify or verify a flight plan in flight, without affecting the guidance output; execute a modified flight plan only after positive action by the flight crew; where provided, assemble and verify an alternative flight plan without affecting the active flight plan; assemble a flight plan, either by identifier or by selection of individual waypoints from the database, or by creation of waypoints from the database, or by creation of waypoints defined by latitude/longitude, bearing/ distance parameters or other parameters; assemble flight plans by joining routes or route segments; allow verification or adjustment of displayed position; provide automatic sequencing through waypoints with turn anticipation; manual sequencing should also be provided to allow flight over, and return to, waypoints; display cross-track error on the CDU; provide time to waypoints on the CDU;	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	execute a direct clearance to any waypoint; fly parallel tracks at the selected offset distance; offset mode should be clearly indicated; purge previous radio updates; carry out RNAV holding procedures (when defined); make available to the flight crew estimates of positional uncertainty, either as a quality factor or by reference to sensor differences from the computed position; conform to WGS-84 geodetic reference system; indicate navigation-equipment failure.						
062 05 03 02	**Navigation computer, VOR/DME navigation**						
LO	State that the navigation computer uses signals from the VOR/DME stations to determine position.	x		x			x
LO	Explain that the system automatically tunes the VOR/DME stations by selecting stations which provide the best angular fix determination.	x		x			x
LO	Explain that the computer uses DME/DME to determine position if possible, and only if two DMEs are not available the system will use VOR/DME to determine the position of the aircraft.	x		x			x
LO	Explain that the computer is navigating on the great circle between waypoints inserted into the system.	x		x			x
LO	State that the system has a navigational database which may contain the following elements: reference data for airports (4-letter ICAO identifier); VOR/DME station data (3-letter ICAO identifier); waypoint data (5-letter ICAO identifier); STAR data; SID data; airport runway data including thresholds and outer makers; NDB stations (alphabetic ICAO identifier); company flight-plan routes.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the navigational database is valid for a limited time, usually 28 days.	x		x			x
LO	State that the navigational database is read only, but additional space exists so that crew-created navigational data may be saved in the computer memory. Such additional data will also be deleted at the 28-day navigational update of the database.	x		x			x
LO	State that the computer receives a TAS input from the air-data computer and a heading input in order to calculate actual wind velocity.	x		x			x
LO	State that the computer calculates track error in relation to desired track. This data can easily be interfaced with the automatic flight control, and when done so, it enables the aircraft to automatically follow the flight plan loaded into the RNAV computer.	x		x			x
LO	State that the computer is able to perform great-circle navigation when receiving VOR/DME stations. If out of range, the system reverts to DR (Dead Reckoning) mode, where it updates the position by means of last computed wind and TAS and heading information. Operation in DR mode is time-limited.	x		x			x
LO	State that the system has 'direct to' capability to any waypoint.	x		x			x
LO	State that the system is capable of parallel offset tracking.	x		x			x
LO	State that any waypoint can be inserted into the computer in one of the following ways: alphanumeric ICAO identifier; latitude and longitude; radial and distance from a VOR station.	x		x			x
062 05 03 03	**Navigation computer input/output**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the following are input data into a 4D-RNAV system: DME distances from DME stations; radial from a VOR station; TAS and altitude from the air-data computer; heading from the aircraft's heading system.	x		x			x
LO	State that the following are output data from a 4D-RNAV system: distance to any waypoint; estimated time overhead; ground speed and TAS; true wind; track error.	x		x			x
062 05 04 00	**Flight Management System (FMS) and general terms**						
062 05 04 01	**Navigation and flight management**						
LO	Explain that the development of computers which combine reliable liquid crystal displays offer the means of accessing more data and displaying them to the flight crew.	x		x			x
LO	Explain that a flight management system has the ability to monitor and direct both navigation and performance of the flight.	x		x			x
LO	Explain the two functions common to all FMS systems: automatic navigation Lateral Navigation (LNAV); flight path management Vertical Navigation (VNAV).	x		x			x
LO	Name the main components of the FMS system as being: Flight Management Computer (FMC); Control and Display Unit (CDU); symbol generator; Electronic Flight Instrument System (EFIS) consisting of the NAV display, including mode selector and attitude display; Auto-throttle (A/T) and Flight Control Computer (FCC).	x		x			x
062 05 04 02	**Flight management computer**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the centre of the flight management system is the FMC with its stored navigation and performance data.	x		x			x
062 05 04 03	**Navigation database**						
LO	State that the navigation database of the FMC may contain the following data: reference data for airports (4-letter ICAO identifier); VOR/DME station data (3-letter ICAO identifier); waypoint data (5-letter ICAO identifier); STAR data; SID data; holding patterns; airport runway data; NDB stations (alphabetic ICAO identifier); company flight-plan routes.	x		x			x
LO	State that the navigation database is updated every 28 days.	x		x			x
LO	State that the navigational database is write-protected, but additional space exists so that crew-created navigational data may be saved in the computer's memory. Such additional data will also be deleted at the 28-day navigational update of the database.	x		x			x
062 05 04 04	**Performance database**						
LO	State that the performance database stores all the data relating to the specific aircraft/engine configuration, and is updated by ground staff when necessary.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the performance database of the FMC contain the following data: V1, VR and V2 speeds; aircraft drag; engine-thrust characteristics; maximum and optimum operating altitudes; speeds for maximum and optimum climb; speeds for long-range cruise, maximum endurance and holding; maximum Zero-Fuel Mass (ZFM), maximum Take-Off Mass (TOM) and maximum Landing Mass (LM); fuel-flow parameters; aircraft flight envelope.	x		x			x
062 05 04 05	**Typical input/output data from the FMC**						
LO	State the following are typical input data to the FMC: time; fuel flow; total fuel; TAS, altitude, vertical speed, Mach number and outside-air temperature from the Air-Data Computer (ADC); DME and radial information from the VHF/NAV receivers; air/ground position; flap/slat position; IRS and GPS positions; Control and Display Unit (CDU) entries.	x		x			x
LO	State that the following are typical output data from the FMC: command signals to the flight directors and autopilot; command signals to the auto-throttle; information to the EFIS displays through the symbol generator; data to the CDU and various annunciators.	x		x			x
062 05 04 06	**Determination of the FMS position of the aircraft**						
LO	State that modern FMS may use a range of sensors for calculating the position of the aircraft including VOR, DME, GPS, IRS and ILS.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the information from the sensors used may be blended into a single position by using the Kalman-filter method.	x		x			x
LO	State that the Kalman filter is an algorithm for filtering incomplete and noisy measurements of dynamical processes so that errors of measurements from different sensors are minimised, thus leading to the calculated position being more accurate than that produced by any single sensor.	x		x			x
062 05 05 00	**Typical flight-deck equipment fitted on FMS aircraft**						
062 05 05 01	**Control and Display Unit (CDU)**						
LO	State that the communication link between the flight crew and the FMC is the CDU.	x		x			x
LO	Explain the main components of the CDU as follows: CDU display including the following terms: • page title, • data field, • scratch pad; line-select keys; numeric keys; alpha keys; function and mode keys used to select specific data pages on the CDU display, to execute orders or to navigate to pages through the data presented; warning lights, message light and offset light.	x		x			x
062 05 05 02	**EFIS instruments (attitude display, navigation display)**						
LO	State that FMS-equipped aircraft typically has two displays on the instrument panel in front of each pilot.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the following data are typically displayed on the attitude display: attitude information; flight director command bars; radio height and barometric altitude; course deviation indication; glide-path information (when an ILS is tuned); speed information.	x		x			x
062 05 05 03	**Typical modes of the navigation display**						
LO	State the following typical modes of the navigation display: full VOR/ILS mode showing the whole compass rose; expanded (arc) VOR/ILS mode showing the forward 90° sector; map mode; plan mode.	x		x			x
062 05 05 04	**Typical information on the navigation display**						

LO	List and interpret the following information typically shown on a navigation display in 'Full VOR/ILS' mode: the map display will be in full VOR mode when a VOR frequency is selected, and full ILS mode when an ILS frequency is selected on the VHF NAV frequency selector; DME distance to selected DME station; a full 360° compass rose. At the top of the compass rose, present heading is indicated and shown as digital numbers in a heading box. Next to the heading box it is indicated whether the heading is true or magnetic. True heading is available on aircraft with IRS. A triangle (different symbols are used on different aircraft) on the compass rose indicates present track. Track indication is only available when the FMC navigation computer is able to compute the aircraft's position. A square symbol on the outside of the compass rose indicates the selected heading for the autopilot, and if 'heading select' mode is activated on the autopilot, this is the heading the aircraft will turn to. Within the compass rose, a CDI is shown. On the CDI, the course pointer points to the selected VOR/ILS course SET on the OBS. On the CDI, the course deviation bar will indicate angular deflection from the selected VOR/ILS track. Full-scale deflection side to side in VOR mode is 20°, and 5° in ILS mode. In VOR mode, a TO/FROM indication is shown on the display. The selected ILS/VOR frequency is shown. ILS or VOR mode is shown according to the selected frequency.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	If an ILS frequency is selected, a glide-path deviation scale is shown.						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	A wind arrow indicating wind direction according to the compass rose, and velocity in numbers next to the arrow.	x		x			x
LO	Given an EFIS navigation display in full VOR/ILS mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; selected course; actual radial; left or right of selected track; above or below the glide path; distance to the DME station; selected heading for the autopilot heading select bug; determine whether the display is in VOR or ILS rose mode.	x		x			x
LO	Given an EFIS navigation display in expanded VOR/ILS mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; tailwind/headwind; wind velocity; selected course; actual radial; left or right of selected track; above or below the glide path; distance to the DME station; selected heading for the autopilot heading select bug; state whether the display is in VOR or ILS rose mode.	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Given an EFIS navigation display in map mode, read off the following information: heading (magnetic/true); track (magnetic/true); drift; wind correction angle; tailwind/headwind; wind velocity; left or right of the FMS track; distance to active waypoint; ETO next waypoint; selected heading for the autopilot heading select bug; determine whether a depicted symbol is a VOR/DME station or an airport; determine whether a specific waypoint is part of the FMS route.	x		x			x
LO	Given an EFIS navigation display in plan mode, read off the following information: heading (magnetic/true) track (magnetic/true) drift; wind correction angle; distance to active waypoint; ETO active waypoint; state the selected heading for the autopilot heading select bug; measure and state true track of specific FMS route track.	x		x			x
062 06 00 00	**GLOBAL NAVIGATION SATELLITE SYSTEMS**						
062 06 01 00	**GPS, GLONASS, GALILEO**						
062 06 01 01	**Principles**						
LO	State that there are two main Global Navigation Satellite Systems (GNSS) currently in existence with a third one which is planned to be fully operational by 2011. These are: USA NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS); Russian GLObal NAvigation Satellite System (GLONASS); European GALILEO.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that all three systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position.	x	x	x	x	x	x
062 06 01 02	**Operation**						
	NAVSTAR GPS						
LO	State that there are currently two modes of operation: Standard Positioning Service (SPS) for civilian users, and Precise Positioning Service (PPS) for authorised users.	x	x	x	x	x	x
LO	SPS was originally designed to provide civilian users with a less accurate positioning capability than PPS.	x	x	x	x	x	x
LO	Name the three segments as follows: space segment; control segment; user segment.	x	x	x	x	x	x
	Space segment						
LO	State that the space segment consists of a notional constellation of 24 operational satellites.	x	x	x	x	x	x
LO	State that the satellites are orbiting the Earth in orbits inclined 55° to the plane of the equator.	x	x	x	x	x	x
LO	State that the satellites are in a nearly circular orbit of the Earth at an altitude of 20 200 km (10 900 NM).	x	x	x	x	x	x
LO	State that the satellites are distributed in 6 orbital planes with at least 4 satellites in each.	x	x	x	x	x	x
LO	State that a satellite completes an orbit in approximately 12 hours.	x	x	x	x	x	x
LO	State that each satellite broadcasts ranging signals on two UHF frequencies: L1 1575.42 MHz and L2 1227.6 MHz.	x	x	x	x	x	x
LO	State that SPS is a positioning and timing service provided on frequency L1.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that PPS uses both frequencies L1 and L2.	x	x	x	x	x	x
LO	In 2005, the first replacement satellite was launched with a new military M code on the L1 frequency, and a second signal for civilian use L2C on the L2 frequency.	x	x	x	x	x	x
LO	State that the ranging signal contains a Coarse Acquisition (C/A) code and a navigational data message.	x	x	x	x	x	x
LO	State that the navigation message contains: almanac data; ephemeris; satellite clock correction parameters; UTC parameters; ionospheric model; satellite health data.	x	x	x	x	x	x
LO	State that it takes 12,5 minutes for a GPS receiver to receive all the data frames in the navigation message.	x	x	x	x	x	x
LO	State that the almanac contains the orbital data about all the satellites in the GPS constellation.	x	x	x	x	x	x
LO	State that the ephemeris contains data used to correct the orbital data of the satellites due to small disturbances.	x	x	x	x	x	x
LO	State that the clock correction parameters are data for the correction of the satellite time.	x	x	x	x	x	x
LO	State that UTC parameters are factors determining the difference between GPS time and UTC.	x	x	x	x	x	x
LO	State that an ionospheric model is currently used to calculate the time delay of the signal travelling through the ionosphere.	x	x	x	x	x	x
LO	State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data.	x	x	x	x	x	x
LO	State that GPS uses the WGS-84 model.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that two codes are transmitted on the L1 frequency, namely a C/A code and a Precision (P) code. The P code is not used for SPS.	x	x	x	x	x	x
LO	State that the C/A code is a Pseudo Random Noise (PRN) code sequence, repeating every millisecond. Each C/A code is unique and provides the mechanism to identify each satellite.	x	x	x	x	x	x
LO	State that satellites broadcast the PRN codes with reference to the satellite vehicle time which are subsequently changed by the receiver to UTC.	x	x	x	x	x	x
LO	State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference.	x	x	x	x	x	x
	Control segment						
LO	State that the control segment comprises: a master control station; ground antenna; monitoring stations.	x	x	x	x	x	x
LO	State that the master control station is responsible for all aspects of the constellation command and control.	x	x	x	x	x	x
LO	State that the main tasks of the control segment are: managing SPS performance; navigation data upload; monitoring satellites.	x	x	x	x	x	x
	User segment						
LO	State that GPS supplies three-dimensional position fixes and speed data, plus a precise time reference.	x	x	x	x	x	x
LO	State that the GPS receiver used in aviation is a multichannel type.	x	x	x	x	x	x
LO	State that a GPS receiver is able to determine the distance to a satellite by determining the difference between the time of transmission by the satellite and the time of reception.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the initial distance calculated to the satellites is called pseudo-range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range.	x	x	x	x	x	x
LO	State that each range defines a sphere with its centre at the satellite.	x	x	x	x	x	x
LO	State that three satellites are needed to determine a two-dimensional position.	x	x	x	x	x	x
LO	State that four spheres are needed to calculate a three-dimensional position, hence four satellites are required.	x	x	x	x	x	x
LO	State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites.	x	x	x	x	x	x
LO	State that the receiver is able to calculate aircraft ground speed using the SV Doppler frequency shift and/or the change in receiver position over time.	x	x	x	x	x	x
	NAVSTAR GPS integrity						
LO	Define 'Receiver Autonomous Integrity Monitoring (RAIM)'. A technique whereby a receiver processor determines the integrity of the navigation signals.	x	x	x	x	x	x
LO	State that RAIM is achieved by consistency check among pseudo-range measurements.	x	x	x	x	x	x
LO	State that basic RAIM requires five satellites. A sixth is for isolating a faulty satellite from the navigation solution.	x	x	x	x	x	x
LO	State that when a GPS receiver uses barometric altitude as an augmentation to RAIM, the number of satellites needed for the receiver to perform the RAIM function may be reduced by one.	x	x	x	x	x	x
	GLONASS						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the three components of GLONASS: space segment, which contains the constellation of satellites; control segment, which contains the ground-based facilities; user segment, which contains the user equipment.	x	x	x	x	x	x
LO	State the composition of the constellation in the 'space segment': 24 satellites in 3 orbital planes with 8 equally displaced by 45° of latitude; a near-circular orbit at 19 100 km at an inclination of 64.8° to the equator; each orbit is completed in 11 hours and 15 minutes.	x	x	x	x	x	x
LO	State that the control segment provides: monitoring of the constellation status; correction to orbital parameters; navigation data uploading.	x	x	x	x	x	x
LO	State that the user equipment consists of receivers and processors for the navigation signals for the calculation of the coordinates, velocity and time.	x	x	x	x	x	x
LO	State that the time reference is UTC.	x	x	x	x	x	x
LO	State that the datum used is PZ-90 Earth-centred Earth-fixed.	x	x	x	x	x	
LO	State that each satellite transmits navigation signals on two frequencies of L-band, L1 1.6 GHz and L2 1.2 GHz.	x	x	x	x	x	x
LO	State that L1 is a standard-accuracy signal designed for civilian users worldwide and L2 is a high-accuracy signal modulated by a special code for authorised users only.	x	x	x	x	x	x
LO	State that the navigation message has a duration of 2 seconds and contains 'immediate' data which relates to the actual satellite transmitting the given navigation signal and 'non-immediate' data which relates to all other satellites within the constellation.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that 'immediate data' consists of: enumeration of the satellite time marks; difference between onboard time scale of the satellite and GLONASS time; relative differences between carrier frequency of the satellite and its nominal value; ephemeris parameters.	x	x	x	x	x	x
LO	State that 'non-immediate' data consists of: data on the status of all satellites within the space segment; coarse corrections to onboard time scales of each satellite relative to GLONASS time; orbital parameters of all satellites within the space segment; correction to GLONASS time relative to UTC (must remain within 1 microsecond).	x	x	x	x	x	x
LO	State that integrity monitoring includes checking the quality of the characteristics of the navigation signal and the data within the navigation message.	x	x	x	x	x	x
LO	State that integrity monitoring is implemented in two ways: Continuous automatic operability monitoring of principal systems in each satellite. If a malfunction occurs, an 'unhealthy' flag appears within the 'immediate data' of the navigation message. Special tracking stations within the ground-based control segment are used to monitor the space-segment performance. If a malfunction occurs, an 'unhealthy' flag appears within the 'immediate data' of the navigation message.	x	x	x	x	x	x
LO	State that agreements have been concluded between the appropriate agencies for the interoperability by any approved user of NAVSTAR and GLONASS systems.	x	x	x	x	x	x
	GALILEO						
LO	State that the core of the Galileo constellation will consist of 30 satellites with 9 plus a spare replacement in each of the 3 planes in near-circular orbit at an altitude of 23 222 km inclined at 56° to the plane of the equator.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that the signals will be transmitted in 3 frequency bands: 1 164–1 215 MHz, 1 260–1 300 MHz and 1 559–1 591 MHz (1 559–1 591 MHz will be shared with GPS on a non-interference basis).	x	x	x	x	x	x
LO	State that each orbit will take 14 hours.	x	x	x	x	x	x
LO	State that each satellite has three sections: timing, signal generation and transmit.	x	x	x	x	x	x
LO	State that in the 'timing section' two clocks have been developed, a Rubidium Frequency Standard clock and a more precise Passive Hydrogen Maser clock.	x	x	x	x	x	x
LO	State that the signal generation contains the navigation signals.	x	x	x	x	x	x
LO	State that the navigation signals consist of a ranging-code identifier and the navigation message.	x	x	x	x	x	x
LO	State that the navigation message basically contains information concerning the satellite orbit (ephemeris) and the clock references.	x	x	x	x	x	x
LO	State that the navigation message is 'up-converted' on four navigation signal carriers and the outputs are combined in a multiplexer before transmission in the transmit section.	x	x	x	x	x	x
LO	State that the navigation antenna has been designed to minimise interference between satellites by having equal power level propagation paths independent of elevation angle.	x	x	x	x	x	x
LO	State that the system is monitored in a similar way for both GPS NAVSTAR and GLONASS, but also by a new method based on spread-spectrum signals.	x	x	x	x	x	x
LO	State that tracking, telemetry and command operations are controlled by sophisticated data encryption and authentication procedures.	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	GPS, EGNOS and GALILEO are compatible, will not interfere with each other, and the performance of the receiver will be enhanced by the interoperability of the systems.	x	x	x	x	x	x
	GALILEO future developments *Info: Further LOs will be written as details are released.*						
062 06 01 03	**Errors and factors affecting accuracy**						
LO	List the most significant factors affecting accuracy: ionospheric propagation delay; dilution of position; satellite clock error; satellite orbital variations; multipath.	x	x	x	x	x	x
LO	State that Ionospheric Propagation Delay (IPD) can almost be eliminated by using two frequencies.	x	x	x	x	x	x
LO	State that in SPS receivers, IPD is currently corrected by using the ionospheric model from the navigation message, but the error is only reduced by 50 %.	x	x	x	x	x	x
LO	State that ionospheric delay is the most significant error.	x	x	x	x	x	x
LO	State that dilution of position arises from the geometry and number of satellites in view. It is called Position Dilution of Precision (PDOP).	x	x	x	x	x	x
LO	State that errors in the satellite orbits are due to: solar wind; gravitation of the Sun, Moon and planets.	x	x	x	x	x	x
LO	State that multipath is when the signal arrives at the receiver via more than one path (the signal being reflected from surfaces near the receiver).	x	x	x	x	x	x
062 06 02 00	**Ground, satellite and airborne-based augmentation systems**						
062 06 02 01	***Ground-Based Augmentation Systems (GBAS)***						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the principle of a GBAS: to measure on ground the signal errors transmitted by GNSS satellites and relay the measured errors to the user for correction.	x	x	x	x	x	x
LO	State that the ICAO GBAS standard is based on this technique through the use of a data link in the VHF band of ILS–VOR systems (108–118 MHz).	x	x	x	x	x	x
LO	State that for a GBAS station the coverage is about 30 km.	x	x	x	x	x	x
LO	Explain that ICAO Standards provide the possibility to interconnect GBAS stations to form a network broadcasting large-scale differential corrections. Such a system is identified as Ground Regional Augmentation System (GRAS).	x	x	x	x	x	x
LO	Explain that GBAS ground subsystems provide two services: precision approach service and GBAS positioning service. The precision approach service provides deviation guidance for final-approach Segments, while the GBAS positioning service provides horizontal position information to support RNAV operations in terminal areas.	x	x	x	x	x	x
LO	Explain that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with approach data, corrections and integrity information for GNSS satellites in view via a VHF Data Broadcast (VDB).	x	x	x	x	x	x
LO	State that the minimum GBAS plan coverage is 15 NM from the landing threshold point within 35° apart the final approach path and 10° apart between 15 and 20 NM.	x	x	x	x	x	x
LO	State that GBAS based on GPS is sometimes called Local Area Augmentation System (LAAS).	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the characteristics of a Local Area Augmentation System (LAAS) with respect to: differential corrections applied to a satellite signal by a ground-based reference station; regional service providers to compute the integrity of the satellite signals over their region; extra accuracy for extended coverage around airports, railways, seaports and urban areas as required by the user.	x	x	x	x	x	x
062 06 02 02	***Satellite-Based Augmentation Systems (SBAS)***						
LO	Explain the principle of a SBAS: to measure on the ground the signal errors transmitted by GNSS satellites and transmit differential corrections and integrity messages for navigation satellites.	X	x	x	x	x	x
LO	State that the frequency band of the data link is identical to that of the GPS signals.	X	x	x	x	x	x
LO	Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas.	X	x	x	x	x	x
LO	Explain that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites.	X	x	x	x	x	x
LO	State that SBAS consists of three elements: the ground infrastructure (monitoring and processing stations); the SBAS satellites; the SBAS airborne receivers.	X	x	x	x	x	x
LO	Explain that the SBAS station network measures the pseudo-range between the ranging source and an SBAS receiver at the known locations and provides separate corrections for ranging source ephemeris errors, clock errors and ionospheric errors. The user applies corrections for tropospheric delay.	X	x	x	x	x	x
LO	Explain that SBAS can provide approach and landing operations with vertical guidance (APV) and precision approach service.	X	x	x	x	x	x
LO	Explain the difference between 'coverage area' and 'service area'.	X	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State that Satellite-Based Augmentation Systems include: EGNOS in western Europe and the Mediterranean; WAAS in the USA; MSAS in Japan; GAGAN in India.	X	x	x	x	x	x
LO	Explain that SBAS systems regionally augment GPS and GLONASS by making them suitable for safety-critical applications such as landing aircraft.	X	x	x	x	x	x
062 06 02 03	***European Geostationary Navigation Overlay Service (EGNOS)***						
LO	State that EGNOS consists of three geostationary Inmarsat satellites which broadcast GPS lookalike signals.	X	x	x	x	x	x
LO	State that EGNOS is designed to improve accuracy to 1–2 m horizontally and 3–5 m vertically.	X	x	x	x	x	x
LO	Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hours GPS alone).	X	x	x	x	x	x
062 06 02 04	***Airborne-Based Augmentation Systems (ABAS)***						
LO	Explain the principle of ABAS: to use redundant elements within the GPS constellation (e.g.: multiplicity of distance measurements to various satellites) or the combination of GNSS measurements with those of other navigation sensors (such as inertial systems) in order to develop integrity control.	x	x	x	x	x	x
LO	State that the type of ABAS using only GNSS information is named Receiver Autonomous Integrity Monitoring (RAIM).	x	x	x	x	x	x
LO	State that a system using information from additional onboard sensors is named Aircraft Autonomous Integrity Monitoring (AAIM).	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain that the typical sensors used are barometric altimeter, clock and inertial navigation system.	x	x	x	x	x	x
LO	Explain that unlike GBAS and SBAS, ABAS does not improve positioning accuracy.	x	x	x	x	x	x

L. SUBJECT 070 — OPERATIONAL PROCEDURES

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
070 00 00 00	**OPERATIONAL PROCEDURES**						
071 01 00 00	**GENERAL REQUIREMENTS**						
071 01 01 00	**ICAO Annex 6**						
071 01 01 01	**Definitions**						
LO	Alternate aerodrome: take-off alternate, en route alternate, ETOPS en route alternate, destination alternate (ICAO Annex 6, Part I, Chapter 1).	x	x				
LO	Alternate heliport (ICAO Annex 6, Part III, Section 1, Chapter 1).			x	x	x	
LO	Flight time — aeroplanes (ICAO Annex 6, Part I, Chapter 1).	x	x				
LO	Flight time — helicopters (ICAO Annex 6, Part III, Section 1, Chapter 1).			x	x	x	
071 01 01 02	**Applicability**						
LO	State that Part I shall be applicable to the operation of aeroplanes by operators authorised to conduct international commercial air transport operations (ICAO Annex 6, Part I, Chapter 2).	x	x				
LO	State that Part III shall be applicable to all helicopters engaged in international commercial air transport operations or in international general aviation operations, except it is not applicable to helicopters engaged in aerial work (ICAO Annex 6, Part III, Section 1, Chapter 2).			x	x	x	
071 01 01 03	**General**						
LO	State compliance with laws, regulations and procedures (ICAO Annex 6, Part I, Chapter 3.1/Part III, Section 2, Chapter 1.1).	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State accident prevention and flight safety programme (ICAO Annex 6, Part I, Chapter 3.2).	x	x				
LO	State flight safety documents system (ICAO Annex 6, Part I, Chapter 3.3).	x	x				
LO	State maintenance release (ICAO Annex 6, Part I, Chapter 8.8/Part III, Section 2, Chapter 6.7).	x	x	x	x	x	
LO	List and describe the lights to be displayed by aircraft (ICAO Annex 6, Part I, Appendix 1).	x	x				
071 01 02 00	**Operational requirements**						
071 01 02 01	**Applicability**						
LO	State the operational regulations applicable to commercial air transportation.	x	x	x	x	x	
LO	Nature of operations and exceptions.	x	x	x	x	x	
071 01 02 02	**General**						
LO	State that a commercial air transportation flight must meet the applicable operational requirements.	x	x	x	x	x	
LO	Flight Manual limitations — Flight through the Height Velocity (HV) envelope.			x	x	x	
LO	Define 'Helicopter Emergency Medical Service'.			x	x	x	
LO	Operations over a hostile environment — Applicability.			x	x	x	
LO	Local area operations — Approval.			x	x	x	
LO	State the requirements about language used for crew communication and operations manual.	x	x	x	x	x	
LO	Explain the relation between MMEL and MEL.	x	x	x	x	x	
LO	State the operator's requirements regarding a management system.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the operator's requirements regarding accident prevention and flight safety programme.	x	x	x	x	x	
LO	State the operator's responsibility regarding the distinction between cabin crew members and additional crew members.	x	x				
LO	State the operations limitations regarding ditching requirements.	x	x				
LO	State the regulations concerning the carriage of persons on an aircraft.	x	x	x	x	x	
LO	State the crew members' responsibilities in the execution of their duties, and define the commander's authority.	x	x	x	x	x	
LO	State the operator's and commander's responsibilities regarding admission to the flight deck and carriage of unauthorised persons or cargo.	x	x	x	x	x	
LO	State the operator's responsibility concerning portable electronic devices.	x	x	x	x	x	
LO	State the operator's responsibilities regarding admission in an aircraft of a person under the influence of drug or alcohol.	x	x	x	x	x	
LO	State the regulations concerning endangering safety.	x	x	x	x	x	
LO	List the documents to be carried on each flight.	x	x	x	x	x	
LO	State the operator's responsibility regarding manuals to be carried.	x	x	x	x	x	
LO	List the additional information and forms to be carried on board.	x	x	x	x	x	
LO	List the items of information to be retained on the ground by the operator.	x	x	x	x	x	
LO	State the operator's responsibility regarding inspections.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the responsibility of the operator and of the commander regarding the production of and access to records and documents.	x	x	x	x	x	
LO	State the operator's responsibility regarding the preservation of documentation and recordings, including recorders recordings.	x	x	x	x	x	
LO	Define the terms used in leasing and state the responsibility and requirements of each party in various cases.	x	x	x	x	x	
071 01 02 03	**Operator certification and supervision**						
LO	State the requirement to be satisfied for the issue of an Air Operator's Certificate (AOC).	x	x	x	x	x	
LO	State the rules applicable to air operator certification.	x	x	x	x	x	
LO	State the conditions to be met for the issue or revalidation of an AOC.	x	x	x	x	x	
LO	Explain the contents and conditions of the AOC.	x	x	x	x	x	
071 01 02 04	**Operational procedures (except long-range flight preparation)**						
LO	Define the terms used for operational procedures.	x	x				
LO	State the operator's responsibilities regarding Operations Manual.	x	x	x	x	x	
LO	State the operator's responsibilities regarding competence of operations personnel.	x	x	x	x	x	
LO	State the operator's responsibilities regarding establishment of procedures.	x	x	x	x	x	
LO	State the operator's responsibilities regarding use of air traffic services.	x	x	x	x	x	
LO	State the operator's responsibilities regarding authorisation of aerodromes/ heliports by the operator.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain which elements must be considered by the operator when specifying aerodrome/heliport operating minima.	x	x	x	x	x	
LO	State the operator's responsibilities regarding departure and approach procedures.	x	x	x	x	x	
LO	State the parameters to be considered in noise-abatement procedures.	x	x				
LO	State the elements to be considered regarding routes and areas of operation.	x	x	x	x	x	
LO	State the additional specific navigation-performance requirements.	x	x	x	x	x	
LO	State the maximum distance from an adequate aerodrome for two-engine aeroplanes without an ETOPS approval.	x	x				
LO	State the requirement for alternate-airport accessibility check for ETOPS operations.	x	x				
LO	List the factors to be considered when establishing minimum flight altitude.	x	x	x	x	x	
LO	Describe the components of the fuel policy.	x	x	x	x	x	
LO	State the requirements for carrying persons with reduced mobility.	x	x	x	x	x	
LO	State the operator's responsibilities for the carriage of inadmissible passengers, deportees or persons in custody.	x	x	x	x	x	
LO	State the requirements for the stowage of baggage and cargo in the passenger cabin.	x	x	x	x	x	
LO	State the requirements regarding passenger seating and emergency evacuation.	x	x	x	x	x	
LO	Detail the procedures for a passenger briefing in respect of emergency equipment and exits.	x	x	x	x	x	
LO	State the flight preparation forms to be completed before flight.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the commander's responsibilities during flight preparation.	x	x	x	x	x	
LO	State the rules for aerodromes/heliports selection (including ETOPS configuration).	x	x	x	x	x	
LO	Explain the planning minima for IFR flights.	x		x			
LO	State the rules for refuelling/defuelling.	x	x	x	x	x	
LO	State 'crew members at station' policy.	x	x	x	x	x	
LO	State the use of seats, safety belts and harnesses.	x	x	x	x	x	
LO	State securing of passenger cabin and galley requirements.	x	x	x	x	x	
LO	State the commander's responsibility regarding smoking on board.	x	x	x	x	x	
LO	State under which conditions a commander can commence or continue a flight regarding meteorological conditions.	x	x	x	x	x	
LO	State the commander's responsibility regarding ice and other contaminants.	x	x	x	x	x	
LO	State the commander's responsibility regarding fuel to be carried and in-flight fuel management.	x	x	x	x	x	
LO	State the requirements regarding the use of supplemental oxygen.	x	x	x	x	x	
LO	State the ground-proximity detection reactions.	x	x	x	x	x	
LO	Explain the requirements for use of ACAS.	x	x	x	x	x	
LO	State the commander's responsibility regarding approach and landing.	x	x	x	x	x	
LO	State the circumstances under which a report shall be submitted.	x	x	x	x	x	
071 01 02 05	**All-weather operations**						
LO	State the operator's responsibility regarding aerodrome/heliport operating minima.	x		x			

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the parameters to be considered in establishing the aerodrome operating minima.	x		x			
LO	Define the criteria to be taken into consideration for the classification of aeroplanes.	x					
LO	Define the following terms: 'circling', 'low-visibility procedures', 'low-visibility take-off', 'visual approach'.	x		x			
LO	Define the following terms: 'flight control system', 'fail-passive flight control system', 'fail-operational flight control system', 'fail-operational hybrid landing system'.	x					
LO	Define the following terms: 'final approach and take-off area'.			x			
LO	State the general operating rules for low-visibility operations.	x		x			
LO	Low-visibility operations — aerodrome/ heliport considerations.	x		x			
LO	State the training and qualification requirements for flight crew to conduct low-visibility operations.	x		x			
LO	State the operating procedures for low-visibility operations.	x		x			
LO	State the operator's and commander's responsibilities regarding minimum equipment for low-visibility operations.	x		x			
LO	VFR operating minima.	x		x			
LO	Aerodrome operating minima: state under which conditions the commander can commence take-off.	x		x			
LO	Aerodrome operating minima: state that take-off minima are expressed as visibility or RVR.	x		x			

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Aerodrome operating minima: state the take-off RVR value depending on the facilities.	x		x			
LO	Aerodrome operating minima: state the system minima for non-precision approach.	x		x			
LO	Aerodrome operating minima: state under which conditions a pilot can continue the approach below MDA/H or DA/H.	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 1 (including single-pilot operations).	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 2 operations.	x		x			
LO	Aerodrome operating minima: state the lowest minima for precision approach category 3 operations.	x					
LO	Aerodrome operating minima: state the lowest minima for circling and visual approach.	x		x			
LO	Aerodrome operating minima: state the RVR value and cloud ceiling depending on the facilities (class 1, 2 and 3).			x			
LO	Aerodrome operating minima: state under which conditions an airborne radar approach can be performed and state the relevant minima.			x			
071 01 02 06	**Instruments and equipment**						
LO	State which items do not require an equipment approval.	x	x	x	x	x	
LO	State the requirements regarding spare-fuses availability.	x	x				
LO	State the requirements regarding operating lights.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirements regarding windshield wipers.	x	x				
LO	List the equipment for operations requiring a radio communication.			x	x	x	
LO	List the equipment for operations requiring a radio-navigation system.			x	x	x	
LO	List the minimum equipment required for day and night VFR flights.	x	x	x	x	x	
LO	List the minimum equipment required for IFR flights.	x		x			
LO	State the required equipment for single-pilot operation under IFR.	x		x			
LO	State the requirements for an altitude alert system.	x	x				
LO	State the requirements for radio altimeters.			x	x	x	
LO	State the requirements for GPWS/TAWS.	x	x				
LO	State the requirements for ACAS.	x	x				
LO	State the conditions under which an aircraft must be fitted with a weather radar.	x	x	x	x	x	
LO	State the requirements for operations in icing conditions.	x	x	x	x	x	
LO	State the conditions under which a crew member interphone system and public address system are mandatory.	x	x	x	x	x	
LO	State the circumstances under which a cockpit voice recorder is compulsory.	x	x	x	x	x	
LO	State the rules regarding the location, construction, installation and operation of cockpit voice recorders.	x	x	x	x	x	
LO	State the circumstances under which a flight data recorder is compulsory.	x	x	x	x	x	
LO	State the rules regarding the location, construction, installation and operation of flight data recorders.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirements about seats, seat safety belts, harnesses and child-restraint devices.	x	x	x	x	x	
LO	State the requirements about 'Fasten seat belt' and 'No smoking' signs.	x	x	x	x	x	
LO	State the requirements regarding internal doors and curtains.	x	x				
LO	State the requirements regarding first-aid kits.	x	x	x	x	x	
LO	State the requirements regarding emergency medical kits and first-aid oxygen.	x	x				
LO	Detail the rules regarding the carriage and use of supplemental oxygen for passengers and crew.	x	x	x	x	x	
LO	Detail the rules regarding crew-protective breathing equipment.	x	x				
LO	Describe the minimum number, type and location of handheld fire extinguishers.	x	x	x	x	x	
LO	Describe the minimum number and location of crash axes and crowbars.	x	x				
LO	Specify the colours and markings used to indicate break-in points.	x	x	x	x	x	
LO	State the requirements for means of emergency evacuation.	x	x				
LO	State the requirements for megaphones.	x	x	x	x	x	
LO	State the requirements for emergency lighting.	x	x	x	x	x	
LO	State the requirements for an emergency locator transmitter.	x	x	x	x	x	
LO	State the requirements for life jackets, life rafts, survival kits and ELTs.	x	x	x	x	x	
LO	State the requirements for crew survival suit.			x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirements for survival equipment.	x	x	x	x	x	
LO	State the additional requirements for helicopters operating to or from helidecks located in a hostile sea area.			x	x	x	
LO	State the requirements for an emergency flotation equipment.			x	x	x	
071 01 02 07	**Communication and navigation equipment**						
LO	Explain the general requirements for communication and navigation equipment.	x	x	x	x	x	
LO	State that the radio-communication equipment must provide communications on 121.5 MHz.	x	x	x	x	x	
LO	State the requirements regarding the provision of an audio selector panel.	x	x	x	x	x	
LO	List the requirements for radio equipment when flying under VFR by reference to visual landmarks.	x	x	x	x	x	
LO	List the requirements for communications and navigation equipment when operating under IFR or under VFR over routes not navigated by reference to visual landmarks.	x	x	x	x	x	
LO	State the equipment required to operate within RVSM airspace.	x	x				
071 01 02 09	**Flight crew**						
LO	State the requirement regarding crew composition and in-flight relief.	x	x	x	x	x	
LO	State the requirement for conversion training and checking.	x	x	x	x	x	
LO	State the requirement for differences training and familiarisation training.	x	x	x	x	x	
LO	State the conditions for upgrade from co-pilot to commander.	x	x	x	x	x	
LO	State the minimum qualification requirements to operate as a commander.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirement for recurrent training and checking.	x	x	x	x	x	
LO	State the requirement for a pilot to operate on either pilot's seat.	x	x	x	x	x	
LO	State the minimum recent experience for the commander and the co-pilot.	x	x	x	x	x	
LO	Specify the route and aerodrome/ heliport qualification required for a commander or a pilot flying.	x	x	x	x	x	
LO	State the requirement to operate on more than one type or variant.	x	x	x	x	x	
LO	State that when a flight crew member operates both helicopters and aeroplanes, the operations are limited to one type of each.	x	x				
LO	State the training records requirement.	x	x	x	x	x	
071 01 02 10	**Cabin crew/crew members other than flight crew**						
LO	State who is regarded as a cabin crew member.	x	x	x	x	x	
LO	Detail the requirements regarding cabin crew members.	x	x	x	x	x	
LO	State the acceptability criteria.	x	x	x	x	x	
LO	State the requirements regarding senior cabin crew members.	x	x	x	x	x	
LO	State the conditions to operate on more than one type or variant.	x	x	x	x	x	
071 01 02 11	**Manuals, logs and records**						
LO	Explain the general rules for the operations manual.	x	x	x	x	x	
LO	Explain the structure and subject headings of the operations manual.	x	x	x	x	x	
LO	State the requirements for a journey logbook.	x	x	x	x	x	
LO	Describe the requirements regarding the operational flight plan.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the requirements for document-storage periods.	x	x	x	x	x	
071 01 02 12	**Flight and duty-time limitations and rest requirements**						
LO	Explain the definitions used for flight-time regulation.	x	x				
LO	State the flight and duty limitations.	x	x				
LO	State the requirements regarding the maximum daily flight-duty period.	x	x				
LO	State the requirements regarding rest periods.	x	x				
LO	Explain the possible extension of flight-duty period due to in-flight rest.	x	x				
LO	Explain the captain's discretion in case of unforeseen circumstances in actual flight operations.	x	x				
LO	Explain the regulation regarding standby.	x	X				
LO	State the requirements regarding flight-duty, duty and rest-period records.	x	x				
071 01 02 13	**Transport of dangerous goods by air**						
LO	Explain the terminology relevant to dangerous goods.	x	x	x	x	X	
LO	Explain the scope of the regulation.	x	x	x	x	x	
LO	Explain the limitations on the transport of dangerous goods.	x	x	x	x	x	
LO	State the requirements for the acceptance of dangerous goods.	x	x	x	x	x	
LO	State the requirements regarding inspection for damage, leakage or contamination.	x	x	x	x	x	
LO	Explain the loading restrictions.	x	x	x	x	x	
LO	State the requirement for provision of information to the crew.	x	x	x	x	x	
LO	Explain the requirements for dangerous goods incident and accident reports.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
071 01 03 00	**Long-range flights**						
071 01 03 01	**Flight management**						
LO	Navigation-planning procedures: describe the operator's responsibilities concerning ETOPS routes; list the factors to be considered by the commander before commencing the flight.	x					
LO	Selection of a route: describe the meaning of the term 'adequate aerodrome'; describe the limitations on extended-range operations with two-engine aeroplanes with and without ETOPS approval.	x					
LO	Selection of cruising altitude (MNPSA Manual Chapter 4): specify the appropriate cruising levels for normal long-range IFR flights and for those operating on the North Atlantic Operational Track Structure.	x					
LO	Selection of alternate aerodrome: state the circumstances in which a take-off alternate must be selected; state the maximum flight distance of a take-off alternate for: two-engine aeroplane, ETOPS-approved aeroplane, three or four-engine aeroplane; state the factors to be considered in the selection of a take-off alternate; state when a destination alternate need not be selected; state when two destination alternates must be selected; state the factors to be considered in the selection of a destination alternate aerodrome; state the factors to be considered in the selection of an en route alternate aerodrome.	x					
LO	Minimum time routes: define, construct and interpret minimum time route (route giving the shortest flight time from departure to destination adhering to all ATC and airspace restrictions).	x					

071 01 03 02	**Transoceanic and polar flight**						
LO	(ICAO Doc 7030) Describe the possible indications of navigation-system degradation. Describe by what emergency means course and INS can be cross-checked in the case of: three navigation systems, two navigation systems. Interpret VOR, NDB, VOR/DME information to calculate aircraft position and aircraft course. Describe the general ICAO procedures applicable in North Atlantic airspace (NAT) if the aircraft is unable to continue the flight in accordance with its air traffic control clearance. Describe the ICAO procedures applicable in North Atlantic Airspace (NAT) in case of radio-communication failure. Describe the recommended initial action if an aircraft is unable to obtain a revised air traffic control clearance. Describe the subsequent action for: aircraft able to maintain assigned flight level, and aircraft unable to maintain assigned flight level. Describe determination of tracks and courses for random routes in NAT. Specify the method by which planned tracks are defined (by latitude and longitude) in the NAT region: when operating predominately in an east–west direction south of 70°N, when operating predominately in an east–west direction north of 70°N. State the maximum flight time recommended between significant points. Specify the method by which planned tracks are defined for flights operating predominantly in a north–south direction. Describe how the desired route must be specified in the air traffic control flight plan.	x					

LO	Polar navigation *Terrestrial magnetism characteristics in polar zones* Explain why magnetic compasses become unreliable or useless in polar zones. State in which area VORs are referenced to the true north. *Specific problems of polar navigation* Describe the general problems of polar navigation. Describe what precautions can be taken when operating in the area of compass unreliability as a contingency against INS failure. Describe how grid navigation can be used in conjunction with a Directional Gyro (DG) in polar areas. Use polar stereographic chart and grid coordinates to solve polar navigation problems. Use polar stereographic chart and grid coordinates to calculate navigation data. Use INS information to solve polar navigation problems. Define, calculate: transport precession, Earth-rate (astronomic) precession, convergence factor. Describe the effect of using a free gyro to follow a given course. Describe the effect of using a gyro compass with hourly rate corrector unit to follow a given course. Convert grid navigation data into true navigation data, into magnetic navigation data, and into compass navigation data. Justify the selection of a different 'north' reference at a given position. Calculate the effects of gyro drift due to the Earth's rotation (15 degrees / h × sin Lm).	x						
071 01 03 03	**MNPS airspace**							
LO	Geographical limits: state the lateral dimensions (in general terms) and vertical limits of MNPS airspace (ICAO Doc 7030 NAT/RAC-2 3.2.1); state that operators must ensure that crew follow NAT MNPSA Operations Manual procedures (ICAO Doc 7030 NAT/RAC-2 3.2.3).	x						
LO	Define the following acronyms: MNPS, MNPSA, OCA, OTS, PRM, PTS, RVSM, LRNS, MASPS, SLOP, WATRS (MNPSA Manual, Glossary of Terms).	x						

LO	Aircraft system requirements (MNPSA Manual, Chapter 1): navigation requirements for unrestricted MNPS airspace operations; routes for use by aircraft not equipped with two LRNSs: routes for aircraft with only one LRNS, routes for aircraft with short-range navigation equipment only; performance monitoring.	x					
LO	Organised Track System (MNPSA Manual, Chapter 2): construction of the Organised Track System (OTS); NAT track message; OTS changeover periods.	x					
LO	Other routes and route structures within or adjacent to NAT MNPS airspace (MNPSA Manual, Chapter 3): other routes within NAT MNPS airspace; route structures adjacent to NAT MNPS airspace: North American routes (NARs), Canadian domestic track systems, routes between North America and the Caribbean area.	x					
LO	Flight planning (MNPSA Manual, Chapter 4): all flights should plan to operate on great-circle tracks joining successive significant waypoints; during the hours of validity of the OTS, operators are encouraged to flight plan as follows: in accordance with the OTS or along a route to join or leave an outer track of the OTS or on a random route to remain clear of the OTS; flight levels available on OTS tracks during OTS periods; flight levels on random tracks or outside OTS periods (appropriate direction levels).	x					

LO	Oceanic ATC Clearances (MNPSA Manual, Chapter 5): it is recommended that pilots should request their Oceanic Clearance at least 40 minutes prior to the oceanic entry point ETA; pilots should notify the Oceanic Area control Centre (OAC) of the maximum acceptable flight level possible at the boundary; at some airports, which are situated close to oceanic boundaries, the Oceanic Clearance must be obtained before departure; if an aircraft, which would normally be RVSM and/or MNPS approved, encounters, whilst en route to the NAT Oceanic Airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the MEL requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting Oceanic Clearance; After obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by 3 minutes or more, should pass a revised estimate to ATC; the pilot should pay particular attention when the issued clearance differs from the flight plan, as a significant proportion of navigation errors investigated in the NAT involve an aircraft which has followed its flight plan rather than its differing clearance; if the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic re-clearance; there are three elements to an Oceanic Clearance: route, Mach number and flight level. These elements serve to provide for the three basic elements of separation: lateral, longitudinal and vertical.	x						

LO	Communications and position-reporting procedures (MNPSA Manual, Chapter 6) *HF voice communications* Pilots communicate with OACs via aeradio stations staffed by communicators who have no executive ATC authority. Messages are relayed, from the ground station to the air traffic controllers in the relevant OAC for action. Frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during daytime. When initiating contact with an aeradio station, the pilot should state the HF frequency in use. *SATCOM voice communications* Since oceanic traffic typically communicates with ATC through aeradio facilities, a SATCOM call made due to unforeseen inability to communicate by other means should be made to such a facility rather than the ATC centre, unless the urgency of the communication dictates otherwise. An air-to-air VHF frequency has been established for worldwide use when aircraft are out of range of VHF ground stations which utilise the same or adjacent frequencies. This frequency (123.45 MHz) is intended for pilot-to-pilot exchanges of operationally significant information. Standard position report message type. Some aircraft flying in the NAT are required to report MET observations of wind speed and direction plus outside-air temperature. Any turbulence encountered should be included in these reports. General guidance for aircraft operating in, or proposing to operate in, the NAT region, which experience a communications failure: general provisions, onboard HF equipment failure, poor HF propagation conditions, loss of HF communications prior to entry into the NAT, loss of HF communications after entering the NAT. All turbine-engine aeroplanes having a maximum certified take-off mass exceeding 5 700 kg or authorised to carry more than 19 passengers are required to carry and operate ACAS II in the NAT region.	x						

LO	Application of Mach number technique (MNPSA Manual, Chapter 7): practical experience has shown that when two or more turbojet aircraft, operating along the same route at the same flight level, maintain the same Mach number, they are more likely to maintain a constant time interval between each other than when using other methods; pilots must ensure that any required corrections to the indicated Mach number are taken into account when complying with the true Mach number specified in the ATC clearance; after leaving oceanic airspace, pilots must maintain their assigned Mach number in domestic controlled airspace unless and until the appropriate ATC unit authorises a change.	x						
LO	MNPS flight operation & navigation procedures (MNPSA Manual, Chapter 8): the pre-flight procedures for any NAT MNPS flight must include a UTC time check and resynchronisation of the aircraft master clock; state the use of the Master Document; state the requirements for position plotting; PRE-FLIGHT PROCEDURES: alignment of IRS, Satellite Navigation Availability Prediction Programme for flights using GNSS LRNS, loading of initial waypoints, flight plan check; IN-FLIGHT PROCEDURES: ATC Oceanic Clearance, entering the MNPS airspace and reaching an oceanic waypoint, routine monitoring; Strategic Lateral Offset Procedure (SLOP): state that along a route or track there will be three positions that an aircraft may fly: centre line or one or two miles right.	x						
LO	RVSM flight in MNPS airspace (MNPSA Manual, Chapter 9): state the altimeter cross-check to be performed before MNPS airspace entry; state the altimeter cross-check to be performed into the MNPS airspace; in NAT MNPS airspace, pilots always have to report to ATC immediately on reaching any new cruising level; crews should report when a 300 ft or more deviation occurs.	x						

LO	Navigation system degradation or failure (MNPSA Manual, Chapter 10) For this part, consider aircraft equipped with only two operational LRNSs. State the requirements for the following situations: one system fails before take-off; one system fails before the OCA boundary is reached; one system fails after the OCA boundary is crossed; the remaining system fails after entering MNPS airspace.	x						
LO	Special procedures for in-flight contingencies (MNPSA Manual, Chapter 11) *General* Until a revised clearance is obtained, the specified NAT in-flight contingency procedures should be carefully followed. The general concept of these NAT in-flight contingency procedures is, whenever operationally feasible, to offset from the assigned route by 15 NM and climb or descend to a level which differs from those normally used by 500 ft if below FL410 or by 1 000 ft if above FL410. State the factors which may affect the direction of turn: direction to an alternate airport, terrain clearance, levels allocated on adjacent routes or tracks and any known SLOP offsets adopted by other nearby traffic. *Deviations around severe weather* State that if the deviation is to be greater than 10 NM, the assigned flight level must be changed by ± 300 ft depending on the followed track and the direction of the deviation (Table 1).	x						
071 01 03 04	**ETOPS**							
LO	State that ETOPS approval is part of an AOC.	x						
LO	State that prior to conducting an ETOPS flight, an operator shall ensure that a suitable ETOPS en route alternate is available, within either the approved diversion time or a diversion time based on the MEL-generated serviceability status of the aeroplane, whichever is shorter.	x						
LO	State the requirements for take-off alternate.	x						
LO	State the planning minima for ETOPS en route alternate.	x						
071 02 00 00	**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS (GENERAL ASPECTS)**							

071 02 01 00	**Operations Manual**						
071 02 01 01	**Operating procedures**						
LO	State that all non-type-related operational policies, instructions and procedures needed for a safe operation are included in Part A of the Operations Manual.	x	x	x	x	x	
LO	State that the following items are included into Part A: de-icing and anti-icing on the ground, adverse and potentially hazardous atmospheric conditions, wake turbulence, incapacitation of crew members, use of the minimum equipment and configuration deviation list(s), security, handling of accidents and occurrences.	x	x	x	x	x	
LO	State that the following items are included into Part A: altitude alerting system procedures, ground proximity warning system procedures, policy and procedures for the use of TCAS/ACAS.	x	x				
LO	State that the following items are included into Part A: rotor downwash.			x	x	x	
LO	Define the following terms: ‘commencement of flight’, ‘inoperative’, ‘MEL’, ‘MMEL’, rectification interval.	x	x	x	x	x	
LO	Define the ‘limits of MEL applicability’.	x	x	x	x	x	
LO	Identify the responsibilities of the operator and the authority with regard to MEL and MMEL.	x	x	x	x	x	
LO	State the responsibilities of the crew members with regard to MEL.	x	x	x	x	x	
LO	State the responsibilities of the commander with regard to MEL.	x	x	x	x	x	
071 02 01 02	**Aeroplane/helicopter operating matters — type-related**						
LO	State that all type-related instructions and procedures needed for a safe operation are included in Part B of the Operations Manual. They will take account of any differences between types, variants or individual aircraft used by the operator.	x	x	x	x	x	
LO	State that the following items are included into Part B: abnormal and emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures.	x	x				

LO	State that the following items are included into Part B: emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures.			x	x	x	
071 02 02 00	**Icing conditions**						
071 02 02 01	**On ground de-icing/anti-icing procedures, types of de-icing/anti-icing fluids**						
LO	Define the following terms: ‘anti-icing’, ‘de-icing’, ‘one-step de-icing/anti-icing’, ‘two-step de-icing/anti-icing’, ‘holdover time’. (ICAO Doc 9640 Glossary)	x	x				
LO	Define the following weather conditions: ‘drizzle’, ‘fog’, ‘freezing fog’, ‘freezing drizzle’, ‘freezing rain’, ‘frost’, ‘rain’, ‘rime’, ‘slush’, ‘snow’, ‘dry snow’, ‘wet snow’. (ICAO Doc 9640 Glossary)	x	x	x	x	x	
LO	Describe ‘The clean aircraft concept’ as presented in the relevant chapter of ICAO Doc 9640. (ICAO Doc 9640, Chapter 2)	x	x				
LO	List the types of de-icing/anti-icing fluids available. (ICAO Doc 9640, Chapter 4)	x	x	x	x	x	
LO	State the procedure to be followed when an aeroplane has exceeded the holdover time. (ICAO Doc 9640, Chapter 4)	x	x				
LO	Interpret the fluid holdover time tables and list the factors which can reduce the fluid protection time. (ICAO Doc 9640, Chapter 5 + Attachment tables)	x	x				
LO	State that the pre-take-off check, which is the responsibility of the pilot-in-command, ensures that the critical surfaces of the aeroplane are free of ice, snow, slush or frost just prior to take-off. This check shall be accomplished as close to the time of take-off as possible and is normally made from within the aeroplane by visually checking the wings. (ICAO Doc 9640, Chapter 6)	x	x				
LO	State that an aircraft has to be treated symmetrically. (ICAO Doc 9640, Chapter 11)	x	x				
LO	State that an operator shall establish procedures to be followed when ground de-icing and anti-icing and related inspections of the aeroplane(s) are necessary.	x	x	x	x	x	
LO	State that a commander shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect the performance and/or controllability of the aircraft except as permitted in the Flight Manual.	x	x	x	x	x	

071 02 02 02	**Procedure to apply in case of performance deterioration, on ground/in flight**						
LO	State that the effects of icing are wide-ranging, unpredictable and dependent upon individual aeroplane design. The magnitude of these effects is dependent upon many variables, but the effects can be both significant and dangerous. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that in icing conditions, for a given speed and a given angle of attack, wing lift can be reduced by as much as 30 % and drag increased by up to 40 %. State that these changes in lift and drag will significantly increase stall speed, reduce controllability and alter flight characteristics. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice on critical surfaces and on the airframe may also break away during take-off and be ingested into engines, possibly damaging fan and compressor blades. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice forming on pitot tubes and static ports or on angle-of-attack vanes may give false altitude, airspeed, angle-of-attack and engine-power information for air-data systems. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that ice, frost and snow formed on the critical surfaces on the ground can have a totally different effect on aircraft flight characteristics than ice formed in flight. (ICAO Doc 9640, Chapter 1)	x	x	x	x	x	
LO	State that flight in known icing conditions is subject to limitations found in Part B of the Operations Manual.	x	x	x	x	x	
LO	State where procedures and performances regarding flight in expected or actual icing conditions are located.	x	x	x	x	x	
071 02 03 00	**Bird-strike risk and avoidance**						
LO	State that presence of birds constituting a potential hazard to aircraft operations is part of the pre-flight information. (ICAO Annex 15, Chapter 8)	x	x	x	x	x	
LO	State that information concerning the presence of birds observed by aircrews is made available to the Aeronautical Information Service for such distribution as the circumstances necessitate. (ICAO Annex 15, Chapter 8)	x	x	x	x	x	
LO	State that AIP ENR 5.6 contains information regarding bird migrations. (ICAO Annex 15, Appendix 1)	x	x	x	x	x	

LO	State significant data regarding bird strikes contained in ICAO Doc 9137. (ICAO Doc 9137, Part 3, 1.1.6)	x	x	x	x	x	
LO	List incompatible land use around airports. (ICAO Doc 9137, Part 3, 10.4)	x	x	x	x	x	
LO	Define the commander's responsibilities regarding the reporting of bird hazards and bird strikes.	x	x	x	x	x	
071 02 04 00	**Noise abatement**						
071 02 04 01	**Noise-abatement procedures**						
LO	Define the operator responsibilities regarding establishment of noise-abatement procedures.	x	x	x	x	x	
LO	State the main purpose of NADP 1 and NADP 2. (ICAO Doc 8168, Volume 1, Part V, 3.1.1)	x	x	x	x	x	
LO	State that the pilot-in-command has the authority to decide not to execute a noise-abatement departure procedure if conditions preclude the safe execution of the procedure. (ICAO Doc 8168, Volume 1, Part V, 3.2.1.3)	x	x	x	x	x	
071 02 04 02	**Influence of the flight procedure (departure, cruise, approach)**						
LO	List the main parameters for NADP 1 and NADP 2 (i.e. speeds, heights, etc.). (ICAO Doc 8168, Volume 1, Part V, Appendix to Chapter 3)	x	x				
LO	State that a runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path for purposes of noise abatement. (ICAO Annex 14, Volume 1, 5.3.7.1/Volume 2, 5.3.4.1)	x	x	x	x	x	
LO	State that detailed information about noise-abatement procedures is to be found in AD 2 and 3 of the AIP. (ICAO Annex 15, Appendix 1)	x	x	x	x	x	
071 02 04 03	**Influence by the pilot (power setting, low drag)**						
LO	List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.2.2)	x	x				
LO	List the adverse operating conditions under which noise-abatement procedures during approach should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.4.4)	x	x				
LO	State the rule regarding the use of reverse thrust on landing. (ICAO Doc 8168, Volume 1, Part V, 3.5)	x	x				

071 02 04 04	**Influence by the pilot (power setting, track of helicopter)**						
LO	List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required. (ICAO Doc 8168, Volume 1, Part V, 3.2.2)			x	x	x	
071 02 05 00	**Fire and smoke**						
071 02 05 01	**Carburettor fire**						
LO	List the actions to be taken in the event of a carburettor fire.	x	x				
071 02 05 02	**Engine fire**						
LO	List the actions to be taken in the event of an engine fire.	x	x				
071 02 05 03	**Fire in the cabin, cockpit, cargo compartment**						
LO	Identify the different types of extinguishants and the type of fire on which each one may be used.	x	x				
LO	Describe the precautions to be considered in the application of fire extinguishant.	x	x				
LO	Identify the appropriate handheld extinguishers to be used in the cockpit, the passenger cabin and toilets, and in the cargo compartments.	x	x				
071 02 05 04	**Smoke in the cockpit and cabin**						
LO	List the actions to be taken in the event of smoke in the cockpit or in the cabin.	x	x				
071 02 05 05	**Actions in case of overheated brakes**						
LO	Describe the problems and safety precautions following overheated brakes after landing or a rejected take-off.	x	x				
071 02 06 00	**Decompression of pressurised cabin**						
071 02 06 01	**Slow decompression**						
LO	Indicate how to detect a slow decompression or an automatic pressurisation system failure.	x	x				
LO	Describe the actions required following a slow decompression.	x	x				
071 02 06 02	**Rapid and explosive decompression**						
LO	Indicate how to detect a rapid or an explosive decompression.	x	x				
071 02 06 03	**Dangers and action to be taken**						

LO	Describe the actions required following a rapid or explosive decompression.	x	x				
LO	Describe the effects on aircraft occupants of a slow decompression and a rapid or explosive decompression.	x	x				
071 02 07 00	**Wind shear and microburst**						
071 02 07 01	**Effects and recognition during departure and approach**						
LO	Define the meaning of the term 'low-level windshear'. (ICAO Circular 186, Chapter 1)	x	x	x	x	x	
LO	Define: vertical wind shear, horizontal wind shear, updraft and downdraft wind shear. (ICAO Circular 186, Chapter 2)	x	x	x	x	x	
LO	Identify the meteorological phenomena associated with wind shear. (ICAO Circular 186, Chapter 3)	x	x	x	x	x	
LO	Explain recognition of wind shear. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
071 02 07 02	**Actions to avoid and actions to take during encounter**						
LO	Describe the effects of and actions required when encountering wind shear, at take-off and approach. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe the precautions to be taken when wind shear is suspected, at take-off and approach. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe the effects of and actions required following entry into a strong downdraft wind shear. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
LO	Describe a microburst and its effects. (ICAO Circular 186, Chapter 4)	x	x	x	x	x	
071 02 08 00	**Wake turbulence**						
071 02 08 01	**Cause**						
LO	Define the term 'wake turbulence'. (ICAO Doc 4444, 4.9)	x	x	x	x	x	
LO	Describe tip vortices circulation. (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Explain when vortex generation begins and ends. (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Describe vortex circulation on the ground with and without crosswind. (ICAO Doc 9426, Part II)	x	x	x	x	x	
071 02 08 02	**List of relevant parameters**						

LO	List the three main factors which, when combined, give the strongest vortices (heavy, clean, slow). (ICAO Doc 9426, Part II)	x	x	x	x	x	
LO	Describe the wind conditions which are worst for wake turbulence near the ground. (ICAO Doc 9426, Part II)	x	x	x	x	x	
071 02 08 03	**Actions to be taken when crossing traffic, during take-off and landing**						
LO	Describe the actions to be taken to avoid wake turbulence, specially separations. (ICAO Doc 4444, 5)	x	x	x	x	x	
071 02 09 00	**Security (unlawful events)**						
071 02 09 01	**ICAO Annex 17**						
LO	Give the following definitions: aircraft security check, screening, security, security-restricted area, unidentified baggage. (ICAO Annex 17, 1)	x	x	x	x	x	
LO	Give the objectives of security. (ICAO Annex 17, 2.1)	x	x	x	x	x	
071 02 09 02	**Use of Secondary Surveillance Radar (SSR)**						
LO	Describe the commander's responsibilities concerning notifying the appropriate ATS unit. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning operation of SSR. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning departing from assigned track and/or cruising level. (ICAO Annex 17 Attachment)	x	x	x	x	x	
LO	Describe the commander's responsibilities concerning the action required or being requested by an ATS unit to confirm SSR code and ATS interpretation response. (ICAO Annex 17 Attachment)	x	x	x	x	x	
071 02 09 03	**Security**						
LO	State the requirements regarding training programmes.	x	x	x	x	x	
LO	State the requirements regarding reporting acts of unlawful interference.	x	x	x	x	x	
LO	State the requirements regarding aircraft search procedures.	x	x	x	x	x	

071 02 10 00	**Emergency and precautionary landings**						
071 02 10 01	**Definition**						
LO	Define 'ditching', 'precautionary landing', 'emergency landing'.	x	x	x	x	x	
LO	Describe a ditching procedure.	x	x	x	x	x	
LO	Describe a precautionary landing.	x	x	x	x	x	
LO	Explain the factors to be considered when deciding to make a precautionary/emergency landing or ditching.	x	x	x	x	x	
071 02 10 02	**Cause**						
LO	List some reasons that may require a ditching, a precautionary landing or an emergency landing.	x	x	x	x	x	
071 02 10 03	**Passenger information**						
LO	Describe the passenger briefing to be given before conducting a precautionary/emergency landing or ditching (including evacuation).	x	x	x	x	x	
071 02 10 04	**Action after landing**						
LO	Describe the actions and responsibilities of crew members after landing.	x	x	x	x	x	
071 02 10 05	**Evacuation**						
LO	State that the aircraft must be stopped and the engine shut down before launching an emergency evacuation.	x	x	x	x	x	
LO	State that evacuation procedures are to be found in Part B of the Operations Manual.	x	x	x	x	x	
LO	State the CS-25 requirements regarding evacuation procedures. (CS 25.803 + Appendix J)	x	x				
071 02 11 00	**Fuel jettisoning**						
071 02 11 01	**Safety aspects**						
LO	State that an aircraft may need to jettison fuel so as to reduce its landing mass in order to effect a safe landing. (ICAO Doc 4444, 15.5.3)	x	x				
LO	State that when an aircraft operating within controlled airspace needs to jettison fuel, the flight crew shall coordinate with ATC the following: route to be flown which, if possible, should be clear of cities and towns, preferably over water and away from areas where thunderstorms have been reported or are expected; the level to be used, which should be not less than 1 800 m (6 000 ft); and the duration of fuel jettisoning. (ICAO Doc 4444, 15.5.3)	x	x				

LO	State that flaps and slats may adversely affect fuel jettisoning. (CS 25.1001)	x	x				
071 02 11 02	**Requirements**						
LO	State that a fuel-jettisoning system must be installed on each aeroplane unless it is shown that the aeroplane meets some CS-25 climb requirements. (CS 25.1001)	x	x				
LO	State that a fuel-jettisoning system must be capable of jettisoning enough fuel within 15 minutes. (CS 25.1001)	x	x				
071 02 12 00	**Transport of dangerous goods**						
071 02 12 01	**ICAO Annex 18**						
LO	Give the following definitions: dangerous goods, dangerous goods accident, dangerous goods incident, exemption, incompatible, packaging, UN number. (ICAO Annex 18, Chapter 1)	x	x	x	x	x	
LO	State that detailed provisions for dangerous goods transportation are contained in the Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284). (ICAO Annex 18, Chapter 2, 2.2.1)	x	x	x	x	x	
LO	State that in case of an in-flight emergency, the pilot-in-command must inform the ATC of dangerous goods transportation. (ICAO Annex 18, Chapter 9, 9.5)	x	x	x	x	x	
071 02 12 02	**Technical Instructions (ICAO Doc 9284)**						
LO	Explain the principle of compatibility and segregation. (ICAO Doc 9284)	x	x	x	x	x	
LO	Explain the special requirements for the loading of radioactive materials. (ICAO Doc 9284)	x	x	x	x	x	
LO	Explain the use of the dangerous goods list. (ICAO Doc 9284)	x	x	x	x	x	
LO	Identify the labels. (ICAO Doc 9284)	x	x	x	x	x	
071 02 12 03	**Transport of dangerous goods by air**						
LO	State that dangerous goods transportation is subject to operator approval.	x	x	x	x	x	
LO	Identify articles and substances, which would otherwise be classed as dangerous goods, that are excluded from the provisions.	x	x	x	x	x	
LO	State that some articles and substances may be forbidden for air transportation.	x	x	x	x	x	
LO	State that packing must comply with the Technical Instructions specifications.	x	x	x	x	x	
LO	List the labelling and marking requirements.	x	x	x	x	x	

LO	List the Dangerous Goods Transport Document requirements.	x	x	x	x	x	
LO	List the Acceptance of Dangerous Goods requirements.	x	x	x	x	x	
LO	Explain the need for an inspection prior to loading on an aircraft.	x	x	x	x	x	
LO	State that some dangerous goods are designated for carriage only on cargo aircraft.	x	x	x	x	x	
LO	State that accidents or incidents involving dangerous goods are to be reported.	x	x	x	x	x	
LO	State that misdeclared or undeclared dangerous goods found in baggage are to be reported.	x	x	x	x	x	
071 02 13 00	**Contaminated runways**						
071 02 13 01	**Kinds of contamination**						
LO	Define a ‘contaminated runway’, a ‘damp runway’, a ‘wet runway’, and a ‘dry runway’.	x	x				
LO	List the different types of contamination: damp, wet or water patches, rime or frost-covered, dry snow, wet snow, slush, ice, compacted or rolled snow, frozen ruts or ridges. (ICAO Annex 15, Appendix 2)	x	x				
LO	Give the definitions of the various types of snow. (ICAO Annex 15, Appendix 2)	x	x				
071 02 13 02	**Estimated surface friction, friction coefficient**						
LO	Identify the difference between friction coefficient and estimated surface friction. (ICAO Annex 15, Appendix 2)	x	x				
LO	State that when friction coefficient is 0.40 or higher, the expected braking action is good. (ICAO Annex 15, Appendix 2)	x	x				
071 02 13 03	**Hydroplaning principles and effects**						
LO	Define the different types of hydroplaning. (NASA TM-85652/Tire friction performance/ pp. 6 to 9)	x	x				
LO	Compute the two dynamic hydroplaning speeds using the following formulas: Spin-down speed (rotating tire) (kt) = 9 square root (pressure in PSI) Spin-up speed (non-rotating tire) (kt) = 7.7 square root (pressure in PSI). (NASA TM-85652/Tire friction performance /p. 8)	x	x				

LO	State that it is the spin-up speed rather than the spin-down speed which represents the actual tire situation for aircraft touchdown on flooded runways. (NASA TM-85652/Tire friction performance/p. 8)	x	x				
071 02 13 04	**Procedures**						
LO	State that some wind limitations may apply in case of contaminated runways. Those limitations are to be found in Part B of the Operations Manual — Limitations.	x	x				
LO	State that the procedures associated with take-off and landing on contaminated runways are to be found in Part B of the Operations Manual — Normal procedures.	x	x				
LO	State that the performances associated with contaminated runways are to be found in Part B of the Operations Manual — Performance.	x	x				
071 02 13 05	**SNOWTAM**						
LO	Interpret from a SNOWTAM the contamination and braking action on a runway.	x	x				
071 02 14 00	**Rotor downwash**						
071 02 14 01	**Describe downwash**						
LO	Describe the downwash.			x	x	x	
071 02 14 02	**Effects**						
LO	Explain the effects on: soil erosion, water dispersal and spray, recirculation, damage to property, loose articles.			x	x	x	
071 02 15 00	**Operation influence by meteorological conditions (Helicopter)**						
071 02 15 01	**White-out/sand/dust**						
LO	Give the definition of 'white-out'.			x	x	x	
LO	Describe loss of spatial orientation.			x	x	x	
LO	Describe take-off and landing techniques.			x	x	x	
071 02 15 02	**Strong winds**						
LO	Describe blade sailing.			x	x	x	
LO	Describe wind operating envelopes.			x	x	x	
LO	Describe vertical speed problems.			x	x	x	
071 02 15 03	**Mountain environment**						
LO	Describe constraints associated with mountain environment.			x	x	x	
071 03 00 00	**EMERGENCY PROCEDURES (HELICOPTER)**						
071 03 01 00	**Influence of technical problems**						

071 03 01 01	**Engine failure**						
LO	Describe techniques for failure in: hover, climb, cruise, approach.			x	x	x	
071 03 01 02	**Fire in cabin/cockpit/engine**						
LO	Describe the basic actions when encountering fire in the cabin, cockpit or engine.			x	x	x	
071 03 01 03	**Tail/rotor/directional control failure**						
LO	Describe the basic actions following loss of tail rotor.			x	x	x	
LO	Describe the basic actions following loss of directional control.			x	x	x	
071 03 01 04	**Ground resonance**						
LO	Describe recovery actions.			x	x	x	
071 03 01 05	**Blade stall**						
LO	Describe cause and recovery actions when encountering retreating blade stall.			x	x	x	
071 03 01 06	**Settling with power (vortex ring)**						
LO	Describe prerequisite conditions and recovery actions.			x	x	x	
071 03 01 07	**Overpitch**						
LO	Describe recovery actions.			x	x	x	
071 03 01 08	**Overspeed: rotor/engine**						
LO	Describe overspeed control.			x	x	x	
071 03 01 09	**Dynamic rollover**						
LO	Describe potential conditions and recovery action.			x	x	x	
071 03 01 10	**Mast bumping**						
LO	Describe conditions ‘conducive to’ and ‘avoidance of’ effect.			x	x	x	

M. SUBJECT 081 — PRINCIPLES OF FLIGHT (AEROPLANE)

(1) The following standard conventions are used for certain mathematical symbols:

* multiplication

≥ greater than or equal to

≤ less than or equal to

SQRT( ) square root of the function, symbol or number in round brackets

(2) Normally, it should be assumed that the effect of a variable under review is the only variation that needs to be addressed, unless specifically stated otherwise.

(3) Candidates are expected in simple calculations to be able to convert knots (kt) into metres/second (m/s), and know the appropriate conversion factors by heart.

(4) In the subsonic range, as covered under subject 081 01, compressibility effects normally are not considered, unless specifically mentioned.

(5) For those questions related to propellers (subject 081 07), as a simplification of the physical reality, the inflow speed into the propeller plane is taken as the aeroplane's TAS. In addition, when discussing propeller rotational direction, it will always be specified as seen from behind the propeller plane.

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Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
080 00 00 00	**PRINCIPLES OF FLIGHT**						
081 00 00 00	**PRINCIPLES OF FLIGHT — AEROPLANE**						
081 01 00 00	**SUBSONIC AERODYNAMICS**						
081 01 01 00	**Basics, laws and definitions**						
081 01 01 01	**Laws and definitions**						
LO	List the SI units of measurement for mass, acceleration, weight, velocity, density, temperature, pressure, force, wing loading and power. Define 'mass', 'force', 'acceleration' and 'weight'. State and interpret Newton's laws. State and interpret Newton's first law. State and interpret Newton's second law. State and interpret Newton's third law. Explain air density. List the atmospheric properties that effect air density. Explain how temperature and pressure changes affect density. Define 'static pressure'.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Define 'dynamic pressure'. Define the 'formula for dynamic pressure'. Apply the formula for a given altitude and speed. State Bernoulli's equation. Define 'total pressure'. Apply the equation to a Venturi. Describe how the IAS is acquired from the pitot-static system. Describe the relationship between density, temperature and pressure for air. Describe the Equation of Continuity. Define 'IAS', 'CAS', 'EAS', 'TAS'.						
081 01 01 02	**Basics about airflow**						
LO	Describe steady and unsteady airflow. Explain the concept of a streamline. Describe and explain airflow through a stream tube. Explain the difference between two and three-dimensional airflow.	x	x				
081 01 01 03	**Aerodynamic forces and moments on aerofoils**						
LO	Describe the force resulting from the pressure distribution around an aerofoil. Resolve the resultant force into the components 'lift' and 'drag'. Describe the direction of lift and drag. Define the 'aerodynamic moment'. List the factors that affect the aerodynamic moment. Describe the aerodynamic moment for a symmetrical aerofoil. Describe the aerodynamic moment for a positively and negatively cambered aerofoil. Forces and equilibrium of forces (refer to 081 08 00 00). Define 'angle of attack'.	x	x				
081 01 01 04	**Shape of an aerofoil section**						
LO	Describe the following parameters of an aerofoil section: leading edge; trailing edge;	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	chord line; thickness to chord ratio or relative thickness; location of maximum thickness; camber line; camber; nose radius. Describe a symmetrical and an asymmetrical aerofoil section.						
081 01 01 05	**Wing shape**						
LO	Describe the following parameters of a wing: span; tip and root chord; taper ratio; wing area; wing planform; mean geometric chord; mean aerodynamic chord (MAC); aspect ratio; dihedral angle; sweep angle; wing twist; geometric; aerodynamic; angle of incidence. *Remark: In certain textbooks, angle of incidence is used as angle of attack. For Part-FCL theoretical knowledge examination purposes this use is discontinued and the angle of incidence is defined as the angle between the aeroplane longitudinal axis and the wing-root chord line.*	x	x				
081 01 02 00	**Two-dimensional airflow around an aerofoil**						
081 01 02 01	**Streamline pattern**						
LO	Describe the streamline pattern around an aerofoil. Describe converging and diverging streamlines and their effect on static pressure and velocity.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe upwash and downwash.						
081 01 02 02	**Stagnation point**						
LO	Describe the stagnation point. Explain the effect on the stagnation point of angle-of-attack changes. Explain local-pressure changes.	x	x				
081 01 02 03	**Pressure distribution**						
LO	Describe pressure distribution and local speeds around an aerofoil including effects of camber and angle of attack. Describe where the minimum local static pressure is typically situated on an aerofoil.	x	x				
081 01 02 04	**Centre of pressure and aerodynamic centre**						
LO	Explain centre of pressure and aerodynamic centre.	x	x				
081 01 02 05	**Lift and downwash**						
LO	Explain the association between lift and downwash.	x	x				
081 01 02 06	**Drag and wake**						
LO	List two physical phenomena that cause drag. Describe skin friction drag. Describe pressure (form) drag. Explain why drag and wake cause loss of energy (momentum).	x	x				
081 01 02 07	**Influence of angle of attack**						
LO	Explain the influence of angle of attack on lift.	x	x				
081 01 02 08	**Flow separation at high angles of attack**						
LO	Refer to 081 01 08 01.	x	x				
081 01 02 09	**The lift — α graph**						
LO	Describe the lift and angle-of-attack graph. Explain the significant points on the graph. Describe lift against α graph for a symmetrical aerofoil.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
081 01 03 00	**Coefficients**						
LO	Explain why coefficients are used in general.	x	x				
081 01 03 01	**The lift coefficient C_l**						
LO	Describe the lift formula and perform simple calculations. Describe the $\mathbf{C_l - \alpha}$ graph (symmetrical and positively/ negatively cambered aerofoils). Describe the typical difference in $\mathbf{C_l - \alpha}$ graph for fast and slow aerofoil design. Define 'C_{lMAX}' and 'α_{stall}' on the graph.	x	x				
081 01 03 02	**The drag coefficient C_d**						
LO	Describe the drag formula and perform simple calculations. Discuss the effect of the shape of a body on the drag coefficient. Describe the $\mathbf{C_l - C_d}$ graph (aerofoil polar). Indicate minimum drag on the graph. Explain why the $\mathbf{C_l–C_d}$ ratio is important as a measure of performance. State the normal values of $\mathbf{C_l–C_d}$.	x	x				
081 01 04 00	**Three-dimensional airflow about an aeroplane**						
LO	Define 'angle of attack.' *Remark: For theoretical knowledge examination purposes, the angle-of-attack definition requires a reference line. This reference line for 3-D has been chosen to be the longitudinal axis and for 2-D the chord line.* Explain the difference between the angle of attack and the attitude of an aeroplane.	x	x				
081 01 04 01	**Streamline pattern**						
LO	Describe the general streamline pattern around the wing, tail section and fuselage.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Explain and describe the causes of spanwise flow over top and bottom surfaces. Describe tip vortices and local α. Explain how tip vortices vary with angle of attack. Explain upwash and downwash due to tip vortices. Describe spanwise lift distribution including the effect of wing planform. Describe the causes, distribution and duration of the wake turbulence behind an aeroplane. Describe the influence of flap deflection on the tip vortex. List the parameters that influence wake turbulence.						
081 01 04 02	**Induced drag**						
LO	Explain what causes the induced drag. Describe the approximate formula for the induced drag coefficient. State the factors that affect induced drag. Describe the relationship between induced drag and total drag in the cruise. Describe the effect of mass on induced drag at a given IAS. Describe the means to reduce induced drag: • aspect ratio; • winglets; • tip tanks; • wing twist; • camber change. Describe the influence of lift distribution on induced drag. Describe the influence of tip vortices on the angle of attack. Explain induced and effective local angle of attack. Explain the influence of the induced angle of attack on the direction of the lift vector. Explain the relationship between induced drag and: • speed;	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	• aspect ratio; • wing planform; • bank angle in a horizontal coordinated turn. Explain the induced drag coefficient. Explain the relationship between the induced drag coefficient and the angle-of-attack or lift coefficient. Explain the influence of induced drag on: • C_L–angle-of-attack graph, how the effect on the graph when comparing high and low aspect ratio wings; • C_L–C_D (aeroplane polar), show the effect on the graph when comparing high and low aspect ratio wings; • parabolic aeroplane polar in a graph and as a formula ($C_D = C_{Dp} + kC_L^2$).						
081 01 05 00	**Total drag**						
LO	State that total drag consists of parasite drag and induced drag.	x	x				
081 01 05 01	**Parasite drag**						
LO	List the types of drag that are included in parasite drag. Describe form (pressure) drag. Describe interference drag. Describe friction drag.	x	x				
081 01 05 02	**Parasite drag and speed**						
LO	Describe the relationship between parasite drag and speed.	x	x				
081 01 05 03	**Induced drag and speed**						
LO	Refer to 081 01 04 02.	x	x				
081 01 05 04	***Intentionally left blank***						
081 01 05 05	**Total drag and speed**						
LO	Explain the total drag–speed graph and the constituent drag components. Indicate the speed for minimum drag.	x	x				
081 01 05 06	***Intentionally left blank***						
081 01 05 07	**The total drag–speed graph**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the effect of aeroplane gross mass on the graph. Describe the effect of pressure altitude on: • drag–IAS graph; • drag–TAS graph. Describe speed stability from the graph. Describe non-stable, neutral and stable IAS regions. Explain what happens to the IAS and drag in the non-stable region if speed suddenly decreases.	x	x				
081 01 06 00	**Ground effect**						
LO	Explain what happens to the tip vortices, downwash, airflow pattern, lift and drag in ground effect.	x	x				
081 01 06 01	**Effect on C_{Di}**						
LO	Describe the influence of ground effect on C_{Di} and induced angle of attack. Explain the effects on entering and leaving ground effect.	x	x				
081 01 06 02	**Effect on α_{stall}**						
LO	Describe the influence of ground effect on α_{stall}.	x	x				
081 01 06 03	**Effect on C_L**						
LO	Describe the influence of ground effect on C_L.	x	x				
081 01 06 04	**Effect on take-off and landing characteristics of an aeroplane**						
LO	Describe the influence of ground effect on take-off and landing characteristics and performance of an aeroplane. Describe the difference between: • high and low wing characteristics; • high and low tail characteristics. Explain the effects on static pressure measurements at the static ports when entering and leaving ground effect.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
081 01 07 00	**The relationship between lift coefficient and speed in steady, straight and level flight**						
081 01 07 01	**Represented by an equation**						
LO	Explain the effect on C_L during speed increase/decrease in steady, straight and level flight, and perform simple calculations.	x	x				
081 01 07 02	**Represented by a graph**						
LO	Explain, by using a graph, the effect on speed of C_L changes at a given weight.	x	x				
081 01 08 00	**The stall**						
081 01 08 01	**Flow separation at increasing angles of attack**						
LO	Define the 'boundary layer'. Describe the thickness of a typical boundary layer. List the factors that affect thickness. Describe the laminar layer. Describe the turbulent layer. Define the 'transition point'. List the differences between laminar and turbulent boundary layers. Explain why the laminar boundary layer separates easier than the turbulent one. List the factors that slow down the airflow over the aft part of an aerofoil, as the angle of attack increases. Define the 'separation point' and describe its location as a function of angle of attack. Define the 'critical stall angle of attack'. Describe the influence of increasing the angle of attack on: • the forward stagnation point; • the pressure distribution; • the location of the centre of pressure (straight and swept back wing); • C_L and L;	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	• C_D and D; • the pitching moment (straight and swept back wing); • the downwash at the horizon stabiliser. Explain what causes the possible natural buffet on the controls in a pre-stall condition. Describe the effectiveness of the flight controls in a pre-stall condition. Describe and explain the normal post-stall behaviour of a wing/ aeroplane; Describe the dangers of using the controls close to the stall.						
081 01 08 02	**The stall speed**						
LO	Explain V_{S0}, V_{S1}, V_{SR}, V_{S1g}. Solve the 1G stall speed from the lift formula. Describe and explain the influence of the following parameters on stall speed: • centre of gravity; • thrust component; • slipstream; • wing loading; • mass; • wing contamination; • angle of sweep; • altitude (for compressibility effects, see 081 02 03 02). Define the 'load factor n'. Explain why the load factor increases in a turn. Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre. Describe and explain the influence of the 'load factor n' on stall speed. Explain the expression 'accelerated stall'. *Remark: Sometimes accelerated stall is also erroneously referred to as high-speed stall. This latter expression will not be used for subject 081.* Calculate the change of stall speed as a function of the load factor.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle. Calculate the change of stall speed as a function of the gross mass.						
081 01 08 03	**The initial stall in span-wise direction**						
LO	Explain the initial stall sequence on the following platforms: • elliptical; • rectangular; • moderate and high taper; • sweepback or delta. Explain the influence of geometric twist (wash out) and aerodynamic twist. Explain the influence of deflected ailerons. Explain the influence of fences, vortilons, saw teeth, vortex generators.	x	x				
081 01 08 04	**Stall warning**						
LO	Explain why stall warning is necessary. Explain when aerodynamic and artificial stall warnings are used. Explain why CS-23 and CS-25 require a margin to stall speed. Describe: • buffet; • stall strip; • flapper switch (leading-edge stall-warning vane); • angle-of-attack vane; • angle-of-attack probe; • stick shaker. Describe the recovery after: • stall warning; • stall; • stick-pusher actuation.	x	x				
081 01 08 05	**Special phenomena of stall**						
LO	Describe the basic stall requirements for transport category aeroplanes. Explain the difference between power-off and power-on stalls and recovery. Describe stall and recovery in a climbing and descending turn. Describe the effect on stall and recovery characteristics of:	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	• wing sweep (consider both forward and backward sweep); • T-tailed aeroplane; • canards. Describe super-stall or deep-stall. Describe the philosophy behind the stick-pusher system. Explain the effect of ice, frost or snow on the stagnation point. Explain the absence of stall warning. Explain the abnormal behaviour of the stall. Describe and explain cause and effects of the stabiliser stall (negative tail stall). Describe when to expect in-flight icing. Explain how the effect is changed when retracting/ extending lift augmentation devices. Describe how to recover from a stall after a configuration change caused by in-flight icing. Explain the effect of a contaminated wing. Explain what 'on-ground' icing is. Describe the aerodynamic effects of de-icing/anti-ice fluid after the holdover time has been reached. Describe the aerodynamic effects of heavy tropical rain on stall speed and drag. Explain how to avoid spins. List the factors that cause a spin to develop. Describe spin development, recognition and recovery. Describe the differences in recovery techniques for aeroplanes that have different mass distributions between the wings and the fuselage.						
081 01 09 00	**C_{LMAX} augmentation**						
081 01 09 01	**Trailing-edge flaps and the reasons for use in take-off and landing**						
LO	Describe trailing-edge flaps and the reasons for their use during take-off and landing. Identify the different types of trailing-edge flaps given a relevant diagram: • split flaps; • plain flaps;	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL/IR	Helicopter ATPL	Helicopter CPL	IR
	• slotted flaps; • fowler flaps. Describe their effect on wing geometry. Describe how the wing's effective camber increases. Describe how the effective chord line differs from the normal chord line. Describe their effect on: • the location of centre of pressure; • pitching moments; • stall speed. Compare their influence on the C_L–α graph: • indicate the variation in C_L at any given angle of attack; • indicate the variation in C_D at any given angle of attack; • indicate their effect on C_{LMAX}; • indicate their effect on the stall or critical angle of attack; • indicate their effect on the angle of attack at a given C_L. Compare their influence on the C_L–C_D graph: • indicate how the $(C_L/C_D)_{MAX}$ differs from that of a clean wing. Explain the influence of trailing-edge flap deflection on the glide angle. Describe flap asymmetry: • explain the effect on aeroplane controllability. Describe trailing-edge flap effect on take-off and landing: • explain the advantages of lower-nose attitudes; • explain why take-off and landing speeds/distances are reduced.						
081 01 09 02	**Leading-edge devices and the reasons for their use in take-off and landing**						
LO	Describe leading-edge high-lift devices. Identify the different types of leading-edge high-lift devices given a relevant diagram: • Krueger flaps; • variable camber flaps;	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	• slats. State their effect on wing geometry. Describe the function of the slot. Describe how the wing's effective camber increases. Describe how the effective chord line differs from the normal chord line. State their effect on the stall speed, also in comparison with trailing edge flaps. Compare their influence on the C_L–α graph, compared with trailing-edge flaps and a clean wing: • indicate the effect of leading-edge devices on C_{LMAX}; • explain how the C_L curve differs from that of a clean wing; • indicate the effect of leading-edge devices on the stall or critical angle of attack. Compare their influence on the C_L–C_D graph; Describe slat asymmetry: • describe the effect on aeroplane controllability. Explain the reasons for using leading-edge high-lift devices on take-off and landing: • explain the disadvantage of increased nose-up attitudes; • explain why take-off and landing speeds/distances are reduced.						
081 01 09 03	**Vortex generators**						
LO	Explain the purpose of vortex generators. Describe their basic operating principle. State their advantages and disadvantages.	x	x				
081 01 10 00	**Means to reduce the C_L–C_D ratio**						
081 01 10 01	**Spoilers and the reasons for use in the different phases of flight**						
LO	Describe the aerodynamic functioning of spoilers: • roll spoilers; • flight spoilers (speed brakes); • ground spoilers (lift dumpers).	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe the effect of spoilers on the C_L–α graph and stall speed. Describe the influence of spoilers on the C_L–C_D graph and lift–drag ratio.						
081 01 10 02	**Speed brakes and the reasons for use in the different phases of flight**						
LO	Describe speed brakes and the reasons for use in the different phases of flight. State their influence on the C_L–C_D graph and lift–drag ratio. Explain how speed brakes increase parasite drag. Describe how speed brakes affect the minimum drag speed. Describe their effect on rate and angle of descent.	x	x				
081 01 11 00	**The boundary layer**						
081 01 11 01	**Different types**						
LO	Refer to 081 01 08 01.	x	x				
081 01 11 02	**Their advantages and disadvantages on pressure drag and friction drag**						
081 01 12 00	**Aerodynamic degradation**						
081 01 12 01	**Ice and other contaminants**						
LO	Describe the locations on an aeroplane where ice build-up will occur during flight. Explain the aerodynamic effects of ice and other contaminants on: • lift (maximum lift coefficient); • drag; • stall speed; • stalling angle of attack; • stability and controllability. Explain the aerodynamic effects of icing on the various phases during take-off.	x	x				
081 01 12 02	**Deformation and modification of airframe, ageing aeroplanes**						
LO	Describe the effect of airframe deformation and modification of an ageing aeroplane on aeroplane performance.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Explain the effect on boundary layer condition of an ageing aeroplane.						
081 02 00 00	**HIGH-SPEED AERODYNAMICS**						
081 02 01 00	**Speeds**						
081 02 01 01	**Speed of sound**						
LO	Define 'speed of sound'. Explain the variation of the speed of sound with altitude. Describe the influence of temperature on the speed of sound.	x					
081 02 01 02	**Mach number**						
LO	Define 'Mach number as a function of TAS and speed of sound'.	x					
081 02 01 03	**Influence of temperature and altitude on Mach number**						
LO	Explain the absence of change of Mach number with varying temperature at constant flight level and calibrated airspeed. Referring to 081 08 01 02 and 081 08 01 03, explain the relationship of Mach number, TAS and IAS during climb and descent at constant Mach number and IAS, and explain variation of lift coefficient, angle of attack, pitch and flight-path angle. Referring to 081 06 01 04 and 081 06 01 05, explain that VMO can be exceeded during a descent at constant Mach number and that MMO can be exceeded during a climb at constant IAS.	x					
081 02 01 04	**Compressibility**						
LO	State that compressibility means that density can change along a streamline. Describe how the streamline pattern changes due to compressibility. State that Mach number is a measure of compressibility.	x					
081 02 01 05	**Subdivision of aerodynamic flow**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	List the subdivision of aerodynamic flow: • subsonic flow; • transonic flow; • supersonic flow. Describe the characteristics of the flow regimes listed above. State that transport aeroplanes normally cruise at Mach numbers above M_{crit}.	x					
081 02 02 00	**Shock waves**						
LO	Define a 'shock wave'.	x					
081 02 02 01	**Normal shock waves**						
LO	Describe a normal shock wave with respect to changes in: static temperature; static and total pressure; velocity; local speed of sound; Mach number; density. Describe a normal shock wave with respect to orientation relative to the wing surface. Explain the influence of increasing Mach number on a normal shock wave, at positive lift, with respect to: strength; length; position relative to the wing; second shock wave at the lower surface. Explain the influence of angle of attack on shock-wave intensity at constant Mach number. Discuss the bow wave.	x					
081 02 02 02	**Oblique shock waves**						
LO	Describe an oblique shock wave with respect to changes in: static temperature; static and total pressure; velocity; local speed of sound;	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Mach number; density. Compare the characteristics of normal and oblique shock waves.						
081 02 02 03	**Mach cone**						
LO	Define 'Mach angle μ' with a formula and perform simple calculations. Identify the Mach-cone zone of influence of a pressure disturbance due to the presence of the aeroplane. Explain 'sonic boom'.	x					
081 02 03 00	**Effects of exceeding M_{crit}**						
081 02 03 01	**M_{crit}**						
LO	Define 'M_{crit}'. Explain how a change in angle of attack influences M_{crit}.	x					
081 02 03 02	**Effect on lift**						
LO	Describe the behaviour of lift coefficient CL versus Mach number at constant angle of attack. Explain shock-induced separation, shock stall, and describe its relationship with Mach buffet. Define 'shock stall'. *Remark: For theoretical knowledge examination purposes, the following description is used for shock stall: Shock stall occurs when the lift coefficient, as a function of Mach number, reaches its maximum value (for a given angle of attack).* Describe the consequences of exceeding M_{crit} with respect to: gradient of the C_L–α graph; C_{LMAX} (stall speed).	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Explain the change in stall speed (IAS) with altitude. Discuss the effect on critical or stalling angle of attack.						
081 02 03 03	**Effect on drag**						
LO	Describe wave drag. Describe the behaviour of drag coefficient C_D versus Mach number at constant angle of attack. Explain the effect of Mach number on the C_L–C_D graph. Define 'drag divergence Mach number' and explain the relation with M_{crit}.	x					
081 02 03 04	**Effect on pitching moment**						
LO	Discuss the effect of Mach number on the location of centre of pressure and aerodynamic centre. Explain 'tuck under' effect. List the methods of compensating for tuck under effect. Discuss the aerodynamic functioning of the Mach trim system. Discuss the corrective measures if the Mach trim fails.	x					
081 02 03 05	**Effect on control effectiveness**						
LO	Discuss the effects on the functioning of control surfaces.	x					
081 02 04 00	**Buffet onset**						
LO	Explain the concept of buffet margin and describe the influence of the following parameters: angle of attack; Mach number; pressure altitude;	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	mass; load factor; angle of bank; CG location. Explain how the buffet onset boundary chart can be used to determine manoeuvre capability. Describe the effect of exceeding the speed for buffet onset. Explain aerodynamic ceiling and 'coffin corner'. Explain the concept of the '1.3G' altitude. Find (using an example graph): buffet free range; aerodynamic ceiling at a given mass; load factor and bank angle at which buffet occurs at a given mass, Mach number and pressure altitude.						
081 02 05 00	**Means to influence M_{crit}**						
081 02 05 01	**Wing sweep**						
LO	Explain the influence of the angle of sweep on: M_{crit}; effective thickness/chord change or velocity component perpendicular to the quarter chord line. Describe the influence of the angle of sweep at subsonic speed on: C_{LMAX}; efficiency of high-lift devices. pitch-up stall behaviour. Discuss the effect of wing sweep on drag.	x					
081 02 05 02	**Aerofoil shape**						
LO	Explain the use of thin aerofoils with reduced camber. Explain the main purpose of supercritical aerofoils.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Identify the shape characteristics of a supercritical aerofoil shape. Explain the advantages and disadvantages of supercritical aerofoils for wing design.						
081 02 05 03	**Vortex generators**						
LO	Explain the use of vortex generators as a means to avoid or restrict flow separation.	x					
081 02 05 04	**Area ruling**						
LO	Explain area ruling in aeroplane design.	x					
081 03 00 00	***Intentionally left blank***						
081 04 00 00	**STABILITY**						
081 04 01 00	**Static and dynamic stability**						
081 04 01 01	**Basics and definitions**						
LO	Define 'static stability': identify a statically stable, neutral and unstable condition (positive, neutral and negative static stability). Explain manoeuvrability. Explain why static stability is the opposite of manoeuvrability. Define 'dynamic stability': identify a dynamically stable, neutral and unstable motion (positive, neutral and negative dynamic stability); identify periodic and aperiodic motion. Explain what combinations of static and dynamic stability will return an aeroplane to the equilibrium state after a disturbance.	x	x				
081 04 01 02	**Precondition for static stability**						
LO	Explain an equilibrium of forces and moments as the condition for the concept of static stability.	x	x				
081 04 01 03	**Sum of forces**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Identify the forces considered in the equilibrium of forces.	x	x				
081 04 01 04	**Sum of moments**						
LO	Identify the moments about all three axes considered in the equilibrium of moments. Discuss the effect of sum of moments not being zero.	x	x				
081 04 02 00	***Intentionally left blank***						
081 04 03 00	**Static and dynamic longitudinal stability**						
081 04 03 01	**Methods for achieving balance**						
LO	Explain the stabiliser and the canard as the means to satisfy the condition of nullifying the total sum of the moments about the lateral axis. Explain the influence of the location of the wing centre of pressure relative to the centre of gravity on the magnitude and direction of the balancing force on stabiliser and canard. Explain the influence of the indicated airspeed on the magnitude and direction of the balancing force on stabiliser and canard. Explain the influence of the balancing force on the magnitude of the wing/fuselage lift. Explain the use of the elevator deflection or stabiliser angle for the generation of the balancing force. Explain the elevator deflection required to balance thrust changes.	x	x				
081 04 03 02	**Static longitudinal stability**						
LO	Explain the changes in aerodynamic forces when varying angle of attack for a static longitudinally stable aeroplane.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Discuss the effect of CG location on pitch manoeuvrability.						
081 04 03 03	**Neutral point**						
LO	Define 'neutral point'. Explain why the location of the neutral point is only dependent on the aerodynamic design of the aeroplane.	x	x				
081 04 03 04	**Factors affecting neutral point**						
LO	Indicate the location of the neutral point relative to the locations of the aerodynamic centre of the wing and tail/canard. Explain the influence of the downwash variations with angle-of-attack variation on the location of the neutral point. Explain the contribution of engine nacelles.	x	x				
081 04 03 05	**Location of centre of gravity**						
LO	Explain the influence of the CG location on static longitudinal stability of the aeroplane. Explain the CG forward and aft limits with respect to: longitudinal control forces; elevator effectiveness; stability. Define 'static margin'.	x	x				
081 04 03 06	**The C_m–α graph**						
LO	Define the 'aerodynamic pitching moment coefficient (C_m)'. Describe the C_m–α graph with respect to: positive and negative sign; linear relationship; angle of attack for equilibrium state; relationship between the slope of the graph and static stability.	x	x				
081 04 03 07	**Factors affecting the C_m–α graph**						

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain: the effect on the C_m–α graph of a shift of CG in the forward and aft direction; the effect on the C_m–α graph when the elevator is moved up or down; the effect on the C_m–α graph when the trim is moved; the effect of the wing contribution and how it is affected by CG location; the effect of the fuselage contribution and how it is affected by CG location; the tail contribution; the effect of aerofoil camber change.	x	x				
081 04 03 08	**The elevator position versus speed graph (IAS)**						
LO	Describe the elevator position speed graph. Explain: the gradient of the elevator position speed graph; the influence of the airspeed on the stick position stability.	x	x				
081 04 03 09	**Factors affecting the elevator position–speed graph**						
LO	Explain the contribution on the elevator position–speed graph of: the location of centre of gravity; the trim (trim tab and stabiliser trim); high-lift devices.	x	x				
081 04 03 10	**The stick force versus speed graph (IAS)**						
LO	Define the 'stick force speed graph'. Describe the minimum gradient for stick force versus speed that is required for certification according to CS-23 and CS-25. Explain the importance of the stick force gradient for good flying qualities of an aeroplane. Identify the trim speed in the stick force speed graph.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Explain how a pilot perceives stable static longitudinal stick force stability.						
081 04 03 11	**Factors affecting the stick force versus speed graph**						
LO	Explain the contribution of: the location of the centre of gravity; the trim (trim tab and stabiliser trim); down spring; bob weight; friction.	x	x				
LO	Explain the contribution of Mach number — Ref. 081 02 03 04.	x					
081 04 03 12	**The manoeuvring stability/stick force per G**						
LO	Define the 'stick force per G'. Explain why: the stick force per G has a prescribed minimum and maximum value; the stick force per G decreases with pressure altitude at the same indicated airspeed.	x	x				
081 04 03 13	***Intentionally left blank***						
081 04 03 14	**Factors affecting the manoeuvring stability/stick force per G**						
LO	Explain the influence on stick force per G of: CG location; trim setting; a down spring in the control system; a bob weight in the control system.	x	x				
081 04 03 15	**Stick force per G and the limit-load factor**						
LO	Explain why the prescribed minimum and maximum values of the stick force per G are dependent on the limit-load factor. Calculate the stick force to achieve a certain load factor at a given manoeuvre stability.	x	x				
081 04 03 16	**Dynamic longitudinal stability**						
LO	Describe the phugoid and short-period motion in terms of period, damping,	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	variations (if applicable) in speed, altitude and angle of attack. Explain why short-period motion is more important for flying qualities than the phugoid. Define and describe 'pilot-induced oscillations'. Explain the effect of high altitude on dynamic stability. Describe the influence of the CG location on the dynamic longitudinal stability of the aeroplane.						
081 04 04 00	**Static directional stability**						
LO	Define 'static directional stability'. Explain the effects of static directional stability being too weak or too strong.	x	x				
081 04 04 01	**Sideslip angle β**						
LO	Define 'sideslip angle'. Identify β as the symbol used for the sideslip angle.	x	x				
081 04 04 02	**Yaw-moment coefficient C_n**						
LO	Define the 'yawing-moment coefficient C_n'. Define the relationship between C_n and β for an aeroplane with static directional stability.	x	x				
081 04 04 03	**C_n–β graph**						
LO	Explain why: C_n depends on the angle of sideslip; C_n equals zero for that angle of sideslip that provides static equilibrium about the aeroplane's normal axis; if no asymmetric engine thrust, flight control or loading condition prevails, the equilibrium angle of sideslip equals zero.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Identify how the slope of the C_n–β graph is a measure for static directional stability.						
081 04 04 04	**Factors affecting static directional stability**						
LO	Describe how the following aeroplane components contribute to static directional stability: wing; fin; dorsal fin; ventral fin; angle of sweep of the wing; angle of sweep of the fin; fuselage at high angles of attack; strakes. Explain why both the fuselage and the fin contribution reduce static directional stability when the CG moves aft.	x	x				
081 04 05 00	**Static lateral stability**						
LO	Define 'static lateral stability'. Explain the effects of static lateral stability being too weak or too strong.	x	x				
081 04 05 01	**Bank angle Ø**						
LO	Define 'bank angle Ø'.	x	x				
081 04 05 02	**The roll-moment coefficient C_l**						
LO	Define the 'roll-moment coefficient C_l'.	x	x				
081 04 05 03	**Contribution of sideslip angle β**						
LO	Explain how without coordination the bank angle creates sideslip angle.	x	x				
081 04 05 04	**The C_l–β graph**						
LO	Describe C_l–β graph. Identify the slope of the C_l–β graph as a measure for static lateral stability.	x	x				
081 04 05 05	**Factors affecting static lateral stability**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the contribution to the static lateral stability of: dihedral, anhedral; high wing, low wing; sweep angle of the wing; ventral fin; vertical tail. Define 'dihedral effect'.	x	x				
081 04 05 06	***Intentionally left blank***						
081 04 06 00	**Dynamic lateral/directional stability**						
081 04 06 01	**Effects of asymmetric propeller slipstream**						
081 04 06 02	**Tendency to spiral dive**						
LO	Explain how lateral and directional stability are coupled. Explain how high-static directional stability and a low-static lateral stability may cause spiral divergence (unstable spiral dive), and under which conditions the spiral dive mode is neutral or stable. Describe an unstable spiral dive mode with respect to deviations in speed, bank angle, nose low-pitch attitude and decreasing altitude.	x	x				
081 04 06 03	**Dutch roll**						
LO	Describe Dutch roll. Explain: why Dutch roll occurs when the static lateral stability is large compared with static directional stability; the condition for a stable, neutral or unstable Dutch roll motion; the function of the yaw damper; the actions to be taken in case of non-availability of the yaw damper.	x	x				
LO	State the effect of Mach number on Dutch roll.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
081 04 06 04	**Effects of altitude on dynamic stability**						
LO	Explain that increased pressure altitude reduces dynamic lateral/directional stability.	x	x				
081 05 00 00	**CONTROL**						
081 05 01 00	**General**						
081 05 01 01	**Basics, the three planes and three axes**						
LO	Define: lateral axis; longitudinal axis; normal axis. Define: pitch angle; bank angle; yaw angle. Describe the motion about the three axes. Name and describe the devices that control these motions.	x	x				
081 05 01 02	**Camber change**						
LO	Explain how camber is changed by movement of a control surface.	x	x				
081 05 01 03	**Angle-of-attack change**						
LO	Explain the influence of local angle-of-attack change by movement of a control surface.	x	x				
081 05 02 00	**Pitch (longitudinal) control**						
081 05 02 01	**Elevator/all-flying tails**						
LO	Explain the working principle of the elevator/all-flying tail and describe its function. Describe the loads on the tailplane over the whole speed range.	x	x				
081 05 02 02	**Downwash effects**						

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the effect of downwash on the tailplane angle of attack. Explain in this context the use of a T-tail or stabiliser trim.	x	x				
081 05 02 03	**Ice on tail**						
LO	Explain how ice can change the aerodynamic characteristics of the tailplane. Explain how this can affect the tail's proper function.	x	x				
081 05 02 04	**Location of centre of gravity**						
LO	Explain the relationship between elevator deflection and CG location to produce a given aeroplane response. Explain the effect of forward CG limit on pitch control.	x	x				
081 05 02 05	**Moments due to engine thrust**						
LO	Describe the effect of engine thrust on pitching moments for different engine locations.	x	x				
081 05 03 00	**Yaw (directional) control**						
LO	Explain the working principle of the rudder and describe its function. State the relationship between rudder deflection and the moment about the normal axis; Describe the effect of sideslip on the moment about the normal axis.	x	x				
081 05 03 01	**Rudder limiting**						
LO	Explain why and how rudder deflection is limited on transport aeroplanes.	x					
081 05 04 00	**Roll (lateral) control**						
081 05 04 01	**Ailerons**						
LO	Explain the functioning of ailerons.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe the adverse effects of ailerons. (Refer to 081 05 04 04 and 081 06 01 02) Explain in this context the use of inboard and outboard ailerons. Explain outboard-aileron lockout and conditions under which this feature is used. Describe the use of aileron deflection in normal flight, flight with sideslip, crosswind landings, horizontal turns, flight with one engine out. Define 'roll rate'. List the factors that affect roll rate. Flaperons, aileron droop.						
081 05 04 02	***Intentionally left blank***						
081 05 04 03	**Spoilers**						
LO	Explain how spoilers can be used to control the rolling movement in combination with or instead of the ailerons.	x	x				
081 05 04 04	**Adverse yaw**						
LO	Explain how the use of ailerons induces adverse yaw.	x	x				
081 05 04 05	**Means to avoid adverse yaw**						
LO	Explain how the following reduce adverse yaw: Frise ailerons; differential aileron deflection; rudder aileron cross-coupling; roll spoilers.	x	x				
081 05 05 00	**Roll/yaw interaction**						
LO	Explain the secondary effect of roll. Explain the secondary effect of yaw.	x	x				
081 05 06 00	**Means to reduce control forces**						
081 05 06 01	**Aerodynamic balance**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the purpose of aerodynamic balance. Describe the working principle of the nose and horn balance. Describe the working principle of internal balance. Describe the working principle and the application of: balance tab; anti-balance tab; spring tab; servo tab.	x	x				
081 05 06 02	**Artificial means**						
LO	Describe fully powered controls. Describe power-assisted controls. Explain why artificial feel is required. Explain the inputs to an artificial feel system.	x	x				
081 05 07 00	**Mass balance**						
LO	Refer to 081 06 01 01 for mass balance. Refer to 081 04 03 11 and 081 04 03 14 for bob weight.	x	x				
081 05 08 00	**Trimming**						
081 05 08 01	**Reasons to trim**						
LO	State the reasons for trimming devices. Explain the difference between a trim tab and the various balance tabs.	x	x				
081 05 08 02	**Trim tabs**						
LO	Describe the working principle of a trim tab including cockpit indications.	x	x				
081 05 08 03	**Stabiliser trim**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain the advantages and disadvantages of a stabiliser trim compared with a trim tab. Explain elevator deflection when the aeroplane is trimmed in the case of fully powered and power-assisted pitch controls. Explain the factors influencing stabiliser setting. Explain the influence of take-off stabiliser trim setting on rotation characteristics and stick force during take-off rotation at extremes of CG position. Discuss the effects of jammed and runaway stabiliser. Explain the landing considerations with a jammed stabiliser.	x	x				
081 06 00 00	**LIMITATIONS**						
081 06 01 00	**Operating limitations**						
081 06 01 01	**Flutter**						
LO	Describe the phenomenon of flutter and list the factors: elasticity; backlash; aeroelastic coupling; mass distribution; structural properties IAS. List the flutter modes of an aeroplane: — wing, — tailplane, — fin, — control surfaces including tabs.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe the use of mass balance to alleviate the flutter problem by adjusting the mass distribution: wing-mounted pylons; control surface mass balance. List the possible actions in the case of flutter in flight.						
081 06 01 02	**Aileron reversal**						
LO	Describe the phenomenon of aileron reversal: at low speeds; at high speeds. Describe the aileron reversal speed in relationship to V_{NE} and V_{NO}.	x	x				
081 06 01 03	**Landing gear/flap operating**						
LO	Describe the reason for flap/landing gear limitations. define ‘V_{LO}’; define ‘V_{LE}’. Explain why there is a difference between V_{LO} and V_{LE} in the case of some aeroplane types. Define ‘V_{FE}’. Describe flap design features to prevent overload.	x	x				
081 06 01 04	**V_{MO}, V_{NO}, V_{NE}**						
LO	Define ‘V_{MO}’, ‘V_{NO}’, ‘V_{NE}’. Describe the differences between V_{MO}, V_{NO} and V_{NE}. Explain the dangers of flying at speeds close to V_{NE}.	x	x				
081 06 01 05	**M_{MO}**						
LO	Define ‘M_{MO}’ and state its limiting factors.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
081 06 02 00	**Manoeuvring envelope**						
081 06 02 01	**Manoeuvring-load diagram**						
LO	Describe the manoeuvring-load diagram. Define limit and ultimate load factor and explain what can happen if these values are exceeded. Define 'V_A', 'V_C', 'V_D'. Identify the varying features on the diagram: load factor 'n'; speed scale, equivalent airspeed, EAS; C_{LMAX} boundary; accelerated stall speed (refer to 081 01 08 02). Describe the relationship between V_{MO} and V_C. State all the manoeuvring limit load factors applicable to CS-23 and CS-25 aeroplanes. Explain the relationship between V_A and V_S in a formula. Explain the adverse consequences of exceeding V_A.	x	x				
081 06 02 02	**Factors affecting the manoeuvring-load diagram**						
LO	State the relationship of mass to: load factor limits; accelerated stall speed limit; V_A and V_C. Explain the relationship between V_A, aeroplane mass and altitude. Calculate the change of V_A with changing mass.	x	x				
LO	Describe the effect of altitude on Mach number, with respect to limitations. Explain why V_A loses significance at higher altitude where compressibility effects occur.	x					

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Define 'M_C' and 'M_D' and their relation with V_C and V_D.						
081 06 03 00	**Gust envelope**						
081 06 03 01	**Gust-load diagram**						
LO	Recognise a typical gust-load diagram. Identify the various features shown on the diagram: gust-load factor 'n'; speed scale, equivalent airspeed and EAS; C_{LMAX} boundary; vertical gust velocities; relationship of V_B to V_C and V_D. gust limit load factor. Define 'V_{RA}', 'V_B'. Discuss considerations for the selection of this speed. Explain the adverse effects on the aeroplane when flying in turbulence.	x	x				
081 06 03 02	**Factors affecting the gust-load diagram.**						
LO	Explain the relationship between the gust-load factor, lift-curve slope, density ratio, wing loading, EAS and equivalent vertical sharp-edged gust velocity and perform relevant calculations.	x	x				
081 07 00 00	**PROPELLERS**						
081 07 01 00	**Conversion of engine torque to thrust**						
LO	Explain the resolution of aerodynamic force on a propeller blade element into lift and drag or into thrust and torque. Describe propeller thrust and torque and their variation with IAS.	x	x				
081 07 01 01	**Relevant propeller parameters**						
LO	Describe the geometry of a typical propeller blade element at the reference section:	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	blade chord line; propeller rotational velocity vector; true-airspeed vector; blade angle of attack; pitch or blade angle; advance or helix angle; define 'geometric pitch', 'effective pitch' and 'propeller slip'. *Remark: For theoretical knowledge examination purposes, the following definition is used for geometric pitch: the theoretical distance a propeller would advance in one revolution at zero blade angle of attack.* Define 'fine and coarse pitch'.						
081 07 01 02	**Blade twist**						
LO	Define 'blade twist'. Explain why blade twist is necessary.	x	x				
081 07 01 03	**Fixed pitch and variable pitch/constant speed**						
LO	List the different types of propellers: fixed pitch; adjustable pitch or variable pitch (non-governing); variable pitch (governing)/ constant speed. Discuss the advantages and disadvantages of fixed-pitch and constant-speed propellers. Discuss climb and cruise propellers. Explain the relationship between blade angle, blade angle of attack and airspeed for fixed and variable pitch propellers. Given a diagram, explain the forces acting on a rotating blade element in normal, feathered, windmilling and reverse operation. Explain the effects of changing propeller pitch at constant IAS.	x	x				
081 07 01 04	**Propeller efficiency versus speed**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'propeller efficiency'. Explain the relationship between propeller efficiency and speed (TAS). Plot propeller efficiency against speed for the types of propellers listed in 081 07 01 03 above. Explain the relationship between blade angle and thrust.	x	x				
081 07 01 05	**Effects of ice on propeller**						
LO	Describe the effects of ice on a propeller.	x	x				
081 07 02 00	**Engine failure**						
081 07 02 01	**Windmilling drag**						
LO	List the effects of an inoperative engine on the performance and controllability of an aeroplane: thrust loss/drag increase; influence on yaw moment during asymmetric power.	x	x				
081 07 02 02	**Feathering**						
LO	Explain the reasons for feathering and the effect on performance and controllability. Influence on yaw moment during asymmetric power.	x	x				
081 07 03 00	**Design features for power absorption**						
LO	Describe the factors of propeller design that increase power absorption.	x	x				
081 07 03 01	**Aspect ratio of blade**						
LO	Define 'blade-aspect ratio'.	x	x				
081 07 03 02	**Diameter of propeller**						
LO	Explain the reasons for restricting propeller diameter.	x	x				
081 07 03 03	**Number of blades**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define 'solidity'. Describe the advantages and disadvantages of increasing the number of blades.	x	x				
081 07 03 04	**Propeller noise**						
LO	Explain how propeller noise can be minimised.	x	x				
081 07 04 00	**Secondary effects of propellers**						
081 07 04 01	**Torque reaction**						
LO	Describe the effects of engine/propeller torque. Describe the following methods for counteracting engine/propeller torque: counter-rotating propellers; contra-rotating propellers.	x	x				
081 07 04 02	**Gyroscopic precession**						
LO	Describe what causes gyroscopic precession. Describe the effect on the aeroplane due to the gyroscopic effect.	x	x				
081 07 04 03	**Asymmetric slipstream effect**						
LO	Describe the possible asymmetric effects of the rotating propeller slipstream.	x	x				
081 07 04 04	**Asymmetric blade effect**						
LO	Explain the asymmetric blade effect (also called P factor). Explain influence of direction of rotation on critical engine on twin engine aeroplanes.	x	x				
081 08 00 00	**FLIGHT MECHANICS**						
081 08 01 00	**Forces acting on an aeroplane**						
081 08 01 01	**Straight horizontal steady flight**						
LO	Describe the forces acting on an aeroplane in straight horizontal steady flight.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	List the four forces and state where they act. Explain how the four forces are balanced. Describe the function of the tailplane.						
081 08 01 02	**Straight steady climb**						
LO	Define 'γ flight-path angle'. Describe the relationship between pitch attitude, flight-path angle and angle of attack for the zero-wind, zero-bank and sideslip conditions. Describe the forces acting on an aeroplane in a straight steady climb. Name the forces parallel and perpendicular to the direction of flight. Apply the formula relating to the parallel forces ($T = D + W \sin \gamma$). Apply the formula relating to the perpendicular forces ($L = W \cos \gamma$). Explain why thrust is greater than drag. Explain why lift is less than weight. Explain the formula (for small angles) giving the relationship between flight-path angle, thrust, weight and lift–drag ratio, and use this formula for simple calculations. Explain how IAS, angle of attack and flight-path angle change in a climb performed with constant pitch attitude and normal thrust decay with altitude.	x	x				
081 08 01 03	**Straight steady descent**						
LO	Describe the forces acting on an aeroplane in a straight steady descent. Name the forces parallel and perpendicular to the direction of flight.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Apply the formula parallel to the direction of flight (T = D – W sin γ). Apply the formula relating to the perpendicular forces (L = W cos γ). Explain why lift is less than weight. Explain why thrust is less than drag.						
081 08 01 04	**Straight steady glide**						
LO	Describe the forces acting on an aeroplane in a straight steady glide. Name the forces parallel and perpendicular to the direction of flight. Apply the formula for forces parallel to the direction of flight (D = W sin γ); Apply the formula for forces perpendicular to the direction of flight (L = W cos γ). Describe the relationship between the glide angle and the lift–drag ratio. Describe the relationship between angle of attack and the best lift–drag ratio. Explain the effect of wind component on glide angle, duration and distance. Explain the effect of mass change on glide angle, duration and distance. Explain the effect of configuration change on glide angle, duration and distance. Describe the relation between TAS and sink rate including minimum glide angle and minimum sink rate.	x	x				
081 08 01 05	**Steady coordinated turn**						
LO	Describe the forces acting on an aeroplane in a steady coordinated turn. Resolve the forces acting horizontally and vertically during a coordinated turn ($\tan\phi = \frac{V^2}{gR}$).	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe the difference between a coordinated and an uncoordinated turn and explain how to correct an uncoordinated turn using turn and slip indicator. Explain why the angle of bank is independent of mass and only depends on TAS and radius of turn. Resolve the forces to show that for a given angle of bank the radius of turn is determined solely by airspeed (tan $\phi = \frac{V^2}{gR}$). Calculate the turn radius, load factor and the time for a complete turn for relevant parameters given for a steady turn. Discuss the effects of bank angle on: load factor; angle of attack; thrust; drag. Define 'angular velocity'. Define 'rate of turn' and 'rate-one turn'. Explain the influence of TAS on rate of turn at a given bank angle.						
081 08 02 00	**Asymmetric thrust**						
LO	Describe the effects on the aeroplane during flight with asymmetric thrust including both jet engine and propeller-driven aeroplanes. Discuss critical engine, include effect of crosswind when on the ground. Explain effect of steady asymmetric flight on a conventional (ball) slip indicator.	x	x				
081 08 02 01	**Moments about the normal axis**						
LO	Describe the moments about the normal axis.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Explain the yawing moments about the CG. Describe the change to yawing moment caused by power changes. Describe the changes to yawing moment caused by engine distance from CG. Describe the methods to achieve balance.						
081 08 02 02	***Intentionally left blank***						
081 08 02 03	**Forces parallel to the lateral axis**						
LO	Explain: the force on the vertical fin; the fuselage side force due to sideslip; the use of bank angle to tilt the lift vector. Explain how bank angle and sideslip are related in a steady asymmetric flight. Explain why the bank angle must be limited. Explain the effect on fin angle of attack due to sideslip.	x	x				
081 08 02 04	**Influence of aeroplane mass**						
LO	Explain why controllability with one engine inoperative is a typical problem encountered at low aeroplane mass.	x	x				
081 08 02 05	***Intentionally left blank***						
081 08 02 06	**Secondary propeller effects**						
LO	Describe propeller effects: slip stream; torque reaction; asymmetric blade effect.	x	x				
081 08 02 07	***Intentionally left blank***						
081 08 02 08	**V_{MCA}**						
LO	Define 'V_{MCA}'. Describe how V_{MCA} is determined. Explain the influence of the CG location.	x	x				
081 08 02 09	**V_{MCL}**						
LO	Define 'V_{MCL}'.	x	x				

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
	Describe how V_{MCL} is determined. Explain the influence of the CG location.						
081 08 02 10	**V_{MCG}**						
LO	Define 'V_{MCG}'. Describe how V_{MCG} is determined. Explain the influence of the CG location.	x	x				
081 08 02 11	**Influence of density**						
LO	Describe the influence of density. Explain why V_{MCA}, V_{MCL} and V_{MCG} reduce with an increase in altitude and temperature.	x	x				
081 08 03 00	**Particular points on a polar curve**						
LO	Identify the particular points on a polar curve and explain their significance, assuming a parabolic approximation.	x	x				

N. SUBJECT 082 — PRINCIPLES OF FLIGHT (HELICOPTER)

(1) VOCABULARY OF MECHANICS

Speed is a scalar quantity, it has only magnitude.

Velocity is a vector quantity having magnitude and direction.

The velocity (speed) of a point of the aerofoil in the rotation around its axis is the 'linear' or 'tangential' velocity (speed).

The rotational velocity (speed) of a body around an axis is an angular velocity (speed) expressed in revolutions per minute (RPM), or degrees per second (deg/s), or radians per second (rad/s).

Density is the mass of the fluid per unit volume, in SI units kg/m^3.

(2) AERONAUTICAL DEFINITIONS

The blade is the aerofoil between a root radius and the tip radius (R) attached to the hub with hinges or flexible elements.

The cross section of a blade perpendicular to the feathering axis, the blade section at a distance (radius) from the hub centre shows the shape of the aerofoil.

Such section is characterised by a contour, a leading and trailing edge, a chord line, a chord, a camber line, the maximum thickness or depth, the thickness-to-chord ratio.

The blade element is a spanwise piece of the blade. It is assumed that its radial extension is small such that the aerodynamic forces don't vary with radial distance. The aerodynamic forces on the blade element produce lift, drag and a pitching moment.

The centre of pressure is defined as the point on the chord where the resultant of all aerodynamic forces acts such that the pitching moment about this point is zero.

The planform of the blade is the shape of the blade as seen from above.

The pitch angle of a section is the angle between the chord line and a reference plane. (The reference planes will be defined later in this text.)

The blade is without twist when the pitch angle is constant from root to tip.

The blade is twisted when the pitch angle of the sections varies as a function of the radial distance (the chord lines are not parallel). If the pitch angle decreases towards the tip, this is called washout.

The vector sum of the undisturbed upstream velocity and the thrust-induced velocity is the relative velocity.

In the helicopter theory we use the following definitions for 'angle of attack', 'lift' and 'drag':

The angle between the relative velocity and the chord line is the angle of attack α or AoA, called effective angle of attack. The geometric angle of attack is the angle between the undisturbed upstream velocity and the chord line.

Lift is the component of the aerodynamic force on a blade element perpendicular to the relative velocity.

Profile drag is the component of the aerodynamic force on a blade element parallel to the relative velocity.

Profile drag is produced by the pressure forces and by skin-friction forces that act on the surface of the blade element.

The component of the drag force due to the pressure forces is the pressure or form drag.

The component of the drag due to the shear forces over the aerofoil is termed skin-friction drag.

The sum of the pressure drag and the skin-friction drag is the profile drag.

(3) HELICOPTER CHARACTERISTICS

Disc loading is by definition the mass M or weight W of the helicopter divided by the area of the disc. (The disc area is πR^2, R being the blade-tip radius)

The disc loading is $M/(\pi R^2)$ or $W/(\pi R^2)$.

Blade loading is by definition the mass (weight) divided by the total planform area of the blades.

The area of a rectangular blade is given by chord times tip radius. For tapered blades, the mean geometric chord is taken as an approximately equivalent chord.

Blade loading is defined as the mass or weight of the helicopter divided by the total area of all blades.

Rotor solidity is the ratio of the total blade area to the disc area.

(4) PLANES, AXES, REFERENCE SYSTEMS OF THE ROTOR

Shaft axis: the axis of the rotor shaft (mast).

Hub plane: plane perpendicular to the shaft axis through the centre of the hub.

Tip-path plane: the plane traced out by the blade tips. This plane is also the no-flapping plane.

Virtual rotation axis: axis through the centre of the hub and perpendicular to the tip-path plane. Another name for this axis is no-flapping axis.

Rotor-disc plane: another name for the tip-path plane.

Rotor disc: the disc traced out by the blade tips in the tip-path plane.

Plane of rotation: the plane parallel to the tip-path plane through the hub centre.

No-feathering plane: is also called the control plane. This is the reference plane relative to which the pitch of the rotating blade has no variation during a full rotation. The control plane is parallel to the swash plate in the simple feathering mechanism (no flap-feathering coupling).

Control axis or axis of no-feathering. Axis through the hub centre and perpendicular to the no-feathering or control plane.

The azimuthal angle of the blade is the angle in the rotor-disc plane counted in the rotation sense from the direction opposite to the helicopter velocity.

(5) REFERENCE SYSTEMS (sometimes called frames of reference)

There are three different reference systems in which the movement of the blades can be studied or observed:

The tip-path plane with the virtual rotation axis: the observer in this system observes no flapping, only cyclic feathering.

The no-feathering plane (or control plane) with the control axis: the observer in this system observes no feathering, only cyclic flapping.

The hub plane and shaft axis: the observer in this system observes both cyclic flapping and cyclic feathering.

(6) ANGLES OF THE BLADES, INDUCED VELOCITY

Pitch angle of a blade section: the angle between the chord line of the section and the hub plane (the reference plane), also called local pitch angle.

Pitch angle of the blade: the pitch angle at 75 % of the tip radius.

Flapping angle: the angle between the longitudinal axis of the blade and the hub plane.

Coning angle: the angle between the longitudinal axis of the blade and the tip-path plane.

Advance angle: the azimuthal angle between the flapping axis and the point where the pitch link is connected to the swash plate (not to be confused with the phase lag from pitch input to flapping response).

The induced velocity is the velocity induced by the rotor thrust in the plane of the rotor disc (about 10 m/s for a light helicopter in hover). The slipstream velocity continues to increase downstream of the rotor. In the hover out-of-ground-effect (HOGE), the velocity in the ultimate wake is equal to two times the induced velocity.

Aerodynamic forces on the BLADES and the ROTOR.

The airflow around the blade element produces an aerodynamic force resolvable in two components: lift and drag. Lift is perpendicular to the relative air velocity, and drag is parallel to the relative air velocity.

The aerodynamic force may also be resolved into thrust perpendicular to the tip-path plane (or plane of rotation) and drag parallel to the tip-path plane. This drag is the sum of the profile drag and the induced drag.

Because the angle between the lift vector and the thrust vector is very small, the magnitudes of these two vectors may be taken as equal.

The blade thrust is the sum of the thrusts of all blade elements along the blade radius.

The sum of the thrusts of all blades is the (total) rotor thrust acting perpendicular to the tip-path plane in the direction of the virtual rotation axis.

The result of the induced drag forces on all the blade elements of all blades is a torque on the shaft which — multiplied by the angular velocity of the rotor — gives the required induced power.

The result of all the profile drags is a torque on the shaft which — multiplied by the angular velocity of the rotor — gives the required profile power.

(7) TYPES OF ROTOR HUBS

There are basically four types of rotor hubs in use:

1. Teetering rotor or seesaw rotor: The two blades are connected together; the hinge is on the shaft axis. A variation is the gimballed hub; the blades and the hub are attached to the rotor shaft by means of a gimbal or universal joint.
2. Fully articulated rotor: The rotor has more than two blades. Each blade has a flapping hinge, a lead-lag hinge and a feathering bearing.

3. Hingeless rotor: There are no flap and lead-lag hinges. They are replaced by flexible elements at the root of the blades which allow flapping and lead-lag movements. The feathering bearing allows feathering of the blade.
4. Bearingless rotor: There are no hinges or bearings. Flapping and lead or lag are obtained by flexing flexible elements called elastomeric hinges and feathering is obtained by twisting the element.

Two remarks:

1. Hinge offset and equivalent hinge offset

   The hinge offset is the distance between the shaft axis and the axis of the hinge. In the hingeless and bearingless rotor, we define an equivalent hinge offset.

2. Elastomeric hinges

   This bearing consists of alternate layers of elastomer and metal. The elasticity in the elastomer allows the movements of flapping, lead-lag and feathering.

(8) DRAG AND POWERS

The induced power is the power resulting from the induced velocity in the rotor disc for the generation of lift. For any given thrust, the induced power is minimum when the induced velocity is uniform over the rotor disc. Such velocity distribution can be approximated by using some blade twist (a truly uniform velocity cannot be obtained).

The rotor profile drag results from the component opposite to the blade velocities of all the profile drags of the blade elements of all the blades.

The resulting power is the rotor profile power or the profile-drag power (sum of the powers to overcome the torque).

The parasite drag is the drag on the helicopter fuselage including the drag of the rotor hub and all external equipment such as wheels, winch, etc. The tail-rotor drag is also included in the parasite drag. The power to overcome this drag is the parasite power.

In the level flight at constant speed, the main-rotor-induced power, the rotor profile power and the parasite power are summed to give the total power required to drive the main rotor.

The tail-rotor-induced power and the tail-rotor profile power are summed to give the power required to drive the tail rotor.

The power required to drive the auxiliary services, such as oil pumps and electrical generators, is the accessory or ancillary power. The power to overcome the mechanical friction in the transmissions is included in the accessory power.

The total power required in level flight at constant speed is the sum of the total power for the main rotor, the power for the tail rotor and the accessory power.

In the low-speed region, the required power in straight and level flight decreases as speed increases. The phenomenon is called translational lift.

The term limited power means that the total power required to hover OGE is greater than the available power.

(9) PHASE ANGLE IN FLAPPING MOVEMENT OF THE BLADE

The cyclic movement tilts the rotor disc in the direction of the intended helicopter velocity.

The flapping response is approximately 90° later than the applied cyclic pitch (somewhat less than 90° for hingeless rotors).

The pitch mechanism consists of the swash plate and for each blade a pitch link attached to the swash plate and a pitch horn attached to the blade.
(10) AXES THROUGH THE CENTRE OF THE HELICOPTER

Longitudinal axis or roll axis: Straight line through the centre of gravity of the helicopter from the nose to the tail about which the helicopter can roll left or right.

Lateral axis, transverse axis or pitch axis: Straight line through the centre of gravity of the helicopter about which the helicopter can pitch its nose up or down. (This axis is also perpendicular to the reference plane of the aircraft.)

Normal axis or yaw axis: Straight line perpendicular to the plane defined by the longitudinal and lateral axes and about which the helicopter can yaw.

Aircraft reference plane: The plane with respect to which a subset of the components that constitutes the major part of the aircraft is symmetrically disposed in the port and starboard sense.

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
080 00 00 00	**PRINCIPLES OF FLIGHT**						
082 00 00 00	**PRINCIPLES OF FLIGHT — HELICOPTER**						
082 01 00 00	**SUBSONIC AERODYNAMICS**						
082 01 01 00	**Basic concepts, laws and definitions**						
082 01 01 01	**SI units and conversion of units**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	List the fundamental quantities and units in SI system: mass (kg), length (m), time (s).			x	x	x	
LO	Show and apply tables of conversion of units of English units to SI units and vice versa.			x	x	x	
LO	The units of the physical quantities should be mentioned when they are introduced.			x	x	x	
082 01 01 02	**Definitions and basic concepts about air**						
LO	Describe air temperature and pressure as functions of height.			x	x	x	
LO	Use the table of the International Standard Atmosphere.			x	x	x	
LO	Define air density; explain the relationship between density, pressure and temperature.			x	x	x	
LO	Explain the influence of moisture content on density.			x	x	x	
LO	Define pressure altitude and density altitude.			x	x	x	
082 01 01 03	**Newton's laws**						
LO	Describe Newton's second law: force equals product of mass and acceleration.			x	x	x	
LO	Distinguish mass and weight, units.			x	x	x	
LO	Describe the other form of the second law, applicable to thrust.			x	x	x	
LO	Describe Newton's third law: action and reaction, force and torque.			x	x	x	
082 01 01 04	**Basic concepts of airflow**						
LO	Describe steady and unsteady airflow.			x	x	x	
LO	Define 'streamline' and 'stream tube'.			x	x	x	
LO	Equation of continuity or mass conservation.			x	x	x	
LO	Mass-flow rate through a stream-tube section.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the relation between the external force on a stream tube and the momentum variation of the airflow.			x	x	x	
LO	State the Bernoulli's equation in a non-viscous airflow, use this equation to explain and define static pressure, dynamic pressure and total pressure.			x	x	x	
LO	Define the stagnation point in a flow around an aerofoil and explain the pressure obtained in the stagnation point.			x	x	x	
LO	Describe the pitot system and explain the measurement of airspeed (no compressibility effects).			x	x	x	
LO	Define TAS, IAS, CAS.			x	x	x	
LO	Define a two-dimensional airflow and an aerofoil of infinite span. Explain the difference between a two-dimensional and a three-dimensional airflow.			x	x	x	
LO	Explain that viscosity is a feature of a fluid (gas or liquid).			x	x	x	
LO	Describe the airflow over a flat surface and explain the tangential friction between air and surface and the development of a boundary layer.			x	x	x	
LO	Define a laminar boundary layer, a turbulent boundary layer and the transition from laminar to turbulent. Show the influence of the roughness of the surface on the position of the transition point.			x	x	x	
082 01 02 00	**Two-dimensional airflow**						
082 01 02 01	**Aerofoil section geometry**						
LO	Define the terms 'aerofoil section', 'aerofoil element', 'chord line', 'chord', 'thickness', 'thickness-to-chord ratio of section', 'camber line', 'camber', 'leading-edge radius'.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe different aerofoil sections, symmetrical and asymmetrical.			x	x	x	
082 01 02 02	**Aerodynamic forces on aerofoil elements**						
LO	Define the 'angle of attack'.			x	x	x	
LO	Describe the pressure distribution on the upper and lower surface.			x	x	x	
LO	Describe the boundary layers on the upper and lower surfaces for small angles of attack (below the onset of stall).			x	x	x	
LO	Describe the resultant force due to the pressure distribution and the friction at the element, the boundary layers and the velocities in the wake, the loss of momentum due to friction forces.			x	x	x	
LO	Resolve the aerodynamic force into the components lift and drag.			x	x	x	
LO	Define the lift coefficient and the drag coefficient, equations.			x	x	x	
LO	Show that the lift coefficient is a function of the angle of attack, draw the graph.			x	x	x	
LO	Explain how drag is caused by pressure forces on the surfaces and by friction forces in the boundary layers. Define the term 'profile drag'.			x	x	x	
LO	Draw the graph of lift (or of the lift coefficient) as a function of drag or of the drag coefficient and define the lift–drag ratio.			x	x	x	
LO	Use the equations of lift and drag to show the influence of speed and density on lift and drag for a given angle of attack and to calculate lift and drag.			x	x	x	
LO	Define the action line of the aerodynamic force, the centre of pressure, the pitching moment.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Know that the pitching moment about the centre of pressure is zero by definition.			x	x	x	
LO	Know that symmetrical aerofoils have the centre of pressure a quarter chord behind the leading edge independently of the angle of attack as long as the angle of attack remains smaller than the angle of stall.			x	x	x	
LO	Taking an asymmetrical aerofoil section with different cambers, know the position of the centre of pressure, the influence of the angle of attack on the centre of pressure and the pitching moment about a line which is a quarter chord behind the leading edge.			x	x	x	
082 01 02 03	**Stall**						
LO	Explain the boundary layer separation when the angle of attack increases beyond stall onset and the decrease of lift and the increase of drag. Define the 'separation point and line'.			x	x	x	
LO	Draw a graph of lift and drag coefficient as a function of the angle of attack before and beyond the stall onset.			x	x	x	
LO	Describe how the stall phenomenon displaces the centre of pressure and how pitching moments appear about the line at quarter chord behind the leading edge.			x	x	x	
082 01 02 04	**Disturbances due to profile contamination**						
LO	Explain ice contamination, the modification of the section profile and the surfaces due to ice and snow, influence on lift and drag and L–D ratio, on the angle of attack at stall onset, effect of the weight increase.			x	x	x	
LO	Explain the erosion effect of heavy rain on the wing and subsequent increase of profile drag.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
082 01 03 00	**Three-dimensional airflow around a blade (wing) and a fuselage**						
082 01 03 01	**The blade**						
LO	Describe different planforms of blades, and describe untwisted and twisted blades.			x	x	x	
LO	Define the root chord and the tip chord, the mean chord, the aspect ratio and the blade twist.			x	x	x	
082 01 03 02	**Airflow pattern and influence on lift**						
LO	Explain the spanwise flow in the case of a blade and the appearance of the tip vortices which are a loss of energy.			x	x	x	
LO	Show that the strength of the vortices increases as the angle of attack and the lift increase.			x	x	x	
LO	Show that downwash causes vortices.			x	x	x	
LO	Define the effective air velocity as the resultant of the undisturbed air velocity and the induced velocity and define the effective angle of attack.			x	x	x	
LO	Explain the spanwise lift distribution and how it can be modified by twist.			x	x	x	
082 01 03 03	**Induced drag**						
LO	Explain the thrust-induced drag, the influence of the angle of attack and of the aspect ratio.			x	x	x	
082 01 03 04	**The airflow around a fuselage**						
LO	Describe the aircraft fuselage and the external components which cause drag, the airflow around the fuselage, influence of the pitch angle of the fuselage.			x	x	x	
LO	Define parasite drag as the sum of pressure drag and friction drag.			x	x	x	
LO	Define ‘interference drag’.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe fuselage shapes that minimise drag.			x	x	x	
LO	Know the formula of the parasite drag and explain the influence of the speed.			x	x	x	
082 02 00 00	**TRANSONIC AERODYNAMICS AND COMPRESSIBILITY EFFECTS**						
082 02 01 00	**Airflow speeds and velocities**						
082 02 01 01	**Speeds and Mach number**						
LO	Define the speed of sound in air.			x	x	x	
LO	State that the speed of sound is proportional to the square root of the absolute temperature (unit Kelvin).			x	x	x	
LO	Explain the variation of speed of sound with altitude.			x	x	x	
LO	Define Mach number.			x	x	x	
LO	Explain the meaning of incompressibility and compressibility of air; relate this to the value of Mach number.			x	x	x	
LO	Define subsonic, high subsonic and supersonic flows in relation to the value of the Mach number.			x	x	x	
082 02 01 02	**Shock waves**						
LO	Describe a shock wave in a supersonic flow and the pressure and speed changes by the shock.			x	x	x	
LO	Describe the appearance of local supersonic flows at the upper surface of a blade section and the compression by a shock when the section is in an upstream high subsonic flow.			x	x	x	
LO	Describe the effect of the shock on lift, drag, the pitching moment and the C_L–C_D ratio, drag divergence Mach number.			x	x	x	
082 02 01 03	**Influence of aerofoil section and blade planform**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the different shapes which allow higher upstream Mach numbers without generating a shock wave on the upper surface: reducing the section thickness-to-chord ratio; special aerofoil sections as supercritical shapes; a planform with sweep angle, positive and negative.			x	x	x	
082 03 00 00	**ROTORCRAFT TYPES**						
082 03 01 00	**Rotorcraft**						
082 03 01 01	**Rotorcraft types**						
LO	Define the 'autogyro' and the 'helicopter'.			x	x	x	
LO	Explain the rolling moment on an autogyro with fixed blades, the necessity to use flapping hinges and the ensuing reduction of the moment arm, the flapback of the blades.			x	x	x	
082 03 02 00	**Helicopters**						
082 03 02 01	**Helicopter configurations**						
LO	Describe the single main rotor helicopter and the other configurations: tandem, coaxial, side by side, synchrocopter (intermeshing blades), the compound helicopter, tilt-wing and tilt-rotor.			x	x	x	
082 03 02 02	**The helicopter, characteristics and associated terminology**						
LO	Describe the general layout of a single main rotor helicopter, fuselage, engine or engines, main gearbox, main rotor shaft and rotor hub.			x	x	x	
LO	Mention the tail rotor at the aft of the fuselage, the fenestron and the NOTOR (No Tail Rotor).			x	x	x	
LO	Define the rotor disc area and the blade area, the blades turning in the hubplane.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the teetering rotor with the hinge axis on the shaft axis and the rotor with more than two blades with offset hinge axes.			x	x	x	
LO	Define the fuselage centre line and the three axes: roll, pitch and normal.			x	x	x	
LO	Define the gross weight and the gross mass (units), the disc and blade loading.			x	x	x	
082 04 00 00	**MAIN-ROTOR AERODYNAMICS**						
082 04 01 00	**Hover flight Outside Ground Effect (OGE)**						
082 04 01 01	**Airflow through the rotor disc and around the blades**						
LO	Define the circumferential (tangential) velocity of the blade sections, which equals the angular velocity of the rotor multiplied by the radius of the section.			x	x	x	
LO	Keep the blade fixed and define the undisturbed upstream air velocity relative to the blade.			x	x	x	
LO	Based on Newton's second law (momentum), explain that the vertical force on the disc, the rotor thrust, produces vertical downward velocities in the rotor-disc plane. The values of these thrust-induced velocities increase as the thrust increases and decrease with increasing rotor diameter. Know that the velocities some distance downstream are twice the value of the induced speed in the disc plane.			x	x	x	
LO	Explain why the production of the induced flow requires a power on the shaft, the induced power. The induced power is smallest if the induced velocities have the same value on the whole disc (flow uniformity over the disc).			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe uniform and typical non-uniform velocities through the rotor disc.			x	x	x	
LO	Explain why the vertical rotor thrust must be somewhat higher than the weight because of the vertical drag on the fuselage.			x	x	x	
LO	Describe the vertical air velocities relative to the rotor disc as the sum of the upstream air velocities and the induced velocities.			x	x	x	
LO	Define the pitch angle and the angle of attack of a blade element.			x	x	x	
LO	Explain lift and the profile drag of a blade element.			x	x	x	
LO	Explain the resulting lift and the thrust on the blade, define the resulting rotor thrust.			x	x	x	
LO	Explain the necessity of collective pitch angle changes, the influence on the angles of attack and on the rotor thrust and the necessity of blade feathering.			x	x	x	
LO	Explain the blade twist necessary to obtain a more even induced airspeed over the disc.			x	x	x	
LO	Describe the different blade shapes (as viewed from above).			x	x	x	
LO	Explain how the profile drag on the blade elements generates a torque on the main shaft and define the resulting rotor profile power.			x	x	x	
LO	Explain the influence of air density on the required powers.			x	x	x	
LO	Show the effect on the airflow over the blade tips.			x	x	x	
082 04 01 02	**Anti-torque force and tail rotor**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Based on Newton's third law, explain the need of a tail-rotor thrust, the required value being proportional to the main-rotor torque. Show that the tail-rotor power is proportional to the tail-rotor thrust.			x	x	x	
LO	Explain the necessity of blade feathering of the tail-rotor blades and the control by the yaw pedals, the maximum and minimum values of the pitch angles of the blades.			x	x	x	
082 04 01 03	**Total power required and hover altitude Outside Ground Effect (OGE)**						
LO	Define the ancillary equipment and its power requirement.			x	x	x	
LO	Define the total power required.			x	x	x	
LO	Describe the influence of ambient pressure, temperature and moisture on the required power.			x	x	x	
082 04 02 00	**Vertical climb**						
082 04 02 01	**Relative airflow and angles of attack**						
LO	Describe the climb speed and the opposite vertical air velocity relative to the rotor disk.			x	x	x	
LO	Explain the relative air velocities and the angle of attack of the blade elements.			x	x	x	
LO	Explain how the angle of attack is controlled by the collective pitch angle control.			x	x	x	
082 04 02 02	**Power and vertical speed**						
LO	Define the total main-rotor power as the sum of the parasite power, the induced power, the climb power and the rotor profile power.			x	x	x	
LO	Explain why the total main-rotor power increases when the rate of climb increases.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define the total required power in vertical flight.			x	x	x	
082 04 03 00	**Forward flight**						
082 04 03 01	**Airflow and forces in uniform inflow distribution**						
LO	Explain the assumption of a uniform inflow distribution on the rotor disc.			x	x	x	
LO	Define the azimuth angle of a blade, the advancing blade angular range centred at 90°, and the retreating blade range centred at 270°.			x	x	x	
LO	Show the upstream air velocities relative to the blade elements and the different effects on the advancing and retreating blade. Define the area of reverse flow. Explain the influence of forward speed on the tip circumferential speed.			x	x	x	
LO	Assuming constant pitch angles and rigid blade attachments, explain the huge roll moment by the asymmetric lift distribution.			x	x	x	
LO	Show that through cyclic feathering this imbalance could be eliminated by a low angle of attack (accomplished by a low-pitch angle) on the advancing blade and a high angle of attack (accomplished by a high-pitch angle) on the retreating blade.			x	x	x	
LO	Describe the high air velocity at the advancing blade tip and the compressibility effects which limit the maximum speed of the helicopter.			x	x	x	
LO	Describe the low air velocities on the retreating blade tip resulting from the circumferential speed and the forward speed, the necessity of high angle of attack and the onset of stall.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define the tip–speed ratio and show the limits.			x	x	x	
LO	Explain the rotor thrust perpendicular to the rotor disc and the necessity to tilt the thrust vector forward. (Realisation will be explained in 082 05 00 00)			x	x	x	
LO	Explain the equilibrium conditions in steady straight and level flight.			x	x	x	
082 04 03 02	**The flare (powered flight)**						
LO	Explain the flare in powered flight, the rearward tilt of the rotor disc and of the thrust vector. Show the horizontal thrust component opposite to the speed.			x	x	x	
LO	State the increase of the thrust due to the upward inflow, and show the modifications of the angles of attack.			x	x	x	
LO	Explain the increase of rotor RPM in the case of a non-governed rotor.			x	x	x	
LO	Explain the actions to be taken by the pilot.			x	x	x	
082 04 03 03	**Non-uniform inflow distribution in relation to inflow roll**						
LO	Explain why the uniform inflow distribution is an assumption to simplify the theory and describe the real inflow distribution which modifies the angle of attack and the lift especially on the forward and backward blades.			x	x	x	
082 04 03 04	**Power and maximum speed**						
LO	Explain that the induced velocities and induced power decrease as the helicopter speed increases.			x	x	x	
LO	Define the profile drag and the profile power and their increase with helicopter speed.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define the fuselage drag and the parasite power and the increase with helicopter speed.			x	x	x	
LO	Define the total drag and the increase with helicopter speed.			x	x	x	
LO	Describe the tail-rotor power and the power required by the ancillary equipment.			x	x	x	
LO	Define the total power requirement as a sum of the partial powers and explain how this total power varies with helicopter speed.			x	x	x	
LO	Explain the influence of the helicopter mass, the air density and additional external equipment on the partial powers and the total power required.			x	x	x	
LO	Describe the translational lift and show the decrease of required total power as the helicopter speed increases in the low-speed region.			x	x	x	
082 04 04 00	**Hover and forward flight In Ground Effect (IGE)**						
082 04 04 01	**Airflow in ground effect, downwash**						
LO	Explain how the vicinity of the ground changes the downward flow pattern and the consequences on lift (thrust) at constant rotor power. Show that the ground effect depends on the height of the rotor above the ground and the rotor diameter. Show the required rotor power at constant AUM as a function of height above the ground. Describe the influence of the forward speed.			x	x	x	
082 04 05 00	**Vertical descent**						
082 04 05 01	**Vertical descent, power on**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the airflow to the rotor disc in a trouble-free vertical descent, power on, the airflow opposite to the helicopter velocity, the relative air velocity and the angle of attack.			x	x	x	
LO	Explain the vortex-ring state, the settling with power. State the approximate values of vertical descent speeds for the formation of vortex ring related to the values of the induced velocities.			x	x	x	
LO	Describe the airflow relative to the blades, the root stall, the loss of lift on the blade tip, the turbulence. Show the effect of raising the lever and discuss the effects on the controls.			x	x	x	
082 04 05 02	**Autorotation**						
LO	State the need for early recognition of malfunctions and for a quick initiation of recovery. Describe the recovery actions.			x	x	x	
LO	Explain that the collective lever position must be lowered sufficient quickly to avoid a rapid decay of rotor RPM, explain the influence of the rotational inertia of the rotor on the rate of decay.			x	x	x	
LO	Show the induced flow through the rotor disc, the rotational velocity and the relative airflow, the inflow and inflow angles.			x	x	x	
LO	Show how the aerodynamic forces on the blade elements vary from root to tip and distinguish three zones: the inner stalled ring (stall region), the middle autorotation ring (driving region), and the outer anti-autorotation ring (driven region). Explain the RPM stability at a given collective pitch.			x	x	x	
LO	Explain the control of the rotor RPM with collective pitch.			x	x	x	
LO	Show the need of negative tail-rotor thrust for yaw control.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the final increase in rotor thrust by pulling the collective to decrease the vertical descent speed and the decay in rotor RPM.			x	x	x	
082 04 06 00	**Forward flight — Autorotation**						
082 04 06 01	**Airflow at the rotor disc**						
LO	Explain the factors affecting inflow angle and angle of attack, the autorotative power distribution and the asymmetry over the rotor disc in forward flight.			x	x	x	
082 04 06 02	**Flight and landing**						
LO	Show the effect of forward speed on the vertical descent speed.			x	x	x	
LO	Explain the effects of gross weight, rotor RPM and altitude (density) on endurance and range.			x	x	x	
LO	Explain the manoeuvers of turning and touchdown.			x	x	x	
LO	Explain the height–velocity avoidance graph or dead man's curves.			x	x	x	
082 05 00 00	**MAIN-ROTOR MECHANICS**						
082 05 01 00	**Flapping of the blade in hover**						
082 05 01 01	**Forces and stresses on the blade**						
LO	Show how the centrifugal forces depend on rotor RPM and blade mass and how they pull on the blade attachment to the hub. Apply the formula to an example. Justify the upper limit of the rotor RPM.			x	x	x	
LO	Assume a rigid attachment and show how thrust may cause huge oscillating bending moments which stress the attachment.			x	x	x	
LO	Explain why flapping hinges do not transfer such moments. Show the small flapping hinge offset on fully articulated rotors and zero offset in the case of teetering rotors.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the working principle of the flexible element in the hingeless rotor and describe the equivalent flapping hinge offset compared to that of the articulated rotor.			x	x	x	
082 05 01 02	**Centrifugal turning moment**						
LO	Describe the centrifugal forces on the mass elements of a blade with pitch applied and the components of these forces. Show how these forces generate a moment which tries to reduce the blade-pitch angle.			x	x	x	
LO	Explain the methods of counteracting by hydraulics, bias springs and balance masses.			x	x	x	
082 05 01 03	**Coning angle in hover**						
LO	Show how the equilibrium of the moments about the flapping hinge of lift (thrust) and of the centrifugal force determine the coning angle of the blade (the blade weight being negligible).			x	x	x	
LO	Define the tip-path plane and the coning angle.			x	x	x	
LO	Explain the influence of rotor RPM and lift on the coning angle, justify the lower limit of the rotor RPM, relate the lift on one blade to the gross weight.			x	x	x	
LO	Explain the effect of the mass of the blade on the tip path and the tracking.			x	x	x	
082 05 02 00	**Flapping angles of the blade in forward flight**						
082 05 02 01	**Forces on the blade in forward flight without cyclic feathering**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Assume rigid attachments of the blade to the hub and show the periodic lift, moment and stresses on the attachment, the ensuing metal fatigue, the roll moment on the helicopter and justify the necessity for flapping hinge.			x	x	x	
LO	Assume no cyclic pitch and describe the lift on the advancing and the retreating blades.			x	x	x	
LO	State the azimuthal phase lag (90° or less) between the input (applied pitch) and the output (flapping angle). Explain the rotor flapback (the rearward tilting of the tip-path plane and the rotor thrust).			x	x	x	
082 05 02 02	**Cyclic pitch (feathering) in helicopter mode, forward flight**						
LO	Show that in order to assume and maintain forward flight, the rotor-thrust vector must get a forward component by tilting the tip-path plane.			x	x	x	
LO	Show how the applied cyclic pitch modifies the lift on the advancing and retreating blades and produces the required forward tilting of the tip-path plane and the rotor thrust.			x	x	x	
LO	Show the cone described by the blades and define the virtual axis of rotation (or the no flapping axis). Define the plane of rotation.			x	x	x	
LO	Define the reference system in which we define the movements: the shaft axis and the hub plane.			x	x	x	
LO	Describe the swash plates, the pitch link and the pitch horn. Explain how the collective lever moves the non-rotating swash plate up or down alongside the shaft axis.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the mechanism by which the desired cyclic blade pitch can be produced by tilting the swash plate with the cyclic stick.			x	x	x	
LO	Define the no-feathering or control plane (control orbit) and the no-feathering axis or control axis.			x	x	x	
LO	Explain the translational lift effect when the speed increases.			x	x	x	
LO	Justify the increase of the tilt angle of the thrust vector and of the tip-path plane disc in order to increase the speed.			x	x	x	
082 05 03 00	**Blade-lag motion in forward flight**						
082 05 03 01	**Forces on the blade in the disc plane (tip-path plane) in forward flight**						
LO	Explain the Coriolis force due to flapping, the resulting periodic moments in the hub plane and the resulting periodic stresses which make lead-lag hinges necessary to avoid material fatigue.			x	x	x	
LO	Describe the profile-drag forces on the blade elements and the periodic variation of these forces.			x	x	x	
082 05 03 02	**The drag or lag hinge**						
LO	Describe the drag hinge of the fully articulated rotor and the lag flexure in the hingeless rotor.			x	x	x	
LO	Explain the necessity for drag dampers.			x	x	x	
082 05 03 03	**Ground resonance**						
LO	Explain the movement of the centre of gravity of the blades due to the lead-lag movements in the multiblade rotor.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Show the effect on the fuselage and the danger of resonance between this force and the fuselage and undercarriage. State the conditions likely to lead to ground resonance.			x	x	x	
082 05 04 00	**Rotor systems**						
082 05 04 01	**See-saw or teetering rotor**						
LO	Explain that a teetering rotor is prone to mast bumping in low G situations because of having no flapping hinge offset.			x	x	x	
082 05 04 02	**Fully articulated rotor**						
LO	Describe the fully articulated rotor with hinges and feathering bearings.			x	x	x	
LO	Describe ball and roller bearings and elastomeric bearings, advantages and disadvantages.			x	x	x	
082 05 04 03	**Hingeless rotor, bearingless rotor**						
LO	Show the forces on the flapping hinges with large offset (virtual hinge) and the resulting moments, compare them with other rotor systems.			x	x	x	
082 05 05 00	**Blade sailing**						
082 05 05 01	**Blade sailing and causes**						
LO	Define blade sailing, the influence of low rotor RPM and of headwind.			x	x	x	
082 05 05 02	**Minimising the danger**						
LO	Describe the actions to minimise danger and the demonstrated wind envelope for engaging and disengaging rotors.			x	x	x	
082 05 05 03	**Droop stops**						
LO	Explain the utility of the droop stops, retraction of the stops.			x	x	x	
082 05 06 00	**Vibrations due to main rotor**						
082 05 06 01	**Origins of the vertical vibrations**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the lift (thrust) variations per revolution of a blade and the resulting vertical rotor-thrust variation in the case of perfect identical blades.			x	x	x	
LO	Show the resulting frequencies and amplitudes as a function of the number of blades.			x	x	x	
LO	Explain the thrust variation in case of an out-of-track blade, causes, frequencies (one-per-revolution).			x	x	x	
LO	Explain the importance of the hinges offset on the effect of the vibrations on the fuselage.			x	x	x	
082 05 06 02	**Lateral vibrations**						
LO	Explain imbalances of a blade, causes, and effects.			x	x	x	
LO	Explain the frequencies lateral one-per-revolution vibration.			x	x	x	
082 06 00 00	**TAIL ROTORS**						
082 06 01 00	**Conventional tail rotor**						
082 06 01 01	**Tail rotor description**						
LO	Describe the two-bladed rotor with teetering hinge, the rotors with more than two blades.			x	x	x	
LO	Show the flapping hinges and the feathering bearing.			x	x	x	
LO	Describe the dangers to ground personnel, to the rotor blades, possibilities of minimising these dangers.			x	x	x	
082 06 01 02	**Tail-rotor aerodynamics**						
LO	Explain the airflow around the blades in hover and in forward flight, the effects of the tip speeds on the noise production and the compressibility, limits.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain in hovering the effect of wind on the tail-rotor aerodynamics and thrust, problems.			x	x	x	
LO	Explain the tail-rotor thrust and the control through pitch control (feathering).			x	x	x	
LO	Explain the tail-rotor flapback, and the effects of delta-three hinges.			x	x	x	
LO	Describe roll moment and drift as side effects of the tail rotor.			x	x	x	
LO	Explain the effects of the tail-rotor failure.			x	x	x	
LO	Explain the loss of tail-rotor effectiveness, vortex-ring state, causes, crosswind and yaw speed.			x	x	x	
082 06 01 03	**Strakes on the tail boom**						
LO	Describe the strake and explain the function of the device.			x	x	x	
082 06 02 00	**The fenestron**						
082 06 02 01	**Technical layout**						
LO	Show the technical layout of a fenestron tail rotor.			x	x	x	
082 06 02 02	**Control concepts**						
LO	Explain the control concepts of a fenestron tail rotor.			x	x	x	
082 06 02 03	**Advantages and disadvantages**						
LO	Explain the advantages and disadvantages.			x	x	x	
082 06 03 00	**The NOTAR**						
082 06 03 01	**Technical layout**						
LO	Show the technical layout.			x	x	x	
082 06 03 02	**Control concepts**						
LO	Explain the control concepts.			x	x	x	
082 06 03 03	**Advantages and disadvantages**						
LO	Explain the advantages and disadvantages.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
082 06 04 00	**Vibrations**						
082 06 04 01	**Tail-rotor vibrations**						
LO	Explain the sources of vibration of the tail rotor and the resulting high frequencies.			x	x	x	
082 06 04 02	**Balancing and tracking**						
LO	Explain balancing and tracking of the tail rotor.			x	x	x	
082 07 00 00	**EQUILIBRIUM, STABILITY AND CONTROL**						
082 07 01 00	**Equilibrium and helicopter attitudes**						
082 07 01 01	**Hover**						
LO	Explain why the vector sum of forces and moments must be zero in any acceleration-free situation.			x	x	x	
LO	Indicate the forces and the moments about the lateral axis in a steady hover.			x	x	x	
LO	Indicate the forces and the moments about the longitudinal axis in a steady hover.			x	x	x	
LO	Deduce how the roll angle in a steady hover without wind results from the moments about the longitudinal axis.			x	x	x	
LO	Explain how the cyclic is used to create equilibrium of moments about the lateral axis in a steady hover.			x	x	x	
LO	Explain the consequence of the cyclic stick reaching its forward or aft limit during an attempt to take off to the hover.			x	x	x	
LO	Explain the influence of the density altitude on the equilibrium of forces and moments in a steady hover.			x	x	x	
082 07 01 02	**Forward flight**						
LO	Explain why the vector sum of forces and of moments must be zero in unaccelerated flight.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Indicate the forces and the moments about the lateral axis acting on a helicopter in a steady straight and level flight.			x	x	x	
LO	Explain the influence of All-Up Mass (AUM) on the forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain the influence of the position of the centre of gravity on the forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain the role of the cyclic stick position in creating equilibrium of forces and moments about the lateral axis in forward flight.			x	x	x	
LO	Explain how forward speed influences the fuselage attitude.			x	x	x	
LO	Describe and explain the inflow roll effect.			x	x	x	
082 07 02 00	**Stability**						
082 07 02 01	**Static longitudinal, roll and directional stability**						
LO	Define static stability; give an example of static stability and of static instability.			x	x	x	
LO	Explain the contribution of the main rotor to speed stability.			x	x	x	
LO	Describe the influence of the horizontal stabiliser on static longitudinal stability.			x	x	x	
LO	Explain the effect of hinge offset on static stability.			x	x	x	
LO	Describe the influence of the tail rotor on static directional stability.			x	x	x	
LO	Describe the influence of the vertical stabiliser on static directional stability.			x	x	x	
LO	Explain the influence of the main rotor on the static roll stability.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Describe the influence of the longitudinal position of the centre of gravity on the static longitudinal stability.			x	x	x	
082 07 02 02	**Static stability in the hover**						
LO	Describe the initial movements of a hovering helicopter after the occurrence of a horizontal gust.			x	x	x	
082 07 02 03	**Dynamic stability**						
LO	Define dynamic stability; give an example of dynamic stability and of dynamic instability.			x	x	x	
LO	Explain why static stability is a precondition for dynamic stability.			x	x	x	
082 07 02 04	**Longitudinal stability**						
LO	Explain the individual contributions of angle of attack and speed stability together with the stabiliser and fuselage on the dynamic longitudinal stability.			x	x	x	
LO	Explain the principle of stability-augmentation systems.			x	x	x	
LO	Define the characteristics of a phugoid.			x	x	x	
082 07 02 05	**Roll stability and directional stability**						
LO	Explain the effect of a dihedral on a helicopter.			x	x	x	
LO	Describe how a dihedral influences the static roll stability.			x	x	x	
LO	Know that a large static roll stability together with a small directional stability may lead to a Dutch roll.			x	x	x	
LO	Explain which stability features taken together may result in spiral dive and the reason why.			x	x	x	
LO	Explain the static directional stability features of a tandem rotor type helicopter.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
082 07 03 00	**Control**						
082 07 03 01	**Manoeuver stability**						
LO	Define the meaning of stick-force stability.			x	x	x	
LO	Define the meaning of stick-position stability.			x	x	x	
LO	Explain the meaning of the stick-force diagram and trim speed.			x	x	x	
LO	Explain the meaning of stick force per G.			x	x	x	
LO	Explain how a bob weight influences stick force per G.			x	x	x	
LO	Explain how helicopter control can be limited because of available stick travel.			x	x	x	
LO	Explain how the position of the centre of gravity influences the remaining stick travel.			x	x	x	
082 07 03 02	**Control power**						
LO	Explain the meaning of the control moment.			x	x	x	
LO	Explain the importance of the centre of gravity position on the control moment.			x	x	x	
LO	Explain how the changes of magnitude of rotor thrust of a helicopter during manoeuvres influence the control moment.			x	x	x	
LO	Explain which control moment provides control for a helicopter rotor with zero-hinge offset (central flapping hinge).			x	x	x	
LO	Explain the different type of rotor control moments which together provide the control of helicopters with a hingeless or a fully articulated rotor system.			x	x	x	
LO	Explain the influence of hinge offset on controllability.			x	x	x	
082 07 03 03	**Static and dynamic rollover**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the mechanism which causes dynamic rollover.			x	x	x	
LO	Explain the required pilot action when dynamic rollover is starting to develop.			x	x	x	
082 08 00 00	**HELICOPTER FLIGHT MECHANICS**						
082 08 01 00	**Flight limits**						
082 08 01 01	**Hover and vertical flight**						
LO	Show the power required OGE and IGE and the power available, the OGE and IGE maximum hover height (see subject 020, piston engines and turbine engines).			x	x	x	
LO	Explain the effects of All-Up Mass (AUM), ambient temperature and pressure, density altitude and moisture.			x	x	x	
LO	Discuss the rate of climb in a vertical flight.			x	x	x	
082 08 01 02	**Forward flight**						
LO	Compare the power required and the power available as a function of speed in straight and level flight.			x	x	x	
LO	Define the maximum speed limited by power and the value relative to V_{NE} and V_{NO}.			x	x	x	
LO	Use the graph to determine the speeds of maximum rate of climb and the maximum angle of climb.			x	x	x	
LO	Use the graph to define the TAS for maximum range and maximum endurance, consider the case of the piston engine and the turbine engine. Explain the effects of tailwind or headwind on the speed for maximum range.			x	x	x	
LO	Explain the effects of AUM, pressure and temperature, density altitude, humidity.			x	x	x	
082 08 01 03	**Manoeuvring**						
LO	Define the load factor, the radius of turn and the rate of turn.			x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the relationship between the bank angle, the airspeed and the radius of turn, between the bank angle and the load factor.			x	x	x	
LO	Explain the influence of All-Up Mass (AUM), pressure and temperature, density altitude, humidity.			x	x	x	
LO	Define the limit-load factors and the certification categories.			x	x	x	
082 08 02 00	**Special conditions**						
082 08 02 01	**Operating with limited power**						
LO	Explain the operations with limited power, use the graph to show the limitations on vertical flight and level flight, discuss the power checks and procedures for take-off and landing.			x	x	x	
LO	Describe manoeuvres with limited power.			x	x	x	
082 08 02 02	**Overpitch, overtorque**						
LO	Describe overpitching and show the consequences.			x	x	x	
LO	Describe situations likely to lead to overpitching.			x	x	x	
LO	Describe overtorqueing and show the consequences.			x	x	x	
LO	Describe situations likely to lead to overtorqueing.			x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
090 00 00 00	**COMMUNICATIONS**						
091 00 00 00	**VFR COMMUNICATIONS**						
091 01 00 00	**DEFINITIONS**						
091 01 01 00	**Meanings and significance of associated terms**						
LO	Stations.	x	x	x	x	x	
LO	Communication methods.	x	x	x	x	x	
091 01 02 00	**Air Traffic Services abbreviations**						
LO	Define commonly used Air Traffic Control abbreviations: flight conditions; airspace; services; time; miscellaneous.	x	x	x	x	x	
091 01 03 00	**Q-code groups commonly used in RTF air–ground communications**						
LO	Define Q-code groups commonly used in RTF air-to-ground communications: pressure settings; directions and bearings.	x	x	x	x	x	
LO	State the procedure for obtaining bearing information in flight.	x	x	x	x	x	
091 01 04 00	**Categories of messages**						
LO	List the categories of messages in order of priority.	x	x	x	x	x	
LO	Identify the types of messages appropriate to each category.	x	x	x	x	x	
LO	List the priority of a message (from given examples of messages to compare).	x	x	x	x	x	
091 02 00 00	**GENERAL OPERATING PROCEDURES**						
091 02 01 00	**Transmission of letters**						
LO	State the phonetic alphabet used in radio-telephony.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Identify the occasions when words should be spelt.	x	x	x	x	x	
091 02 02 00	**Transmission of numbers (including level information)**						
LO	Describe the method of transmission of numbers: pronunciation; single digits, whole hundreds and whole thousands.	x	x	x	x	x	
091 02 03 00	**Transmission of time**						
LO	Describe the ways of transmitting time: standard time reference (UTC); minutes, minutes and hours, when required.	x	x	x	x	x	
091 02 04 00	**Transmission technique**						
LO	Explain the techniques used for making good R/T transmissions.	x	x	x	x	x	
091 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**						
LO	Define the meaning of 'standard words and phrases'.	x	x	x	x	x	
LO	Use correct phraseology for each phase of VFR flight.	x	x	x	x	x	
LO	Aerodrome procedures: departure information; taxiing instructions; aerodrome traffic and circuits; final approach and landing; after landing; essential aerodrome information.	x	x	x	x	x	
LO	VFR departure.	x	x	x	x	x	
LO	VFR arrival.	x	x	x	x	x	
091 02 06 00	**Radio-telephony call signs for aeronautical stations including use of abbreviated call signs**						
LO	Name the two parts of the call sign of an aeronautical station.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Identify the call-sign suffixes for aeronautical stations.	x	x	x	x	x	
LO	Explain when the call sign may be omitted or abbreviated to the use of suffix only.	x	x	x	x	x	
091 02 07 00	**Radio-telephony call signs for aircraft including use of abbreviated call signs**						
LO	List the three different ways to compose an aircraft call sign.	x	x	x	x	x	
LO	Describe the abbreviated forms for aircraft call signs.	x	x	x	x	x	
LO	Explain when aircraft call signs may be abbreviated.	x	x	x	x	x	
091 02 08 00	**Transfer of communication**						
LO	Describe the procedure for transfer of communication: by ground station; by aircraft.	x	x	x	x	x	
091 02 09 00	**Test procedures including readability scale**						
LO	Explain how to test radio transmission and reception.	x	x	x	x	x	
LO	State the readability scale and explain its meaning.	x	x	x	x	x	
091 02 10 00	**Read-back and acknowledgement requirements**						
LO	State the requirement to read back ATC route clearances.	x	x	x	x	x	
LO	State the requirement to read back clearances related to the runway in use.	x	x	x	x	x	
LO	State the requirement to read back other clearances including conditional clearances.	x	x	x	x	x	
LO	State the requirement to read back other data such as runway, SSR codes, etc.	x	x	x	x	x	
091 02 11 00	**Radar procedural phraseology**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Use the correct phraseology for an aircraft receiving a radar service: radar identification; radar vectoring; traffic information and avoidance; SSR procedures.	x	x	x	x	x	
091 03 00 00	**RELEVANT WEATHER INFORMATION TERMS (VFR)**						
091 03 01 00	**Aerodrome weather**						
LO	List the contents of aerodrome weather reports and state units of measurement used for each item: wind direction and speed; variation of wind direction and speed; visibility; present weather; cloud amount and type (including the meaning of CAVOK); air temperature and dew point; pressure values (QNH, QFE); supplementary information (aerodrome warnings, landing runway, runway conditions, restrictions, obstructions, wind-shear warnings, etc.).	x	x	x	x	x	
091 03 02 00	**Weather broadcast**						
LO	List the sources of weather information available for aircraft in flight.	x	x	x	x	x	
LO	Explain the meaning of the acronyms ‘ATIS’, ‘VOLMET’.	x	x	x	x	x	
091 04 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**						
LO	State the action to be taken in case of communication failure on a controlled VFR flight.	x	x	x	x	x	
LO	Identify the frequencies to be used in an attempt to establish communication.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	State the additional information that should be transmitted in the event of receiver failure.	x	x	x	x	x	
LO	Identify the SSR code that may be used to indicate communication failure.	x	x	x	x	x	
LO	Explain the action to be taken by a pilot with communication failure in the aerodrome traffic pattern at controlled aerodromes.	x	x	x	x	x	
091 05 00 00	**DISTRESS AND URGENCY PROCEDURES**						
091 05 01 00	**Distress (definition, frequencies, watch of distress frequencies, distress signal, distress message)**						
LO	State the DISTRESS procedures.	x	x	x	x	x	
LO	Define DISTRESS.	x	x	x	x	x	
LO	Identify the frequencies that should be used by aircraft in DISTRESS.	x	x	x	x	x	
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	x	x	x	x	x	
LO	Describe the action to be taken by the station which receives a DISTRESS message.	x	x	x	x	x	
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x	x	x	x	x	
LO	List the content of a DISTRESS signal/message in the correct sequence.	x	x	x	x	x	
091 05 02 00	**Urgency (definition, frequencies, urgency signal, urgency message)**						
LO	State the URGENCY procedures.	x	x	x	x	x	
LO	Define URGENCY.	x	x	x	x	x	
LO	Identify the frequencies that should be used by aircraft in URGENCY.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the action to be taken by the station which receives an URGENCY message.	x	x	x	x	x	
LO	Describe the action to be taken by all other stations when an URGENCY procedure is in progress.	x	x	x	x	x	
LO	List the content of an URGENCY signal/message in the correct sequence.	x	x	x	x	x	
091 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**						
LO	Describe the radio-frequency spectrum with particular reference to VHF.	x	x	x	x	x	
LO	Describe the radio-frequency spectrum of the bands into which the radio-frequency spectrum is divided.	x	x	x	x	x	
LO	Identify the frequency range of the VHF band.	x	x	x	x	x	
LO	Name the band normally used for Aeronautical Mobile Service voice communication.	x	x	x	x	x	
LO	State the frequency separation allocated between consecutive VHF frequencies.	x	x	x	x	x	
LO	Describe the propagation characteristics of radio transmissions in the VHF band.	x	x	x	x	x	
LO	Describe the factors which reduce the effective range and quality of radio transmissions.	x	x	x	x	x	
LO	State which of these factors apply to the VHF band.	x	x	x	x	x	
LO	Calculate the effective range of VHF transmissions assuming no attenuating factors.	x	x	x	x	x	

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Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
090 00 00 00	**COMMUNICATIONS**						
092 00 00 00	**IFR COMMUNICATIONS**						
092 01 00 00	**DEFINITIONS**						
092 01 01 00	**Meanings and significance of associated terms**						
LO	Stations.	x		x			x
LO	Communication methods.	x		x			x
LO	The terms used in conjunction with the approach and holding procedures.	x		x			x
092 01 02 00	**Air Traffic Control abbreviations**						
LO	Define commonly used Air Traffic Control abbreviations: flight conditions; airspace; services; time; miscellaneous.	x		x			x
LO	The additional IFR-related terms.	x		x			x
092 01 03 00	**Q-code groups commonly used in RTF air–ground communications**						
LO	Define Q-code groups commonly used in RTF air-to-ground communications: pressure settings; directions and bearings.	x		x			x
LO	State the procedure for obtaining a bearing information in flight.	x		x			x
092 01 04 00	**Categories of messages**						
LO	List the categories of messages in order of priority.	x		x			x
LO	Identify the types of messages appropriate to each category.	x		x			x
LO	List the priority of a message (given examples of messages to compare).	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
092 02 00 00	**GENERAL OPERATING PROCEDURES**						
092 02 01 00	**Transmission of letters**						
LO	State the phonetic alphabet used in radio-telephony.	x		x			x
LO	Identify the occasions when words should be spelt.	x		x			x
092 02 02 00	**Transmission of numbers (including level information)**						
LO	Describe the method of transmitting numbers: pronunciation; single digits, whole hundreds and whole thousands.	x		x			x
092 02 03 00	**Transmission of time**						
LO	Describe the ways of transmitting time: standard time reference (UTC); minutes, minutes and hours, when required.	x		x			x
092 02 04 00	**Transmission technique**						
LO	Explain the techniques used for making good R/T transmissions.	x		x			x
092 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**						
LO	Define the meaning of ‘standard words and phrases’.	x		x			x
LO	Use correct standard phraseology for each phase of IFR flight: pushback; IFR departure; airways clearances; position reporting; approach procedures; IFR arrivals.	x		x			x
092 02 06 00	**Radio-telephony call signs for aeronautical stations including use of abbreviated call signs**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Name the two parts of the call sign of an aeronautical station.	x		x			x
LO	Identify the call-sign suffixes for aeronautical stations.	x		x			x
LO	Explain when the call sign may be omitted or abbreviated to the use of suffix only.	x		x			x
LO	Name the two parts of the call sign of an aeronautical station.	x		x			x
LO	Identify the call-sign suffixes for aeronautical stations.	x		x			x
LO	Explain when the call sign may be abbreviated to the use of suffix only.	x		x			x
092 02 07 00	**Radio-telephony call signs for aircraft including use of abbreviated call signs**						
LO	List the three different ways to compose an aircraft call sign.	x		x			x
LO	Describe the abbreviated forms for aircraft call signs.	x		x			x
LO	Explain when aircraft call signs may be abbreviated.	x		x			x
LO	Explain when the suffix 'HEAVY' should be used with an aircraft call sign.	x		x			x
LO	Explain the use of the phrase 'Change your call sign to…'.	x		x			x
LO	Explain the use of the phrase 'Revert to flight plan call sign'.	x		x			x
092 02 08 00	**Transfer of communication**						
LO	Describe the procedure for transfer of communication: by ground station; by aircraft.	x		x			x
092 02 09 00	**Test procedures including readability scale; establishment of RTF communication**						

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Explain how to test radio transmission and reception.	x		x			x
LO	State the readability scale and explain its meaning.	x		x			x
092 02 10 00	**Read-back and acknowledgement requirements**						
LO	State the requirement to read back ATC route clearances.	x		x			x
LO	State the requirement to read back clearances related to runway in use.	x		x			x
LO	State the requirement to read back other clearances including conditional clearances.	x		x			x
LO	State the requirement to read back data such as runway, SSR codes, etc.	x		x			x
092 02 11 00	**Radar procedural phraseology**						
LO	Use the correct phraseology for an aircraft receiving a radar service: radar identification; radar vectoring; traffic information and avoidance; SSR procedures.	x		x			x
092 02 12 00	**Level changes and reports**						
LO	Use the correct term to describe vertical position: in relation to flight level (standard pressure setting); in relation to altitude (metres/feet on QNH); in relation to height (metres/feet on QFE).	x		x			x
092 03 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**						
LO	Describe the action to be taken in communication failure on an IFR flight.	x		x			x
LO	Describe the action to be taken in case of communication failure on an IFR flight when flying in VMC and the flight will be terminated in VMC.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the action to be taken in case of communication failure on an IFR flight when flying in IMC.	x		x			x
092 04 00 00	**DISTRESS AND URGENCY PROCEDURES**						
092 04 01 00	**PAN MEDICAL**						
LO	Describe the type of flights to which PAN MEDICAL applies.	x		x			x
LO	List the content of a PAN MEDICAL message in correct sequence.	x		x			x
092 04 02 00	**Distress (definition, frequencies, watch of distress frequencies, distress signal, distress message)**						
LO	State the DISTRESS procedures.	x		x			x
LO	Define DISTRESS.	x		x			x
LO	Identify the frequencies that should be used by aircraft in DISTRESS.	x		x			x
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	x		x			x
LO	Describe the action to be taken by the station which receives a DISTRESS message.	x		x			x
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x		x			x
LO	List the content of a DISTRESS message.	x		x			x
092 04 03 00	**Urgency (definition, frequencies, urgency signal, urgency message)**						
LO	State the URGENCY procedures.	x		x			x
LO	Define URGENCY.	x		x			x
LO	Identify the frequencies that should be used by aircraft in URGENCY.	x		x			x
LO	Describe the action to be taken by the station which receives an URGENCY message.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	x		x			x
LO	List the content of an URGENCY signal/message in the correct sequence.	x		x			x
092 05 00 00	**RELEVANT WEATHER INFORMATION TERM**						
092 05 01 00	**Aerodrome weather**						
LO	List the contents of aerodrome weather reports and state units of measurement used for each item: wind direction and speed; variation of wind direction and speed; visibility; present weather; cloud amount and type (including the meaning of CAVOK); air temperature and dew point; pressure values (QNH, QFE); supplementary information (aerodrome warnings, landing runway, runway conditions, restrictions, obstructions, wind-shear warnings, etc.).	x		x			x
LO	State units for measurement used for runway visual range.	x		x			x
LO	State units of measurement used for braking action (friction coefficient).	x		x			x
092 05 02 00	**Weather broadcast**						
LO	List the sources of weather information available for aircraft in flight.	x		x			x
LO	Explain the meaning of the acronyms 'ATIS', 'VOLMET'.	x		x			x
LO	Explain when aircraft routine meteorological observations should be made.	x		x			x
LO	Explain when aircraft special meteorological observations should be made.	x		x			x

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Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
092 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**						
LO	Describe the radio-frequency spectrum with particular reference to VHF.	x		x			x
LO	State the names of the bands into which the radio-frequency spectrum is divided.	x		x			x
LO	Identify the frequency range of the VHF band.	x		x			x
LO	Name the band normally used for Aeronautical Mobile Service voice communications.	x		x			x
LO	State the frequency separation allocated between consecutive VHF frequencies.	x		x			x
LO	Describe the propagation characteristics of radio transmissions in the VHF band.	x		x			x
LO	Describe the factors which reduce the effective range and quality of radio transmissions.	x		x			x
LO	State which of these factors apply to the VHF band.	x		x			x
LO	Calculate the effective range of VHF transmissions assuming no attenuating factors.	x		x			x
092 07 00 00	**MORSE CODE**						
LO	Identify radio-navigation aids (VOR, DME, NDB, ILS) from their Morse-code identifiers.	x	x	x	x	x	x
LO	SELCAL, TCAS, ACARS phraseology and procedures.	x	x	x	x	x	x

(b) Airship

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CPL AND IR

The applicable items for each licence or rating are marked with 'x'. An 'x' on the main title of a subject means that all the subdivisions are applicable.'

SUBPART F — AIRLINE TRANSPORT PILOT LICENCE — ATPL

AMC1 FCL.510.A (b)(1) ATPL(A) — Prerequisites, experience and crediting

Equivalent requirements for CS-25 and CS-23 commuter category are the JAR/FAR-25 transport category, JAR/FAR-23 commuter category, or BCAR or AIR 2051.

AMC1 FCL.520.A; FCL.520.H

ATPL SKILL TEST
The ATPL skill test may serve at the same time as a skill test for the issue of the licence and a proficiency check for the revalidation of the type rating for the aircraft used in the test and may be combined with the skill test for the issue of a MP type rating.

SUBPART G — INSTRUMENT RATING — IR

AMC1 FCL.615(b) IR – Theoretical knowledge and flight instruction

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE IR FOLLOWING THE COMPETENCY-BASED MODULAR COURSE AND EIR

(a) The following tables contain the detailed theoretical knowledge syllabus for the IR following the competency-based modular route (IR(A)) and the EIR.
(b) Aspects related to non-technical skills should be included in an integrated manner, taking into account the particular risks associated to the licence and the activity.
(c) The applicant who has completed a modular IR(A) course according to Appendix 6 A and passed the IR(A) theoretical knowledge examination should be fully credited towards the requirements of theoretical knowledge instruction and examination for a competency-based IR(A) or EIR within the validity period of the examination. An applicant wishing to transfer to a competency-based IR(A) or EIR course during a modular IR(A) course should be credited towards the requirements of theoretical knowledge instruction and examination for a competency-based IR(A) or EIR for those subjects or theory items already completed.
(d) The applicant for an IR(A) who has completed an EIR theoretical knowledge course and passed the EIR theoretical knowledge examination according to FCL.825 should be fully credited towards the requirements of theoretical knowledge instruction and examination for an competency-based IR(A) according to Annex 6 Aa.

010 00 00 00	**AIR LAW**
010 04 00 00	PERSONNEL LICENSING
010 05 00 00	RULES OF THE AIR
010 06 00 00	PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS OPS)
010 07 00 00	AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT
010 08 00 00	AERONAUTICAL INFORMATION SERVICE
010 09 00 00	AERODROMES (ICAO Annex 14, Volume I, Aerodrome Design and Operations)
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**
022 02 00 00	MEASUREMENT OF AIR DATA PARAMETERS
022 04 00 00	GYROSCOPIC INSTRUMENTS
022 13 00 00	INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS
033 00 00 00	**FLIGHT PLANNING AND MONITORING**
033 02 00 00	FLIGHT PLANNING FOR IFR FLIGHTS
033 03 00 00	FUEL PLANNING
033 04 00 00	PRE-FLIGHT PREPARATION
033 05 00 00	ICAO FLIGHT PLAN (ATS FLIGHT PLAN)
040 00 00 00	**HUMAN PERFORMANCE**
040 01 00 00	HUMAN FACTORS: BASIC CONCEPTS
040 02 00 00	BASIC AVIATION PHYSIOLOGY AND HEALTH MAINTENANCE
040 03 00 00	BASIC AVIATION PSYCHOLOGY
050 00 00 00	**METEOROLOGY**
050 01 00 00	THE ATMOSPHERE
050 02 00 00	WIND
050 03 00 00	THERMODYNAMICS
050 04 00 00	CLOUDS AND FOG

050 05 00 00	PRECIPITATION
050 06 00 00	AIR MASSES AND FRONTS
050 07 00 00	PRESSURE SYSTEMS
050 08 00 00	CLIMATOLOGY
050 09 00 00	FLIGHT HAZARDS
050 10 00 00	METEOROLOGICAL INFORMATION
062 00 00 00	**RADIO NAVIGATION**
062 02 00 00	RADIO AIDS
062 03 00 00	RADAR
062 05 00 00	AREA NAVIGATION SYSTEMS, RNAV/FMS
092 00 00 00	**IFR COMMUNICATIONS**
092 01 00 00	DEFINITIONS
092 02 00 00	GENERAL OPERATING PROCEDURES
092 03 00 00	ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE
092 04 00 00	DISTRESS AND URGENCY PROCEDURES
092 05 00 00	RELEVANT WEATHER INFORMATION TERM
092 06 00 00	GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES
092 07 00 00	MORSE CODE

AMC1 FCL.625(c) IR — Validity, revalidation and renewal

RENEWAL OF INSTRUMENT RATING: REFRESHER TRAINING

(a) Paragraph (b)(1) of FCL.740 determines that if the instrument rating has lapsed, the applicant shall go through refresher training at an ATO, to reach the level of proficiency needed to pass the instrument element of the skill test prescribed in Appendix 9 to Part-FCL. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant. To determine this, the ATO should evaluate the pilot’s log book, and, if necessary, conduct a test in an FSTD.

(2) the amount of time lapsed since the expiry of the validity period of the rating. The amount of training needed to reach the desired level of proficiency should increase with the time lapsed. In some cases, after evaluating the pilot, and when the time lapsed is very limited (less than 3 months), the ATO may even determine that no further refresher training is necessary. The following may be taken as guidance when determining the needs of the applicant:

(i) expiry for a period shorter than 3 months: no supplementary requirements;

(ii) expiry for longer than 3 months but shorter than 1 year: a minimum of one training session;

(iii) expiry for longer than 1 year but shorter than 7 years: a minimum of three training sessions;

(iv) expiry for longer than 7 years: the applicant should undergo the full training course for the issue of the IR.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme, which should be based on the initial training for the issue of instrument ratings and focus on the aspects where the applicant has shown the greatest needs.

(c) After successful completion of the training, the ATO should give a certificate to the applicant, to be submitted to the competent authority when applying for the renewal.

AMC2 FCL.615(b) IR - Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Air Law (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	**Syllabus details and associated Learning Objectives**	**CB-IR(A) and EIR**
010 00 00 00	**AIR LAW**	
010 04 00 00	**PERSONNEL LICENSING**	
010 04 02 00	**Regulation on Air Crew — Part-FCL**	
010 04 02 01	Definitions	
LO	Define the following: Category of aircraft, cross country flight, dual instruction time, flight time, flight time as SPIC, instrument time, instrument flight time, instrument ground time, MCC, multi-pilot aeroplanes, night, PPL, CPL, proficiency check, rating, renewal, revalidation, skill test, solo flight time, type of aircraft	x
010 04 02 02	Part-FCL	
LO	Name the content of PART-FCL	x
010 04 02 05	Ratings	
LO	Explain the requirements for plus validity and privileges of Instrument Ratings	x
010 05 00 00	**RULES OF THE AIR**	
010 05 02 00	**Applicability of the Rules of the Air**	
LO	Explain the duties of the PIC concerning pre-flight actions in case of an IFR flight	x
010 05 03 00	**General Rules**	
LO	Describe the requirements when carrying out simulated instrument flights	x
LO	Explain why a time check has to be obtained before flight	x
LO	Describe the required actions to be carried out, if the continuation of a controlled VFR flight in VMC is not practicable anymore	x

LO	Describe the provisions for transmitting a position report to the appropriate ATS Unit including time of transmission and normal content of the message	x
LO	Describe the necessary action when an aircraft is experiencing a COM failure	x
010 05 05 00	**Instrument Flight Rules (IFR)**	
LO	Describe the Instrument Flight Rules as contained in Chapter 5 of ICAO Annex 2	x
010 06 00 00	**PROCEDURES FOR AIR NAVIGATION SERVICES — AIRCRAFT OPERATIONS (PANS OPS)**	
010 06 03 00	**Departure procedures**	
010 06 03 01	General criteria (assuming all engines operating)	
LO	Name the factors dictating the design of instrument departure procedures	x
LO	Explain in which situations the criteria for omni-directional departures are applied	x
010 06 03 02	Standard Instrument Departures (SIDs)	
LO	Define the terms ‘straight departure’ and ‘turning departure’	x
LO	State the responsibility of the operator when unable to utilize the published departure procedures	x
010 06 03 03	Omni-directional departures	
LO	Explain when the ‘omni-directional method’ is used for departure	x
LO	Describe the solutions when an omni-directional procedures is not possible	x
010 06 03 04	Published information	
LO	State the conditions for the publication of a SID and/or RNAV route	x
LO	Describe how omni-directional departures are expressed in the appropriate publication	x
010 06 03 05	Area Navigation (RNAV) Departure Procedures and RNP-based Departures	
LO	Explain the relationship between RNAV/RNP-based departure procedures and those for approaches	x
010 06 04 00	**Approach procedures**	
010 06 04 01	General criteria	
LO	Name the five possible segments of an instrument approach procedure	x
LO	Give reasons for establishing aircraft categories for the approach	x
LO	State the maximum angle between the final approach track and the extended RWY centre-line to still consider a non-precision-approach as being a ‘Straight-In Approach’	x
LO	State the minimum obstacle clearance provided by the minimum sector altitudes (MSA) established for an aerodrome	x
LO	Describe the point of origin, shape, size and sub-divisions of the area used for MSAs	x
LO	State that a pilot shall apply wind corrections when carrying out an instrument approach procedures	x

LO	Name the most significant performance factor influencing the conduct of Instrument Approach Procedures	x
LO	Explain why a Pilot should not descend below OCA/Hs which are established for -precision approach procedures -a non-precision approach procedures — visual (circling) procedures	x
LO	Describe in general terms, the relevant factors for the calculation of operational minima	x
LO	Translate the following abbreviations into plain language: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H	x
LO	Explain the relationship between the terms: DA, DH, OCA, OCH, MDA, MDH, MOC, DA/H, OCA/H, MDA/H	x
010 06 04 02	Approach Procedure Design	x
LO	Describe how the vertical cross-section for each of the five approach segments is broken down into the various areas	x
LO	State within which area of the cross-section the Minimum Obstacle Clearance (MOC) is provided for the whole width of the area	x
LO	Define the terms IAF, IF, FAF, MAPt and TP	x
LO	State the accuracy of facilities providing track (VOR, ILS, NDB)	
LO	Describe the basic information relating to approach area splays	x
LO	State the optimum descent gradient (preferred for a precision approach) in degrees and per cent	x
010 06 04 03	Arrival and approach segments	
LO	Name the five standard segments of an instrument APP procedure and state the beginning and end for each of them	x
LO	Describe where an ARR route normally ends	x
LO	State whether or not omni-directional or sector arrivals can be provided	x
LO	Explain the main task for the initial APP segment	x
LO	Describe the maximum angle of interception between the initial APP segment and the intermediate APP segment (provided at the intermediate fix) for a precision APP and a non-precision APP	x
LO	Describe the main task of the intermediate APP segment	x
LO	State the main task of the final APP segment	x
LO	Name the two possible aims of a final APP	x
LO	Explain the term 'final approach point' in case of an ILS approach	x
LO	State what happens if an ILS GP becomes inoperative during the APP	x
010 06 04 04	Missed Approach	
LO	Name the three phases of a missed approach procedure and describe their geometric limits	x
LO	Describe the main task of a missed approach procedure	x

LO	State at which height/altitude the missed approach is assured to be initiated	x
LO	Define the term 'missed approach point (MAPt)'	x
LO	Describe how an MAPt may be established in an approach procedure	x
LO	State the pilot's reaction if, upon reaching the MAPt, the required visual reference is not established	x
LO	Describe what a pilot is expected to do in the event a missed approach is initiated prior to arriving at the MAPt	x
LO	State whether the pilot is obliged to cross the MAPt at the height/altitude required by the procedure or whether he is allowed to cross the MAPt at an altitude/height greater than that required by the procedure	x
010 06 04 05	Visual manoeuvring (circling) in the vicinity of the aerodrome:	
LO	Describe what is meant by 'visual manoeuvring (circling)'	x
LO	Describe how a prominent obstacle in the visual manoeuvring (circling) area outside the final approach and missed approach area has to be considered for the visual circling	x
LO	State for which category of aircraft the obstacle clearance altitude/height within an established visual manoeuvring (circling) area is determined	x
LO	Describe how an MDA/H is specified for visual manoeuvring (circling) if the OCA /H is known	x
LO	State the conditions to be fulfilled before descending below MDA/H in a visual manoeuvring (circling) approach	x
LO	Describe why there can be no single procedure designed that will cater for conducting a circling approach in every situation	x
LO	State how the pilot is expected to behave after initial visual contact during a visual manoeuvring (circling)	x
LO	Describe what the pilot is expected to do if visual reference is lost while circling to land from an instrument approach	x
010 06 04 06	Area navigation (RNAV) approach procedures based on VOR/DME	
LO	Describe the provisions that must be fulfilled before carrying out VOR/DME RNAV approaches	x
LO	Explain the disadvantages of the VOR/DME RNAV system	x
LO	List the factors on which the navigational accuracy of the VOR/DME RNAV system depends	x
LO	State whether the VOR/DME/RNAV approach is a precision or a non-precision procedure	x
010 06 05 00	**Holding procedures**	
010 06 05 01	Entry and Holding	
LO	Explain why deviations from the in-flight procedures of a holding established in accordance with ICAO Doc 8168 are dangerous	x

LO	State that if for any reasons a pilot is unable to conform to the procedures for normal conditions laid down for any particular holding pattern, he/she should advise ATC as early as possible.	x
LO	Describe how the right turns holdings can be transferred to left turn holding patterns	x
LO	Describe the shape and terminology associated with the holding pattern	x
LO	State the bank angle and rate of turn to be used whilst flying in a holding pattern	x
LO	Explain why pilots in a holding pattern should attempt to maintain tracks and how this can be achieved	x
LO	Describe where outbound timing begins in a holding pattern	x
LO	State where the outbound leg in a holding terminates if the outbound leg is based on DME	x
LO	Describe the three heading entry sectors for entries into a holding pattern	x
LO	Define the terms 'parallel entry', 'offset entry' and 'direct entry'	x
LO	Determine the correct entry procedure for a given holding pattern	x
LO	State the still air time for flying the outbound entry heading with or without DME	x
LO	Describe what the pilot is expected to do when clearance is received specifying the time of departure from the holding point	x
010 06 05 02	Obstacle clearance (except table)	
LO	Describe the layout of the basic holding area, entry area and buffer area of a holding pattern	x
LO	State which obstacle clearance is provided by a minimum permissible holding level referring to the holding area, the buffer area (general only) and over high terrain or in mountainous areas	x
010 06 06 00	**Altimeter setting procedures**	
010 06 06 01	Basic requirements and procedures	
LO	Describe the two main objectives for altimeter settings	x
LO	Define the terms 'QNH' and 'QFE'	x
LO	Describe the different terms of altitude or flight levels respectively which are the references during climb or descent to change the altimeter setting from QNH to 1013.2 hPa and vice versa	x
LO	Define the term 'Flight Level' (FL)	x
LO	State where flight level zero shall be located	x
LO	State the interval by which consecutive flight levels shall be separated	x
LO	Describe how flight levels are numbered	x
LO	Define the term 'Transition Altitude'	x
LO	State how Transition Altitudes shall normally be specified	x
LO	Explain how the height of the Transition Altitude is calculated and expressed in practice	x
LO	State where Transition Altitudes shall be published	x

LO	Define the term 'Transition Level'	x
LO	State when the Transition Level is normally passed to aircraft	x
LO	State how the vertical position of aircraft shall be expressed at or below the Transition Altitude and Transition Level	x
LO	Define the term 'Transition Layer'	x
LO	Describe when the vertical position of an aircraft passing through the transition layer shall be expressed in terms of flight levels and when in terms of altitude	x
LO	State when the QNH altimeter setting shall be made available to departing aircraft	x
LO	Explain when the vertical separation of aircraft during en-route flight shall be assessed in terms of altitude and when in terms of flight levels	x
LO	Explain when, in air-ground communications during an en-route flight, the vertical position of an aircraft shall be expressed in terms of altitude and when in terms of flight levels	x
LO	Describe why QNH altimeter setting reports should be provided from sufficient locations	x
LO	State how a QNH altimeter setting shall be made available to aircraft approaching a controlled aerodrome for landing	x
LO	State under which circumstances the vertical position of an aircraft above the transition level may be referenced to altitudes	x
010 06 06 02	Procedures for Operators and Pilots	
LO	State the three requirements that altitudes or flight levels selected should have	x
LO	Describe a pre-flight operational test in case of QNH setting and in case of QFE setting including indication (error) tolerances referred to the different test ranges	x
LO	State on which setting at least one altimeter shall be set prior to take off	x
LO	State where during the climb the altimeter setting shall be changed from QNH to 1013.2 hPa	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the transition level	x
LO	Describe when a pilot of an aircraft intending to land at an AD shall obtain the actual QNH altimeter setting	x
LO	State where the altimeter settings shall be changed from 1013.2 hPa to QNH during descent for landing	x
010 06 07 00	**Simultaneous Operation on parallel or near-parallel instrument Runways**	
LO	Describe the difference between independent and dependent parallel approaches	x
LO	Describe the following different operations: — Simultaneous instrument departures — Segregated parallel approaches/departures — Semi-mixed and mixed operations	x
010 06 08 00	**Secondary surveillance radar (transponder) operating procedures**	
010 06 08 01	Operation of transponders	

LO	State when and where the pilot shall operate the transponder	x
LO	State the modes and codes that the pilot shall operate in the absence of any ATC directions or regional air navigation agreements	x
LO	Indicate when the pilot shall operate Mode S	x
LO	State when the pilot shall 'SQUAWK IDENT'	x
LO	State the transponder mode and code to indicate: -a state of emergency -a Communication failure -unlawful interference	x
LO	Describe the consequences of a transponder failure in flight	x
LO	State the primary action of the pilot in the case of an unserviceable transponder before departure when no repair or replacement at this aerodrome is possible	x
010 06 08 02	Operation of ACAS equipment	
LO	Describe the main reason for using ACAS	x
010 07 00 00	**AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT**	
010 07 01 00	**ICAO Annex 11 — Air Traffic Services**	
010 07 01 03	Airspace	
LO	Understand the various rules and services that apply in the various classes of airspace	x
010 07 01 04	Air Traffic Control Services	
LO	Name the ATS units providing ATC service (area control service, approach control service, aerodrome control service)	x
LO	Describe which unit(s) may be assigned with the task to provide specified services on the apron	x
LO	Name the purpose of clearances issued by an ATC unit	x
LO	Describe the aim of clearances issued by ATC with regard to IFR, VFR or special VFR flights and refer to the different airspaces	x
LO	List the various (five possible) parts of an ATC clearance	x
LO	State how ATC shall react when it becomes apparent that traffic, additional to that one already accepted, cannot be accommodated within a given period of time at a particular location or in a particular area, or can only be accommodated at a given rate	x
010 07 02 00	**ICAO Document 4444 — Air Traffic Management**	
010 07 02 01	Foreword (Scope and purpose)	
LO	State whether or not a clearance issued by ATC units does include prevention of collision with terrain and if there is an exception to this, name the exception	x
010 07 02 03	ATS System Capacity and Air Traffic Flow Management	
LO	Explain when and where an air traffic flow management (ATFM) service shall be implemented	x

010 07 02 05	ATC Clearances	
LO	Explain 'the sole scope and purpose' of an ATC clearance	x
LO	State on which information the issue of an ATC clearance is based	x
LO	Describe what a PIC should do if an ATC clearance is not suitable	x
LO	Indicate who bears the responsibility for maintaining applicable rules and regulations whilst flying under the control of an ATC unit	x
LO	Explain what is meant by the expression 'clearance limit'	x
LO	Explain the meaning of the phrases 'cleared via flight planned route', 'cleared via (designation) departure' and 'cleared via (designation) arrival' in an ATC clearance.	x
LO	List which items of an ATC clearance shall always be read back by the flight crew	x
010 07 02 06	Horizontal Speed Control Instructions	
LO	Explain the reason for speed control by ATC	x
LO	Define the maximum speed changes that ATC may impose	x
LO	State within which distance from the threshold the PIC must not expect any kind of speed control	x
010 07 02 07	Change from IFR to VFR flight	
LO	Explain how the change from IFR to VFR can be initiated by the PIC	x
LO	Indicate the expected reaction of the appropriate ATC unit upon a request to change from IFR to VFR	x
010 07 02 09	Altimeter Setting Procedures	
LO	Define the following terms: — transition level — transition layer — and transition altitude	x
LO	Indicate how the vertical position of an aircraft in the vicinity of an aerodrome shall be expressed at or below the transition altitude, at or above the transition level and while climbing or descending through the transition layer	x
LO	Describe when the height of an aircraft using QFE during an NDB approach is referred to the landing threshold instead of the aerodrome elevation	x
LO	Indicate how far altimeter settings provided to aircraft shall be rounded up or down	x
LO	Define the expression 'lowest usable flight level'	x
LO	Determine how the vertical position of an aircraft on a flight en-route is expressed at or above the lowest usable flight level and below the lowest usable flight level	x
LO	State who establishes the transition level to be used in the vicinity of an aerodrome	x
LO	Decide how and when a flight crew shall be informed about the transition level	x
LO	State whether or not the pilot can request the transition level to be included in the approach clearance	x
LO	State in what kind of clearance the QNH altimeter setting shall be included	x
010 07 02 10	Position Reporting	

LO	Describe when position reports shall be made by an aircraft flying on routes defined by designated significant points	x
LO	List the six items that are normally included in a voice position report	x
LO	Name the requirements for using a simplified position report with Flight level, next position (and time over) and ensuing significant points omitted	x
LO	Name the item of a position report which must be forwarded to ATC with the initial call after changing to a new frequency	x
LO	Indicate the item of a position report which may be omitted if SSR Mode C is used	x
010 07 02 12	Separation methods and minima	
LO	Explain the general provisions for the separation of controlled traffic	x
LO	Name the different kind of separation used in aviation	x
LO	Understand the difference between the type of separation provided within the various classes of airspace and between the various types of flight	x
LO	State who is responsible for the avoidance of collision with other aircraft when operating in VMC	x
LO	State the ICAO documents in which details of current separation minima are prescribed	x
LO	Describe how vertical separation is obtained	x
LO	State the required vertical separation minimum	x
LO	Describe how the cruising levels of aircraft flying to the same destination and the expected approach sequence are correlated with each other	x
LO	Name the conditions that must be adhered to, when two aircraft are cleared to maintain a specified vertical separation between them during climb or descent	x
LO	List the two main methods for horizontal separation	x
LO	Describe how lateral separation of aircraft at the same level may be obtained	x
LO	Explain the term 'Geographical Separation'	x
LO	Describe track separation between aircraft using the same navigation aid or method	x
LO	Describe the three basic means for the establishment of longitudinal separation	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed	x
LO	Indicate the standard horizontal radar separation in NM	x
LO	State the wake turbulence radar separation for aircraft in the APP and DEP phases of a flight when an aircraft is operating directly behind another aircraft at the same ALT or less than 300 m (1 000 ft) below	x
010 07 02 13	Separation in the vicinity of aerodromes	
LO	State the condition to enable ATC to initiate a visual approach for an IFR flight	x

LO	Indicate whether or not separation will be provided by ATC between an aircraft executing a visual approach and other arriving or departing aircraft	x
LO	State in which case when the flight crew are not familiar with the instrument approach procedure being carried out, that only the final approach track has to be forwarded to them by ATC	x
LO	Describe which flight level should be assigned to an aircraft first arriving over a holding fix for landing	x
LO	Talk about the priority that will be given to aircraft for a landing	x
LO	Understand the situation when a pilot of an aircraft in an approach sequence indicates his intention to hold for weather improvements	x
LO	Explain the term 'Expected Approach Time' and the procedures for its use	x
LO	State the reasons which could probably lead to the decision to use another take-off or landing direction than the one into the wind	x
LO	Name the possible consequences for a PIC if the 'RWY-in-use' is not considered suitable for the operation involved	x
010 07 02 14	Miscellaneous separation procedures	
LO	Be familiar with the separation of aircraft holding in flight	x
LO	Be familiar with the minimum separation between departing aircraft	x
LO	Be familiar with the minimum separation between departing and arriving aircraft	x
LO	Be familiar with the non-radar wake turbulence longitudinal separation minima	x
LO	Know about a clearance to 'maintain own separation' while in VMC	x
LO	Give a brief description of 'Essential Traffic' and 'Essential Traffic Information'	x
LO	Describe the circumstances under which a reduction in separation minima may be allowed	x
010 07 02 15	Arriving and Departing aircraft	
LO	List the elements of information which shall be transmitted to an aircraft as early as practicable if an approach for landing is intended	x
LO	List the information to be transmitted to an aircraft at the commencement of final approach	x
LO	List the information to be transmitted to an aircraft during final approach	x
LO	State the sequence of priority between aircraft landing (or in the final stage of an approach to land) and aircraft intending to depart	x
LO	Explain the factors that influence the approach sequence	x
LO	State the significant changes in the meteorological conditions in the take-off or climb-out area that shall be transmitted without delay to a departing aircraft.	x
LO	Describe what information shall be forwarded to a departing aircraft as far as visual or non-visual aids are concerned	x

LO	State the significant changes that shall be transmitted as early as practicable to an arriving aircraft, particularly changes in the meteorological conditions.	x
010 07 02 16	Procedures for Aerodrome Control Service	
LO	Describe the general tasks of the Aerodrome Control Tower (TWR) when issuing information and clearances to aircraft under its control	x
LO	List for which aircraft and their given positions or flight situations the TWR shall prevent collisions	x
LO	Name the operational failure or irregularity of AD equipment which shall be reported to the TWR immediately	x
LO	State that, after a given period of time, the TWR shall report to the ACC or FIC if an aircraft does not land as expected	x
LO	Describe the procedures to be observed by the TWR whenever VFR operations are suspended	x
010 07 02 17	Radar services	
LO	State to what extent the use of radar in air traffic services may be limited	x
LO	State what radar derived information shall be available for display to the controller as a minimum	x
LO	Name the two basic identification procedures used with radar	x
LO	Define the term ‘PSR’	x
LO	Describe the circumstances under which an aircraft provided with radar service should be informed of its position	x
LO	List the possible forms of position information passed to the aircraft by radar services	x
LO	Define the term ‘radar vectoring’	x
LO	State the aims of radar vectoring as shown in ICAO Doc 4444	x
LO	State how radar vectoring shall be achieved	x
LO	Describe the information which shall be given to an aircraft when radar vectoring is terminated and the pilot is instructed to resume own navigation	x
LO	Explain the procedures for the conduct of Surveillance Radar Approaches (SRA)	x
LO	Describe what kind of action (concerning the transponder) the pilot is expected to perform in case of emergency if he has previously been directed by ATC to operate the transponder on a specific code	x
010 07 02 19	Procedures related to emergencies, communication failure and contingencies	
LO	State the Mode and Code of SSR equipment a pilot might operate in a (general) state of emergency or (specifically) in case the aircraft is subject to unlawful interference	x
LO	State the special rights an aircraft in a state of emergency can expect from ATC	x
LO	Describe the expected action of aircraft after receiving a broadcast from ATS concerning the emergency descent of an aircraft	x

LO	State how it can be ascertained, in case of a failure of two-way communication, whether the aircraft is able to receive transmissions from the ATS unit	x
LO	Explain the assumption based on which separation shall be maintained if an aircraft is known to experience a COM failure in VMC or in IMC	x
LO	State on which frequencies appropriate information, for an aircraft encountering two way COM failure, will be sent by ATS	x
LO	Describe the expected activities of an ATS-unit after having learned that an aircraft is being intercepted in or outside its area of responsibility	x
LO	State what is meant by the expression 'Strayed aircraft' and 'Unidentified aircraft'	x
010 08 00 00	**AERONAUTICAL INFORMATION SERVICE**	
010 08 02 00	**Definitions in ICAO Annex 15**	
LO	Recall the following definitions: Aeronautical Information Circular (AIC), Aeronautical Information Publication (AIP), AIP amendment, AIP supplement, AIRAC, danger area, Integrated Aeronautical Information Package, international airport, international NOTAM office (NOF), manoeuvring area, movement area, NOTAM, pre-flight information bulletin (PIB), prohibited area, restricted area, SNOWTAM, ASHTAM	x
010 08 04 00	**Integrated Aeronautical Information Package**	
010 08 04 01	Aeronautical Information Publications (AIP)	
LO	State in which main part of the AIP the following information can be found: — Differences from ICAO Standards, Recommended Practices and Procedures — Location indicators, aeronautical information services, minimum flight altitude, VOLMET service, SIGMET service — General rules and procedures (especially general rules, VFR, IFR, ALT setting procedure, interception of civil aircraft, unlawful interference, air traffic incidents), — ATS airspace (especially FIR, UIR, TMA), — ATS routes (especially lower ATS routes, upper ATS routes, area navigation routes) — Aerodrome data including Aprons, TWYs and check locations/positions data — Navigation warnings (especially prohibited, restricted and danger areas) — aircraft instruments, equipment and flight documents — AD surface movement guidance and control system and markings, — RWY physical characteristics, declared distances, APP and RWY lighting, — AD radio navigation and landing aids, — charts related to an AD — entry, transit and departure of aircraft, passengers, crew and cargo	x
010 08 04 02	NOTAMs	
LO	Describe how information shall be published which in principal would belong to NOTAMs but includes extensive text and/or graphics	x
LO	Summarise essential information which lead to the issuance of a NOTAM	x

LO	Explain how information regarding snow, ice and standing water on AD pavements shall be reported	x
010 08 04 03	Aeronautical Information Regulation and Control (AIRAC)	
LO	List the circumstances of which the information concerned shall or should be distributed as AIRAC	x
LO	State the sequence in which AIRACs shall be issued and state how many days in advance of the effective date the information shall be distributed by AIS	x
010 08 04 05	Pre-flight and Post-flight Information/Data	
LO	Describe how a recapitulation of current NOTAM and other information of urgent character shall be made available to flight crews	x
010 09 00 00	**AERODROMES (ICAO Annex 14, Volume I, Aerodrome Design and Operations)**	
010 09 02 00	**Aerodrome data**	
010 09 02 01	Aerodrome Reference Point	
LO	Describe where the aerodrome reference point shall be located and where it shall normally remain	x
010 09 03 00	**Physical Characteristics**	
010 09 03 01	Runways	
LO	Acquaint yourself with the general considerations concerning runways associated with a Stopway or Clearway	x
010 09 03 02	Runway Strips	
LO	Explain the term ‘Runway strip’	x
010 09 03 03	Runway end safety area	
LO	Explain the term ‘RWY end safety area’	x
010 09 03 04	Clearway	
LO	Explain the term ‘Clearway’	x
010 09 03 05	Stopway	
LO	Explain the term ‘Stopway’	x
010 09 03 07	Taxiways	
LO	Describe where runway-holding positions shall be established	x
010 09 04 00	**Visual aids for navigation**	
010 09 04 02	Markings	
LO	Name the colours used for the various markings (RWY, TWY, aircraft stands, apron safety lines)	x
LO	Describe the application and characteristics of: — RWY centre line markings — THR marking	x
010 09 04 03	Lights	

LO	Describe mechanical safety considerations regarding elevated approach lights and elevated RWY, stopway and taxiway-lights	x
LO	Discuss the relationship of the intensity of RWY lighting, the approach lighting system and the use of a separate intensity control for different lighting systems	x
LO	List the conditions for the installation of an AD beacon and describe its general characteristics	x
LO	Name the different kinds of operations for which a simple APP lighting system shall be used	x
LO	Describe the basic installations of a simple APP lighting system including the dimensions and distances normally used	x
LO	Describe the principle of a precision APP category I lighting system including such information as location and characteristics *Remark — This includes the 'Calvert' system with additional crossbars*	x
LO	Describe the wing bars of PAPI and APAPI	x
LO	Interpret what the pilot will see during approach, using PAPI, APAPI, T-VASIS and ATVASIS	x
LO	Explain the application and characteristics of: — RWY edge lights — RWY threshold and wing bar lights — RWY end lights — RWY centre line lights — RWY lead in lights — RWY touchdown zone lights — Stopway lights — Taxiway centre line lights — Taxiway edge lights — Stop bars — Intermediate holding position lights — RWY guard lights — Road holding position lights	x
010 09 04 04	Signs	
LO	State the general purpose for installing signs	x
LO	Explain what signs are the only ones on the movement area utilising red	x
LO	List the provisions for illuminating signs	x
LO	State the purpose for installing mandatory instruction signs	x
LO	Name the kind of signs which mandatory instruction signs shall include	x
LO	Name the colours used with mandatory instruction signs	x
LO	Describe the location of: — a RWY designation sign at a taxiway/RWY intersection — a NO ENTRY sign — a RWY holding position sign	x
LO	Name the sign with which it shall be indicated that a taxiing aircraft is about to infringe an obstacle limitation surface or to interfere with the operation of radio navigation aids (e.g. ILS/MLS critical/sensitive area)	x
LO	Describe the various possible inscriptions on RWY designation signs and on holding position signs	x
LO	Describe the inscription on an Intermediate-holding position sign on a taxiway	x
010 09 08 00	**Attachment A to ICAO Annex 14, Volume 1 — Supplementary Guidance Material**	
010 09 08 03	Approach lighting systems	
LO	Name the two main groups of approach lighting systems	x

LO	Describe the two different versions of a simple approach lighting system	x
LO	Describe the two different basic versions of precision approach lighting systems for CAT I	x
LO	Describe how the arrangement of an approach lighting system and the location of the appropriate threshold are interrelated with each other	x

AMC3 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Aircraft General Knowledge — Instrumentation (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR(A) and EIR
022 00 00 00	**AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION**	
022 02 00 00	**MEASUREMENT OF AIR DATA PARAMETERS**	
022 02 01 00	**Pressure measurement**	
022 02 01 02	Pitot/static system: design and errors	
LO	Describe the design and the operating principle of a: — static source — Pitot tube — combined Pitot/static probe	x
LO	For each of these indicate the various locations, describe the following associated errors: — position errors — instrument errors -errors due to a non-longitudinal axial flow (including manoeuvre-induced errors), and the means of correction and/or compensation	x
LO	Explain the purpose of heating and interpret the effect of heating on sensed pressure	x
LO	List the affected instruments and explain the consequences for the pilot in case of a malfunction including blockage and leakage	x
LO	Describe alternate static sources and their effects when used	x
022 02 04 00	**Altimeter**	
LO	Define the following terms: -height, altitude, -indicated altitude, true altitude, -pressure altitude, density altitude	x
LO	Define the following barometric references: QNH, QFE, 1013,25 hPa	x
LO	Explain the operating principles of an altimeter	x
LO	Describe and compare the following three types of altimeters: — simple altimeter (single capsule) — sensitive altimeter (multi capsule) — servo-assisted altimeter	x
LO	Give examples of associated displays: pointer, multi pointer, drum, vertical straight scale	x

LO	Describe the following errors: — Pitot/static system errors — temperature error (air column not at ISA conditions) — time lag (altimeter response to change of height) and the means of correction	x
LO	Give examples of altimeter corrections table from an Aircraft Operations Manual (AOM)	x
LO	Describe the effects of a blockage or a leakage on the static pressure line	x
022 02 05 00	**Vertical Speed Indicator (VSI)**	
LO	Explain the operating principles of a VSI	x
LO	Describe and compare the following two types of vertical speed indicators: — barometric type — inertial type (inertial information provided by an Inertial Reference Unit)	x
LO	Describe the following VSI errors: — Pitot/static system errors — time lag and the means of correction	x
LO	Describe the effects on a VSI of a blockage or a leakage on the static pressure line	x
022 02 06 00	**Airspeed Indicator (ASI)**	
LO	Define IAS, CAS, EAS, TAS and state and explain the relationship between these speeds	x
LO	Describe the following ASI errors and state when they must be considered: — Pitot/static system errors — compressibility error — density error	x
LO	Explain the operating principles of an ASI (as appropriate to aeroplanes or helicopters)	x
LO	Describe the effects on an ASI of a blockage or a leak in the static and/or total pressure line(s)	x
022 03 00 00	**MAGNETISM — DIRECT READING COMPASS AND FLUX VALVE**	
022 04 00 00	**GYROSCOPIC INSTRUMENTS**	
022 04 01 00	**Gyroscope: basic principles**	
LO	Define a gyro	x
LO	Explain the fundamentals of the theory of gyroscopic forces	x
LO	Define the degrees of freedom of a gyro *Remark: As a convention, the degrees of freedom of a gyroscope do not include its own axis of rotation (the spin axis)*	x
022 04 02 00	**Rate of turn indicator /-Turn Co-ordinator — Balance (Slip) Indicator**	
LO	Explain the purpose of a rate of turn and balance (slip) indicator	x
LO	Define a rate-one turn	x
LO	Explain the relation between bank angle, rate of turn and TAS	x
LO	Explain why the indication of a rate of turn indicator is only correct for one TAS and when turn is co-ordinated	x
LO	Explain the purpose of a balance (slip) indicator	x
LO	Describe the indications of a rate of turn and balance (slip) indicator during a balanced, slip or skid turn	x
LO	Describe the construction and principles of operation of a Turn Co-ordinator (or Turn and Bank Indicator)	x

LO	Compare the rate of turn indicator and the turn co-ordinator	x
022 04 03 00	**Attitude Indicator (Artificial Horizon)**	
LO	Explain the purpose of the attitude indicator	x
LO	Describe the different designs and principles of operation of attitude indicators (air driven, electric)	x
LO	Describe the attitude display and instrument markings	x
022 04 04 00	**Directional gyroscope**	
LO	Explain the purpose of the directional gyroscope	x
LO	Describe the following two types of directional gyroscopes: — Air driven directional gyro — Electric directional gyro	x
022 04 06 00	**Solid-State Systems — AHRS**	
LO	Describe the basic principle of a solid-state Attitude and Heading Reference System (AHRS) using a solid state 3-axis rate sensor, 3-axis accelerometer and a 3-axis magnetometer	x
022 12 00 00	**ALERTING SYSTEMS, PROXIMITY SYSTEMS**	
022 13 00 00	**INTEGRATED INSTRUMENTS — ELECTRONIC DISPLAYS**	
022 13 01 00	**Electronic display units**	
022 13 01 01	Design, limitations	
LO	List the different technologies used e.g. CRT and LCD and the associated limitations: — cockpit temperature — glare	x
022 13 02 00	**Mechanical Integrated instruments: ADI/HSI**	
LO	Describe an Attitude and Director Indicator (ADI) and a Horizontal Situation Indicator (HSI)	x
LO	List all the information that can be displayed for either instruments	x
022 13 03 00	**Electronic Flight Instrument Systems (EFIS)**	
022 13 03 01	Design, operation	
LO	List and describe the different components of an EFIS	x
022 13 03 02	Primary Flight Display (PFD), Electronic Attitude Director Indicator (EADI)	
LO	State that a PFD (or an EADI) presents a dynamic colour display of all the parameters necessary to control the aircraft	x
LO	List and describe the following information that can be displayed on the Primary Flight Display (PFD) unit of an aircraft: — Flight Mode Annunciation — basic T: — attitude	x

	— IAS — altitude — heading/track indications — vertical speed — maximum airspeed warning — selected airspeed —speed trend vector — selected altitude — current barometric reference — steering indications (FD command bars) — selected heading — Flight Path Vector (FPV) — Radio altitude — Decision height — ILS indications — ACAS (TCAS) indications — failure flags and messages	
022 13 03 03	Navigation Display (ND), Electronic Horizontal Situation Indicator (EHSI)	
LO	State that a ND (or an EHSI) provides a mode-selectable colour flight navigation display	x

AMC4 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Flight Planning and Flight Monitoring (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument (EIR) rating course according to FCL.825)

Syllabus reference	**Syllabus details and associated Learning Objectives**	**CB-IR(A) and EIR**
033 00 00 00	**FLIGHT PLANNING AND FLIGHT MONITORING**	
033 02 00 00	**FLIGHT PLANNING FOR IFR FLIGHTS**	
033 02 01 00	**IFR Navigation plan**	
033 02 01 01	Airways and routes	
LO	Select the preferred airway(s) or route(s) considering: — Altitudes and Flight levels — Standard routes — ATC restrictions — Shortest distance — Obstacles — Any other relevant data	x
033 02 01 02	Courses and distances from en-route charts	
LO	Determine courses and distances	x
LO	Determine bearings and distances of waypoints from radio navigation aids	x
033 02 01 03	Altitudes	
LO	Define the following altitudes: — Minimum En-route Altitude (MEA) — Minimum Obstacle Clearance Altitude (MOCA) — Minimum Off Route Altitude (MORA) — Grid Minimum Off-Route Altitude (Grid MORA) — Maximum Authorised Altitude (MAA) — Minimum Crossing Altitude (MCA) — Minimum Holding Altitude (MHA)	x

LO	Extract the following altitudes from the chart(s): — Minimum En-route Altitude (MEA) — Minimum Obstacle Clearance Altitude (MOCA) — Minimum Off Route Altitude (MORA) — Grid Minimum Off-Route Altitude (Grid MORA) — Maximum Authorised Altitude (MAA) — Minimum Crossing Altitude (MCA) — Minimum Holding Altitude (MHA)	x
033 02 01 04	Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs)	
LO	Explain the reasons for studying SID and STAR charts	x
LO	State the reasons why the SID and STAR charts show procedures only in a pictorial presentation style which is not to scale	x
LO	Interpret all data and information represented on SID and STAR charts, particularly: — Routings. — Distances — Courses — Radials — Altitudes/Levels — Frequencies — Restrictions	x
LO	Identify SIDs and STARs which might be relevant to a planned flight	x
033 02 01 05	Instrument Approach Charts	
LO	State the reasons for being familiar with instrument approach procedures and appropriate data for departure, destination and alternate airfields	x
LO	Select instrument approach procedures appropriate for departure, destination and alternate airfields	x
LO	Interpret all procedures, data and information represented on Instrument Approach Charts, particularly: — Courses and Radials — Distances — Altitudes/Levels/Heights — Restrictions — Obstructions — Frequencies — Speeds and times — Decision Altitudes/Heights (DA/H) and Minimum Descent Altitudes/Heights (MDA/H) — Visibility and Runway Visual Ranges (RVR)	x

	— Approach light systems	
033 02 01 06	Communications and Radio Navigation planning data	
LO	Find communication frequencies and call signs for the following: — Control agencies and service facilities — Flight information services (FIS) — Weather information stations — Automatic Terminal Information Service (ATIS)	x
LO	Find the frequency and/or identifiers of radio navigation aids	x
033 02 01 07	Completion of navigation plan	
LO	Complete the navigation plan with the courses, distances and frequencies taken from charts	x
LO	Find Standard Instrument Departure and Arrival Routes to be flown and/or to be expected	x
LO	Determine the position of Top of Climb (TOC) and Top of Descent (TOD) given appropriate data	x
LO	Determine variation and calculate magnetic/true courses	x
LO	Calculate True Air Speed (TAS) given aircraft performance data, altitude and Outside Air Temperature (OAT)	x
LO	Calculate Wind Correction Angles (WCA)/Drift and Ground Speeds (GS)	x
LO	Determine all relevant Altitudes/Levels particularly MEA, MOCA, MORA , MAA, MCA, MRA and MSA	x
LO	Calculate individual and accumulated times for each leg to destination and alternate airfields	x
033 03 00 00	**FUEL PLANNING**	
033 03 01 00	General	
LO	Convert between volume, mass and density given in different units which are commonly used in aviation	x
LO	Determine relevant data from flight manual, such as fuel capacity, fuel flow/consumption at different power/thrust settings, altitudes and atmospheric conditions	x
LO	Calculate attainable flight time/range given fuel flow/consumption and available amount of fuel	x
LO	Calculate the required fuel given fuel flow/consumption and required time/range to be flown	x
LO	Calculate the required fuel for an IFR flight given expected meteorological conditions and expected delays under defined conditions.	x
033 04 00 00	**PRE-FLIGHT PREPARATION**	
033 04 01 00	NOTAM briefing	
033 04 01 01	Ground facilities and services	
LO	Check that ground facilities and services required for the planned flight are available and adequate	x
033 04 01 02	Departure, destination and alternate aerodromes	
LO	Find and analyse the latest state at the departure, destination and alternate aerodromes, in particular for: — Opening hours	x

	— Work in Progress (WIP) — Special procedures due to Work in Progress (WIP) — Obstructions — Changes of frequencies for communications, navigation aids and facilities	
033 04 01 03	Airway routings and airspace structure	
LO	Find and analyse the latest en-route state for: — Airway(s) or Route(s) — Restricted, Dangerous and Prohibited areas — Changes of frequencies for communications, navigation aids and facilities	x
033 04 02 00	Meteorological briefing	
033 04 02 02	Update of navigation plan using the latest meteorological information:	
LO	Confirm the optimum altitude/FL given wind, temperature and aircraft data	x
LO	Confirm magnetic headings and ground speeds	x
LO	Confirm the individual leg times and the total time en route	x
LO	Confirm the total time en route for the trip to the destination	x
LO	Confirm the total time from destination to the alternate airfield	x
033 04 02 05	Update of fuel log	
LO	Calculate revised fuel data in accordance with changed conditions	x
033 05 00 00	**ICAO FLIGHT PLAN (ATS Flight Plan)**	
033 05 01 00	Individual Flight Plan	
033 05 01 01	Format of Flight Plan	
LO	State the reasons for a fixed format of an ICAO ATS Flight Plan (FPL)	x
LO	Determine the correct entries to complete an FPL plus decode and interpret the entries in a completed FPL, particularly for the following: — Aircraft identification (Item 7) — Flight rules and type of flight (Item 8) — Number and type of aircraft and wake turbulence category (Item 9) — Equipment (Item 10) — Departure aerodrome and time (Item 13) — Route (Item 15) — Destination aerodrome, total estimated elapsed time and Alternate aerodrome (Item 16) — Other information (Item 18) — Supplementary Information (Item 19)	x

033 05 01 02	Completion of an ATS Flight Plan (FPL)	
LO	Complete the Flight Plan using information from the following: — Navigation plan — Fuel plan — Operator’s records for basic aircraft information	x
033 05 03 00	Submission of an ATS Flight Plan (FPL)	
LO	Explain the requirements for the submission of an ATS Flight Plan	x
LO	Explain the actions to be taken in case of Flight Plan changes	x
LO	State the actions to be taken in case of inadvertent changes to Track, TAS and time estimate affecting the current Flight Plan	x
LO	Explain the procedures for closing a Flight Plan	x

AMC5 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Human Performance (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus Reference	Syllabus and Learning Objectives	CB-IR (A) and EIR
040 00 00 00	**HUMAN PERFORMANCE**	
040 01 00 00	**HUMAN FACTORS: BASIC CONCEPTS**	
040 01 03 00	**Flight safety concepts**	
LO	Explain the three components of the Threat and Error Management Model (TEM).	x
LO	Explain and give examples of latent threats	x
LO	Explain and give examples of Environmental Threats	x
LO	Explain and give examples of Organizational Threats	x
LO	Explain and give a definition of Error according the TEM-model in ICAO Annex 1	x
LO	Give examples of different countermeasures which may be used in order to manage Threats, Errors and Undesired Aircraft States	x
LO	Explain and give examples of Procedural Error	x
040 01 04 00	**Safety culture**	
LO	Distinguish between 'open cultures' and 'closed cultures'	x
LO	Illustrate how Safety Culture is reflected by National Culture	x
LO	Explain James Reason's Swiss Cheese Model	x
LO	State important factors that promote a good Safety Culture	x
LO	Distinguish beteween 'Just Culture' and 'Non-punative Culture'	x
LO	Name five components which form Safety Culture (According to James Reason)	x
040 02 00 00	**BASIC AVIATION PHYSIOLOGY AND HEALTH MAINTENANCE**	
040 02 01 00	**Basics of flight physiology**	
040 02 01 02	Respiratory and circulatory systems	

LO	Define 'linear', 'angular' and 'radial acceleration'	x
LO	Describe the effects of acceleration on the circulation and blood volume distribution	x
LO	List the factors determining the effects of acceleration on the human body	x
LO	Describe measures which may be taken to increase tolerance to positive acceleration	x
LO	List the effects of positive acceleration with respect to type, sequence and the corresponding G-load	x
040 02 02 00	**Man and Environment: the sensory system**	
LO	List the different senses	x
LO	State the multi-sensory nature of human perception	x
040 02 02 04	Equilibrium	
Functional Anatomy		
LO	List the main elements of the vestibular apparatus	x
LO	State the functions of the vestibular apparatus on the ground and in flight	x
LO	Distinguish between the component parts of the vestibular apparatus in the detection of linear and angular acceleration as well as on gravity	x
LO	Explain how the semicircular canals are stimulated	x
Motion sickness		
LO	Describe air-sickness and its accompanying symptoms	x
LO	List the causes of motion sickness	x
LO	Describe the necessary actions to be taken to counteract the symptoms of motion sickness	x
040 02 02 05	Integration of sensory inputs	
LO	State the interaction between vision, equilibrium, proprioception and hearing to obtain spatial orientation in flight	x
LO	Define the term 'illusion'	x
LO	Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons and surface planes	x
LO	Relate these illusions to problems that may be experienced in flight and identify the danger attached to them	x
LO	State the conditions which cause the 'black hole' effect and 'empty field myopia'	x
LO	Give examples of approach and landing illusions, state the danger involved and give recommendations to avoid or counteract these problems	x
LO	State the problems associated with flickering lights (strobe-lights, anti-collision lights, etc.)	x

LO	Give examples of vestibular illusions such as Somatogyral (the Leans), Coriolis, Somatogravic and g-effect illusions	x
LO	Relate the above mentioned vestibular illusions to problems encountered in flight and state the dangers involved	x
LO	List and describe the function of the proprioceptive senses (‘Seat-of-the-Pants-Sense’)	x
LO	Relate illusions of the proprioceptive senses to the problems encountered during flight	x
LO	State that the ‘Seat-of-the-Pants-Sense’ is completely unreliable when visual contact with the ground is lost or when flying in IMC or poor visual horizon	x
LO	Differentiate between Vertigo, Coriolis effect and spatial disorientation	x
LO	Explain The Flicker Effect (Stroboscopic Effect) and discuss counter measures	x
LO	Explain how spatial disorientation can result from a mismatch in sensory input and information processing	x
LO	List the measures to prevent and/or overcome spatial disorientation	x
040 03 00 00	**BASIC AVIATION PSYCHOLOGY**	
040 03 02 00	**Human error and reliability**	
040 03 02 02	Mental models and situation awareness	
LO	Define the term 'situation awareness'	x
LO	List cues which indicate the loss of situation awareness and name the steps to regain it	x
LO	List factors which influence one’s Situation Awareness both positively and negatively and stress the importance of Situation Awareness in the context of flight safety	x
LO	Define the term 'mental model' in relation to a surrounding complex situation	x
LO	Describe the advantage/disadvantage of mental models	x
LO	Explain the relationship between personal ‘mental models’ and the creation of cognitive illusions	x
040 03 02 03	Theory and model of human error	
LO	Define the term ‘error’	x
LO	Explain the concept of the ‘error chain’	x
LO	Differentiate between an isolated error and an error chain	x
LO	Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations)	x
LO	Discuss the above errors and their relevance in-flight	x
LO	Distinguish between an active and a latent error and give examples	x
040 03 02 04	Error generation	
LO	Distinguish between internal and external factors in error generation	x
LO	Identify possible sources of internal error generation	x

LO	Define and discuss the two errors associated with motor programmes	x
LO	List the three main sources for external error generation in the cockpit	x
LO	Give examples to illustrate the following factors in external error generation in the cockpit: — Ergonomics — Economics — Social environment	x
LO	Name major goals in the design of human centred man-machine interfaces	x
LO	Define the term 'error tolerance'	x
LO	List (and describe) strategies which are used to reduce human error	x
040 03 03 00	**Decision making**	
040 03 03 01	Decision-making concepts	
LO	Define the term 'deciding' and 'decision-making'	x
LO	Describe the major factors on which a decision-making should be based during the course of a flight	x
LO	Describe the main human attributes with regard to decision making	x
LO	Discuss the nature of bias and its influence on the decision making process	x
LO	Describe the main error sources and limits in an individual's decision making mechanism	x
LO	State the factors upon which an individual's risk assessment is based	x
LO	Explain the relationship between risk assessment, commitment, and pressure of time on decision making strategies	x
LO	Describe the positive and negative influences exerted by other group members on an individual's decision making process	x
LO	Explain the general idea behind the creation of a model for decision making based upon: — definition of the aim — collection of information — risk assessment — development of options — evaluation of options — decision — implementation — consequences — review and feedback	x
040 03 04 00	**Avoiding and managing errors: cockpit management**	
040 03 04 01	Safety awareness	

LO	Justify the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks	x
LO	Stress the overall importance of constantly and positively striving to monitor for errors and thereby maintaining situation awareness	x
040 03 06 00	**Human overload and underload**	
040 03 06 02	Stress	
LO	Explain the biological reaction to stress by means of the general adaptation syndrome (GAS)	x
LO	Name the 3 phases of the GAS	x
LO	Name the symptoms of stress relating to the different phases of the GAS	x
LO	Explain how stress is cumulative and how stress from one situation can be transferred to a different situation	x
LO	Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future	x
LO	Describe the effect of human under/overload on effectiveness in the cockpit	x
LO	List sources and symptoms of human underload	x
040 03 07 00	**Advanced cockpit automation**	
040 03 07 01	Advantages and disadvantages	
LO	Define and explain the basic concept of automation	x
LO	List the advantages/disadvantages of automation in the cockpit in respect of level of vigilance, attention, workload, situation awareness and crew coordination	x
LO	State the advantages and disadvantages of the two components of the man-machine system with regard to information input and processing, decision making, and output activities	x
LO	Explain the 'ironies of automation'	x
LO	Give examples of methods to overcome the disadvantages of automation	x
040 03 07 02	Automation complacency	
LO	State the main weaknesses in the monitoring of automatic systems	x
LO	Explain the following terms in connection with automatic systems: — Passive monitoring — Blinkered concentration — Confusion — Mode awareness	x
LO	Give examples of actions which may be taken to counteract ineffective monitoring of automatic systems	x
LO	Define 'complacency'	x

040 03 07 03	Working concepts	
LO	Summarise how the negative effects of automation on pilots may be alleviated	x
LO	Interpret the role of automation with respect to flight safety	x

AMC6 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Meteorology (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR (A) and EIR
050 00 00 00	**METEOROLOGY**	
050 01 00 00	**THE ATMOSPHERE**	
050 01 02 00	**Air temperature**	
050 01 02 04	Lapse rates	
LO	Describe qualitatively and quantitatively the temperature lapse rates of the troposphere (mean value 0.65°C/100 m or 2°C/1 000 ft and actual values)	x
050 01 02 05	Development of inversions, types of inversions	
LO	Describe development and types of inversions	x
LO	Explain the characteristics of inversions and of an isothermal layer	x
LO	Explain the reasons for the formation of the following inversions:	
— ground inversion (nocturnal radiation/advection), subsidence inversion, frontal inversion, inversion above friction layer, valley inversion	x	
— tropopause inversion		

050 01 02 06	Temperature near the earth's surface, surface effects, diurnal and seasonal variation, effect of clouds, effect of wind	
LO	Describe how the temperature near the earth's surface is influenced by seasonal variations	x
LO	Explain the cooling and warming of the air on the earth or sea surfaces	x
LO	Sketch the diurnal variation of the temperature of the air in relation to the radiation of the sun and of the earth	x
LO	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface	x
LO	Distinguish between the influence of low or high clouds, thick or thin clouds	x
LO	Explain the influence of the wind on the cooling and warming of the air near the surfaces	x
050 01 03 00	**Atmospheric pressure**	
050 01 03 01	Barometric pressure, isobars	
LO	Define atmospheric pressure	x
LO	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches) *(Refer to 050 10 01 01)*	x
LO	Describe isobars on the surface weather charts	x
LO	Define high, low, trough, ridge, wedge, col	x
050 01 03 02	Pressure variation with height, contours (isohypses)	
LO	Explain the pressure variation with height	x
LO	Describe qualitatively the variation of the barometric lapse rate *Note: The average value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa, at about 5500 m/AMSL is 50 ft (15 m) per 1 hPa*	x
LO	Describe and interpret contour lines (isohypses) on a constant pressure chart *(Refer to 050 10 02 03)*	x
050 01 03 03	Reduction of pressure to mean sea level, QFF	
LO	Define QFF	x
LO	Explain the reduction of measured pressure to mean sea level, QFF	x
LO	Mention the use of QFF for surface weather charts	x
050 01 03 04	Relationship between surface pressure centres and pressure centres aloft	
LO	Illustrate with a vertical cross section of isobaric surfaces the relationship between surface pressure systems and upper air pressure systems	x
050 01 04 00	**Air density**	
050 01 04 01	Relationship between pressure, temperature and density	
LO	Describe the relationship between pressure, temperature and density	x

LO	Describe the vertical variation of the air density in the atmosphere	x
LO	Describe the effect of humidity changes on the density of air	x
050 01 05 00	**ICAO Standard Atmosphere (ISA)**	
050 01 05 01	ICAO Standard Atmosphere	
LO	Explain the use of standardised values for the atmosphere	x
LO	List the main values of the ISA (mean sea level pressure, mean sea level temperature, the vertical temperature lapse rate up to 20 km, height and temperature of the tropopause)	x
LO	Calculate the standard temperature in degree Celsius for a given flight level	x
LO	Determine a standard temperature deviation by the difference between the given outside air temperature and the standard temperature	x
050 01 06 00	**Altimetry**	
050 01 06 01	Terminology and definitions	
LO	Define the following terms and abbreviations and explain how they are related to each other: height, altitude, pressure altitude, flight level, level, true altitude, true height, elevation, QNH, QFE and standard altimeter setting	x
LO	Describe the terms transition altitude, transition level, transition layer, terrain clearance, lowest usable flight level	x
050 01 06 03	Calculations	
LO	Calculate the different readings on the altimeter when the pilot changes the altimeter setting	x
LO	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level	x
LO	Derive the reading of the altimeter of an aircraft on the ground when the pilot uses the different settings	x
LO	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two flight levels	x
LO	Explain the influence of pressure areas on the true altitude	x
LO	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation	x
LO	Calculate the terrain clearance and the lowest usable flight level for given atmospheric temperature and pressure conditions	x
	Note: The following rules shall be considered for altimetry calculations: *a. All calculations are based on rounded pressure values to the nearest lower hPa* *b. The value for the barometric lapse rate near mean sea level is 27 ft (8 m) per 1 hPa*	

	c. To determine the true altitude/height the following rule of thumb, called the '4 %-rule', shall be used: the altitude/height changes by 4 % for each 10°C temperature deviation from ISA *d. If no further information is given, the deviation of outside air temperature from ISA is considered to be constantly the same given value in the whole layer* *e. The elevation of the airport has to be taken into account. The temperature correction has to be considered for the layer between ground and the position of the aircraft*	
050 01 06 04	Effect of accelerated airflow due to topography	
LO	Describe qualitatively how the effect of accelerated airflow due to topography (Bernoulli effect) affects altimetry	x
050 02 00 00	**WIND**	
050 02 02 00	**Primary cause of wind**	
050 02 02 02	Variation of wind in the friction layer	
LO	Describe why and how the wind changes direction and speed with height in the friction layer in the northern and in the southern hemisphere (rule of thumb)	x

LO	Explain the relationship between isobars and wind (direction and speed) *Note: Approximate value for variation of wind in the friction layer (values to be used in examinations):* *Type of landscape — Wind speed in friction layer in % of the geostrophic wind — The wind in the friction layer blows across the isobars towards the low pressure. Angle between wind direction and isobars* *over water — ca 70 % — ca 10°* *over land — ca 50 % — ca 30°* *WMO-NO. 266*	x
050 02 02 03	Effects of convergence and divergence	
LO	Describe atmospheric convergence and divergence	x
LO	Explain the effect of convergence and divergence on the following: pressure systems at the surface and aloft; wind speed; vertical motion and cloud formation (relationship between upper air conditions and surface pressure systems)	x
050 02 04 00	**Local winds**	
050 02 04 01	Anabatic and katabatic winds, mountain and valley winds, venturi effects, land and sea breezes	
LO	Describe and explain anabatic and katabatic winds	x

LO	Describe and explain mountain and valley winds	x
LO	Describe and explain the venturi effect, convergence in valleys and mountain areas	x
LO	Describe and explain land and sea breezes, sea breeze front	x
050 02 05 00	**Mountain waves (standing waves, lee waves)**	
050 02 05 01	Origin and characteristics	
LO	Describe and explain the origin and formation of mountain waves	x
LO	State the conditions necessary for the formation of mountain waves	x
LO	Describe the structure and properties of mountain waves	x
LO	Explain how mountain waves may be identified by their associated meteorological phenomena	x
050 02 06 00	**Turbulence**	
050 02 06 01	Description and types of turbulence	
LO	Describe turbulence and gustiness	x
LO	List common types of turbulence (convective, mechanical, orographic, frontal, clear air turbulence)	x
050 02 06 02	Formation and location of turbulence	
LO	Explain the formation of convective turbulence, mechanical and orographic turbulence, frontal turbulence, clear air turbulence *(Refer to 050 02 06 03)*	x
LO	State where turbulence will normally be found (rough ground surfaces, relief, inversion layers, CB, TS zones, unstable layers)	x
050 03 00 00	**THERMODYNAMICS**	
050 03 01 00	**Humidity**	
050 03 01 01	Water vapour in the atmosphere	
LO	Describe humid air	x
LO	Describe the significance of water vapour in the atmosphere for meteorology	x
LO	Indicate the sources of atmospheric humidity	x
050 03 01 03	Temperature/dew point, relative humidity	
LO	Define dew point	x
LO	Recognise the dew point curve on a simplified diagram (T,P)	x
LO	Define relative humidity	x
LO	Explain the factors influencing the relative humidity at constant pressure	x
LO	Explain the diurnal variation of the relative humidity	x
LO	Describe the relationship between relative humidity, the amount of water vapour and the temperature	x
LO	Describe the relationship between temperature and dew point	x

LO	Estimate the relative humidity of the air from the difference between dew point and temperature	x
050 04 00 00	**CLOUDS AND FOG**	
050 04 01 00	**Cloud formation and description**	
050 04 01 01	Cloud formation	
LO	Explain cloud formation by adiabatic cooling, conduction, advection and radiation	x
LO	Describe the cloud formation based on the following lifting processes: unorganised lifting in thin layers and turbulent mixing; forced lifting at fronts or over mountains; free convection	x
LO	Determine the cloud base and top in a simplified diagram (temperature, pressure, humidity)	x
LO	Explain the influence of relative humidity on the height of the cloud base	x
LO	Illustrate in a thermodynamic diagram the meaning of convective temperature (temperature at which formation of cumulus starts)	x
LO	List cloud types typical for stable and unstable air conditions	x
LO	Summarise the conditions for the dissipation of clouds	x
050 04 01 02	Cloud types and cloud classification	
LO	Describe cloud types and cloud classification	x
LO	Identify by shape cirriform, cumuliform and stratiform clouds	x
LO	Identify by shape and typical level the ten cloud types (genera)	x
LO	Describe and identify by shape the following species and supplementary feature: castellanus, lenticularis, fractus, humilis, mediocris, congestus, calvus, capillatus and virga	x
LO	Distinguish between low, medium and high level clouds according to the WMO cloud étage (including heights)	
— for mid-latitudes	x	
— for all latitudes		
LO	Distinguish between ice clouds, mixed clouds and pure water clouds	x
050 04 01 03	Influence of inversions on cloud development	
LO	Explain the influence of inversions on vertical movements in the atmosphere	x
LO	Explain the influence of an inversion on the formation of stratus clouds	x
LO	Explain the influence of ground inversion on the formation of fog	x
LO	Determine the top of a cumulus cloud caused by an inversion on a simplified diagram	x
050 04 01 04	Flying conditions in each cloud type	

LO	Assess the ten cloud types for icing and turbulence	x
050 04 02 00	**Fog, mist, haze**	
050 04 02 01	General aspects	
LO	Define fog, mist and haze with reference to WMO standards of visibility range	x
LO	Explain the formation of fog, mist and haze in general	x
LO	Name the factors contributing in general to the formation of fog and mist	x
LO	Name the factors contributing to the formation of haze	x
LO	Describe freezing fog and ice fog	x
050 04 02 02	Radiation fog	
LO	Explain the formation of radiation fog	x
LO	Explain the conditions for the development of radiation fog	x
LO	Describe the significant characteristics of radiation fog, and its vertical extent	x
LO	Summarise the conditions for the dissipation of radiation fog	x
050 04 02 03	Advection fog	
LO	Explain the formation of advection fog	x
LO	Explain the conditions for the development of advection fog	x
LO	Describe the different possibilities of advection fog formation (over land, sea and coastal regions)	x
LO	Describe significant characteristics of advection fog	x
LO	Summarise the conditions for the dissipation of advection fog	x
050 04 02 04	Steam fog	
LO	Explain the formation of steam fog	x
LO	Explain the conditions for the development of steam fog	x
LO	Describe significant characteristics of steam fog	x
LO	Summarise the conditions for the dissipation of steam fog	x
050 04 02 05	Frontal fog	
LO	Explain the formation of frontal fog	x
LO	Explain the conditions for the development of frontal fog	x
LO	Describe significant characteristics of frontal fog	x
LO	Summarise the conditions for the dissipation of frontal fog	x
050 04 02 06	Orographic fog (hill fog)	
LO	Summarise the features of orographic fog	x
LO	Explain the conditions for the development of orographic fog	x

LO	Describe significant characteristics of orographic fog	x
LO	Summarise the conditions for the dissipation of orographic fog	x
050 05 00 00	**PRECIPITATION**	
050 05 01 00	**Development of precipitation**	
050 05 01 01	Process of development of precipitation	
LO	Distinguish between the two following processes by which precipitation is formed	x
LO	— Summarise the outlines of the ice crystal process (Bergeron-Findeisen)	x
LO	— Summarise the outlines of the coalescence process	x
LO	Describe the atmospheric conditions that favour either process	x
LO	Explain the development of snow, rain, drizzle and hail	x
050 05 02 00	**Types of precipitation**	
050 05 02 01	Types of precipitation, relationship with cloud types	
LO	List and describe the types of precipitation given in the TAF and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, freezing rain)	x
LO	State ICAO/WMO approximate diameters for cloud, drizzle and rain drops	x
LO	State approximate weights and diameters for hailstones	x
LO	Explain the mechanism for the formation of freezing precipitation	x
LO	Describe the weather conditions that give rise to freezing precipitation	x
LO	Distinguish between the types of precipitation generated in convective and stratiform cloud	x
LO	Assign typical precipitation types and intensities to different clouds	x
050 06 00 00	**AIR MASSES AND FRONTS**	
050 06 01 00	**Air masses**	
050 06 01 01	Description, classification and source regions of air masses	
LO	Define the term air mass	x
LO	Describe the properties of the source regions	x
LO	Summarise the classification of air masses by source regions	x
LO	State the classifications of air masses by temperature and humidity at source	x
LO	State the characteristic weather in each of the air masses	x
LO	Name the three main air masses that affect Europe	x
LO	Classify air masses on a surface weather chart	x

	Note: Names and abbreviations of air masses used in examinations: *— first letter: humidity* *continental (c),* *maritime (m)* *— second letter: type of air mass* *Arctic (A),* *Polar (P),* *Tropical (T),* *Equatorial (E)* *— third letter: temperature* *cold (c),* *warm (w)*	
050 06 01 02	Modifications of air masses	
LO	List the environmental factors that affect the final properties of an air mass	x
LO	Explain how maritime and continental tracks modify air masses	x
LO	Explain the effect of passage over cold or warm surfaces	x
LO	Explain how air mass weather is affected by the season, the air mass track and by orographic and thermal effects over land	x
LO	Assess the tendencies of the stability for an air mass and describe the typical resulting air mass weather including the hazards for aviation	x
050 06 02 00	**Fronts**	
050 06 02 01	General aspects	
LO	Describe the boundaries between air masses (fronts)	x
LO	Define front and frontal surface (frontal zone)	x
050 06 02 02	Warm front, associated clouds and weather	
LO	Define a warm front	x
LO	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air	x
LO	Explain the seasonal differences in the weather at warm fronts	x
LO	Describe the structure, slope and dimensions of a warm front	x
LO	Sketch a cross-section of a warm front, showing weather, cloud and aviation hazards	x
050 06 02 03	Cold front, associated clouds and weather	
LO	Define a cold front	x

LO	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air	x
LO	Explain the seasonal differences in the weather at cold fronts	x
LO	Describe the structure, slope and dimensions of a cold front	x
LO	Sketch a cross-section of a cold front, showing weather, cloud and aviation hazards	x
050 06 02 04	Warm sector, associated clouds and weather	
LO	Define fronts and air masses associated with the warm sector	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector	x
LO	Explain the seasonal differences in the weather in the warm sector	x
LO	Sketch a cross-section of a warm sector, showing weather, cloud and aviation hazards	x
050 06 02 05	Weather behind the cold front	
LO	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front	x
LO	Explain the seasonal differences in the weather behind the cold front	x
050 06 02 06	Occlusions, associated clouds and weather	
LO	Define the term occlusion	x
LO	Define a cold occlusion	x
LO	Define a warm occlusion	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion	x
LO	Explain the seasonal differences in the weather at occlusions	x
LO	Sketch a cross-section of cold and warm occlusions, showing weather, cloud and aviation hazards	x
LO	In a sketch plan illustrate the development of an occlusion and the movement of the occlusion point	x
050 06 02 07	Stationary front, associated clouds and weather	
LO	Define a stationary or quasi-stationary front	x
LO	Describe the cloud, weather, ground visibility and aviation hazards in a stationary or quasi-stationary front	x
050 06 02 08	Movement of fronts and pressure systems, life cycle	
LO	Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression	x
LO	State the rules for predicting the direction and the speed of movement of fronts	x
LO	Explain the difference between the speed of movement of cold and warm fronts	x
LO	State the rules for predicting the direction and the speed of movement of frontal depressions	x
LO	Describe, with a sketch if required, the genesis, development and life cycle of a frontal depression with associated cloud and rain belts	x

050 06 02 09	Changes of meteorological elements at a frontal wave	
LO	Sketch a plan and a cross-section of a frontal wave (warm front, warm sector and cold front) and illustrate the changes of pressure, temperature, surface wind and wind in the vertical axis	x
050 07 00 00	**PRESSURE SYSTEMS**	
050 07 02 00	**Anticyclone**	
050 07 02 01	Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence	
LO	List the different types of anticyclones	x
LO	Describe the effect of high level convergence in producing areas of high pressure at ground level	x
LO	Describe air mass subsidence, its effect on the environmental lapse rate, and the associated weather	x
LO	Describe the formation of warm and cold anticyclones	x
LO	Describe the formation of ridges and wedges *(Refer to 050 08 03 02)*	x
LO	Describe the properties of and the weather associated with warm and cold anticyclones	x
LO	Describe the properties of and the weather associated with ridges and wedges	x
LO	Describe the blocking anticyclone and its effects	x
050 07 03 00	**Non frontal depressions**	
050 07 03 01	Thermal-, orographic-, polar- and secondary depressions, troughs	
LO	Describe the effect of high level divergence in producing areas of low pressure at ground level	x
LO	Describe the formation and properties of thermal-, orographic- (lee lows), polar- and secondary depressions	x
LO	Describe the formation, the properties and the associated weather of troughs	x
050 08 00 00	**CLIMATOLOGY**	
050 08 03 00	**Typical weather situations in the mid-latitudes**	
050 08 03 01	Westerly situation (westerlies)	
LO	Identify on a weather chart the typical westerly situation with travelling polar front waves	x
LO	Describe the typical weather in the region of the travelling polar front waves including the seasonal variations	x
050 08 03 02	High pressure area	
LO	Describe the high pressure zones with the associated weather	x
LO	Identify on a weather chart high pressure regions	x
LO	Describe the weather associated with wedges in the polar air *(Refer to 050 07 02 01)*	x
050 08 03 03	Flat pressure pattern	
LO	Identify on a surface weather chart the typical flat pressure pattern	x

LO	Describe the weather associated with a flat pressure pattern	x
050 09 00 00	**FLIGHT HAZARDS**	
050 09 01 00	**Icing**	
050 09 01 01	Conditions for ice accretion	
LO	Summarise the general conditions under which ice accretion occurs on aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle; possibility of sublimation)	x
LO	Indicate the general weather conditions under which ice accretion in venturi carburettor occurs	x
LO	Explain the general weather conditions under which ice accretion on airframe occurs	x
LO	Explain the formation of supercooled water in clouds, rain and drizzle *(Refer to 050 03 02 01)*	x
LO	Explain qualitatively the relationship between the air temperature and the amount of supercooled water	x
LO	Explain qualitatively the relationship between the type of cloud and the size and number of the droplets, in cumuliform and stratiform clouds	x
LO	Indicate in which circumstances ice can form on an aircraft on the ground: air temperature, humidity, precipitation	x
LO	Explain in which circumstances ice can form on an aircraft in flight: inside clouds, in precipitation, outside clouds and precipitation	x
LO	Describe the different factors influencing the intensity of icing: air temperature, amount of supercooled water in a cloud or in precipitation, amount of ice crystals in the air, speed of the aircraft, shape (thickness) of the airframe parts (wings, antennas, etc)	x
LO	Explain the effects of topography on icing	x
LO	Explain the higher concentration of water drops in stratiform orographic clouds	x
050 09 01 02	Types of ice accretion	
LO	Define clear ice	x
LO	Describe the conditions for the formation of clear ice	x
LO	Explain the formation of the structure of clear ice with the release of latent heat during the freezing process	x
LO	Describe the aspect of clear ice: appearance, weight, solidity	x
LO	Define rime ice	x
LO	Describe the conditions for the formation of rime ice	x
LO	Describe the aspect of rime ice: appearance, weight, solidity	x
LO	Define mixed ice	x
LO	Describe the conditions for the formation of mixed ice	x

LO	Describe the aspect of mixed ice: appearance, weight, solidity	x
LO	Describe the possible process of ice formation in snow conditions	x
LO	Define hoar frost	x
LO	Describe the conditions for the formation of hoar frost	x
LO	Describe the aspect of hoar frost: appearance, solidity	x
050 09 01 03	Hazards of ice accretion, avoidance	
LO	State the ICAO qualifying terms for the intensity of icing *(See ICAO ATM Doc 4444)*	x
LO	Describe, in general, the hazards of icing	x
LO	Assess the dangers of the different types of ice accretion	x
LO	Describe the position of the dangerous zones of icing in fronts, in stratiform and cumuliform clouds and in the different precipitation types	x
LO	Indicate the possibilities of avoidance — in the flight planning: weather briefing, choice of track and altitude — during flight: recognition of the dangereous zones, choice of appropriate track and altitude	x
050 09 02 00	**Turbulence**	
050 09 02 01	Effects on flight, avoidance	
LO	State the ICAO qualifying terms for the intensity of turbulence *(See ICAO ATM Doc 4444)*	x
LO	Describe the effects of turbulence on an aircraft in flight	x
LO	Indicate the possibilities of avoidance — in the flight planning: weather briefing, choice of track and altitude — during flight: choice of appropriate track and altitude	x
050 09 03 00	**Wind shear**	
050 09 03 01	Definition of wind shear	
LO	Define wind shear (vertical and horizontal)	x
LO	Define low level wind shear	x
050 09 03 02	Weather conditions for wind shear	
LO	Describe conditions where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief)	x
050 09 03 03	Effects on flight, avoidance	
LO	Describe the effects on flight caused by wind shear	x
LO	Indicate the possibilities of avoidance — in the flight planning — during flight	x

050 09 04 00	**Thunderstorms**	
050 09 04 01	Conditions for and process of development, forecast, location, type specification	
LO	Name the cloud types which indicate the development of thunderstorms	x
LO	Describe the different types of thunderstorms, their location, the conditions for and the process of development and list their properties (air mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms)	x
050 09 04 02	Structure of thunderstorms, life history	
LO	Describe and sketch the stages of the life history of a thunderstorm: initial, mature and dissipating stage	x
LO	Assess the average duration of thunderstorms and their different stages	x
LO	Describe supercell storm: initial, supercell, tornado and dissipating stage	x
LO	Summarise the flight hazards of a fully developed thunderstorm	x
LO	Indicate on a sketch the most dangerous zones in and around a thunderstorm	x
050 09 04 03	Electrical discharges	
LO	Describe the basic outline of the electric field in the atmosphere	x
LO	Describe the electrical potential differences in and around a thunderstorm	x
LO	Describe and asses 'St. Elmo's fire'	x
LO	Describe the development of lightning discharges	x
LO	Describe the effect of lightning strike on aircraft and flight execution	x
050 09 04 04	Development and effects of downbursts	
LO	Define the term downburst	x
LO	Distinguish between macroburst and microburst	x
LO	State the weather situations leading to the formation of downbursts	x
LO	Describe the process of development of a downburst	x
LO	Give the typical duration of a downburst	x
LO	Describe the effects of downbursts	x
050 09 04 05	Thunderstorm avoidance	
LO	Explain how the pilot can anticipate each type of thunderstorms: pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar and by airborne weather radar *(Refer to 050 10 01 04),* use of the stormscope (lightning detector)	x
LO	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms	x
050 09 05 00	**Tornadoes**	
050 09 05 01	Properties and occurrence	

LO	Define the tornado	x
050 09 06 00	**Inversions**	
050 09 06 01	Influence on aircraft performance	
LO	Explain the influence of inversions on the aircraft performance	x
LO	Compare the flight hazards during take-off and approach associated to a strong inversion alone and to a strong inversion combined with marked wind shear	x
050 09 08 00	**Hazards in mountainous areas**	
050 09 08 01	Influence of terrain on clouds and precipitation, frontal passage	
LO	Describe the influence of a mountainous terrain on cloud and precipitation	x
LO	Describe the effects of the Foehn	x
LO	Describe the influence of a mountainous area on a frontal passage	x
050 09 08 02	Vertical movements, mountain waves, wind shear, turbulence, ice accretion	
LO	Describe the vertical movements, wind shear and turbulence typical of mountain areas	x
LO	Indicate in a sketch of a chain of mountains the turbulent zones (mountain waves, rotors)	x
LO	Explain the influence of relief on ice accretion	x
050 09 08 03	Development and effect of valley inversions	
LO	Describe the formation of valley inversion due to the katabatic winds	x
LO	Describe the valley inversion formed by warm winds aloft	x
LO	Describe the effects of a valley inversion for an aircraft in flight	x
050 09 09 00	**Visibility reducing phenomena**	
050 09 09 01	Reduction of visibility caused by precipitation and obscurations	
LO	Describe the reduction of visibility caused by precipitation: drizzle, rain, snow	x
LO	Describe the reduction of visibility caused by obscurations: — fog, mist, haze, smoke, volcanic ash — sand (SA), dust (DU)	x
LO	Describe the differences between the ground visibility, flight visibility, slant visibility and vertical visibility when an aircraft is above or within a layer of haze or fog	x
050 09 09 02	Reduction of visibility caused by other phenomena	
LO	Describe the reduction of visibility caused by — low drifting and blowing snow — low drifting and blowing dust and sand — duststorm (DS) and sandstorm (SS) — icing (windshield)	x

	— the position of the sun relative to the visual direction — the reflection of sun's rays from the top of layers of haze, fog and clouds	
050 10 00 00	**METEOROLOGICAL INFORMATION**	
050 10 01 00	**Observation**	
050 10 01 01	Surface observations	
LO	Define visibility	x
LO	Describe the mereorological measurement of visibility	x
LO	Define prevailing visibility	x
LO	Define ground visibility	x
LO	List the units used for visibility (m, km)	x
LO	Define runway visual range	x
LO	Describe the meteorological measurement of runway visual range	x
LO	Indicate where the transmissometers/forward-scatter meters are placed on the airport	x
LO	List the units used for runway visual range (m)	x
LO	List the different possibilities to transmit information about runway visual range to pilots	x
LO	Compare visibility and runway visual range	x
LO	List the clouds considered in meteorological reports, and how they are indicated in METARs (TCU, CB)	x
LO	Define oktas	x
LO	Define cloud base	x
LO	Define ceiling	x
LO	Name the unit and the reference level used for information about cloud base (ft)	x
LO	Define vertical visibility	x
LO	Explain briefly how and when the vertical visibility is measured	x
LO	Name the unit used for vertical visibility (ft)	x
050 10 01 04	Weather radar observations	
LO	Interpret ground weather radar images	x
LO	Describe the basic principle and the type of information given by airborne weather radar	x
LO	Describe the limits and the errors of airborne weather radar information	x
LO	Interpret typical airborne weather radar images	x
050 10 02 00	**Weather charts**	
050 10 02 01	Significant weather charts	
LO	Decode and interpret significant weather charts (low, medium and high level)	x

LO	Describe from a significant weather chart the flight conditions at designated locations and/or along a defined flight route at a given flight level	x
050 10 02 02	Surface charts	
LO	Recognize the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high and low pressure areas	x
050 10 03 00	**Information for flight planning**	
050 10 03 01	Aviation weather messages	
LO	Describe, decode and interpret the following aviation weather messages (given in written and/or graphical format): METAR, SPECI, TREND, TAF, SIGMET, AIRMET, GAMET, special air-report, volcanic ash advisory information	x
LO	Describe the general meaning of MET REPORT and SPECIAL	x
LO	List, in general, the cases when a SIGMET and an AIRMET are issued	x
LO	Describe, decode (by using a code table) and interpret the following messages: Runway State Message (as written in a METAR), GAFOR	x
	Note: For Runway State Message and GAFOR refer to Air Navigation Plan European Region ICAO Doc 7754	
050 10 03 02	Meteorological broadcasts for aviation	
LO	Describe the meteorological content of broadcasts for aviation: — VOLMET, ATIS — HF-VOLMET	x
050 10 03 03	Use of meteorological documents	
LO	Describe meteorological briefing and advice	x
LO	List the information that a flight crew can receive from meteorological services for pre-flight planning and apply the content of these information on a designated flight route	x
LO	List the meteorological information that a flight crew can receive from services during flight and apply the content of these information for the continuation of the flight	x
050 10 03 04	Meteorological warnings	
LO	Describe and interpret aerodrome warnings and wind shear warnings and alerts	x

AMC7 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject Radio Navigation (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	**Syllabus details and associated Learning Objectives**	**CB-IR (A) and EIR**
062 00 00 00	**RADIO NAVIGATION**	
062 02 00 00	**RADIO AIDS**	
062 02 01 00	**Ground D/F**	
062 02 01 03	Coverage and range	
LO	Use the formula, 1,23 x √transmitter height in feet + 1,23 x √receiver height in feet, to calculate the range in NM	x
062 02 02 00	**NDB/ADF**	
062 02 02 01	Principles	
LO	Define the abbreviation NDB Non Directional Beacon	x
LO	Define the abbreviation ADF Automatic Direction Finder	x
LO	State that the NDB is the ground part of the system	x
LO	State that the ADF is the airborne part of the system	x
LO	State that NDB operates in the LF and MF frequency bands	x
LO	The frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is 190–1750 kHz	x
LO	Define a locator beacon. An LF/MF NDB used as an aid to final approach usually with a range, according to ICAO Annex 10, of 10–25 NM	x
LO	Explain the difference between NDBs and locator beacons	x
LO	Explain which beacons transmit signals suitable for use by an ADF	x
LO	State that certain commercial radio stations transmit within the frequency band of the NDB	x
LO	Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave	x

LO	Describe the use of NDBs for navigation	x
LO	Describe the procedure to identify an NDB station	x
LO	Interpret the term 'cone of silence' in respect of an NDB	x
LO	State that an NDB station emits a N0N/A1A or a NON/A2A signal	x
LO	State the function of the BFO (Beat Frequency Oscillator)	x
LO	State that in order to identify a NON/A1A NDB, the BFO circuit of the receiver has to be activated	x
LO	State that the NDB emitting NON/A1A gives rise to erratic indications of the bearing while the station is identifying	x
LO	Explain that on modern aircraft the BFO is activated automatically	x
062 02 02 02	Presentation and interpretation	
LO	Name the types of indicator in common use: — Electronic navigation display — Radio Magnetic Indicator RMI — Fixed card ADF (radio compass) — Moving card ADF	x
LO	Describe the indications given on RMI, fixed card and moving card ADF displays	x
LO	Given a display interpret the relevant ADF information	x
LO	Calculate the true bearing from the compass heading and relative bearing	x
LO	Convert the compass bearing into magnetic bearing and true bearing	x
LO	Describe how to fly the following in-flight ADF procedures according to Doc 8168 Vol. 1: — Homing and tracking and explain the influence of wind — Interceptions — Procedural turns — Holding patterns	x
062 02 02 03	Coverage and range	
LO	State that the power limits the range of an NDB	x
LO	State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land	x
LO	Describe the propagation path of NDB radio waves with respect to the ionosphere and the Earth's surface	x
LO	Explain that interference between sky and ground waves at night leads to 'fading'	x
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established during approach according to ICAO DOC 8168 as within ± 5°	x
LO	State that there is no warning indication of NDB failure	x

062 02 02 04	Errors and accuracy	
LO	Explain Coastal Refraction. As a radio wave travelling over land crosses the coast, the wave speeds up over water and the wave front bends	x
LO	Define Night/twilight effect. The influence of sky waves and ground waves arriving at the ADF receiver with a difference of phase and polarisation which introduce bearing errors	x
LO	State that interference from other NDB stations on the same frequency may occur at night due to sky wave contamination	x
062 02 02 05	Factors affecting range and accuracy	
LO	State that there is no coastal refraction error when: — The propagation direction of the wave is 90° to the coast line — The NDB station is sited on the coast line	x
LO	State that coastal refraction error increases with increased incidence.	x
LO	State that night effect predominates around dusk and dawn.	x
LO	Define multipath propagation of the radio wave (mountain effect).	x
LO	State that static emission energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.	x
062 02 03 00	**VOR and Doppler-VOR**	
062 02 03 01	Principles	
LO	State that the frequency band allocated to VOR according to ICAO Annex 10 is VHF and the frequencies used are 108.0–117.975 MHz.	x
LO	State that frequencies in the allocated VOR range with the first decimal place an odd number, are used by ILS	x
LO	State that the following types of VOR are in operation: — Conventional VOR (CVOR) a first generation VOR station emitting signals by means of a rotating antenna — Doppler VOR (DVOR) a second generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle — En-route VOR for use by IFR traffic — Terminal VOR (TVOR) a station with a shorter range used as part of the approach and departure structure at major airports — Test VOR (VOT) a VOR station emitting a signal to test VOR indicators in an aircraft	x
LO	Describe how ATIS information is transmitted on VOR frequencies.	x
LO	List the three main components of VOR airborne equipment:	x

	— The antenna — The receiver — The indicator	
LO	Describe the identification of a VOR in terms of Morse-code letters, continuous tone or dots (VOT), tone pitch, repetition rate and additional plain text	x
LO	State that failure of the VOR station to stay within the required limits can cause the removal of identification and navigation components from the carrier or radiation to cease	x
062 02 03 02	Presentation and interpretation	
LO	Read off the radial on a Radio Magnetic Indicator (RMI)	x
LO	Read off the angular displacement, in relation to a pre-selected radial on an HSI or CDI	x
LO	Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR considering also the heading of the aircraft	x
LO	Interpret VOR information as displayed on HSI, CDI and RMI	x
LO	Describe the following in-flight VOR procedures as in DOC 8168 Vol.1: — Tracking and explain the influence of wind when tracking — Interceptions — Procedural turns — Holding patterns	x
LO	State that when converting a radial into a true bearing, the variation at the VOR station has to be taken into account	x
062 02 03 03	Coverage and Range	
LO	Calculate the range using the formula: 1,23 x √transmitter height in feet + 1,23 x √receiver height in feet	x
062 02 03 04	Errors and accuracy	
LO	Define the accuracy the pilot has to fly the required bearing in order to be considered established on a VOR track when flying approach procedures according to ICAO Doc 8168 as within half full scale deflection of the required track	x
LO	State that due to reflections from terrain, radials can be bent and lead to wrong or fluctuating indications which is called 'scalloping'.	x
062 02 04 00	**DME**	
062 02 04 01	Principles	
LO	State that DME operates in the UHF band between 960–1215 MHz according to ICAO Annex 10	x
LO	State that the system comprises two basic components:	x

	— The aircraft component, the interrogator — The ground component, the transponder	
LO	State that the distance measured by DME is slant range	x
LO	Illustrate that a position line using DME is a circle with the station at its centre	x
LO	Describe how the pairing of VHF and UHF frequencies (VOR/DME) enables selection of two items of navigation information from one frequency setting	x
LO	Describe, in the case of co-location, the frequency pairing and identification procedure	x
LO	Explain that depending on the configuration, the combination of a DME distance with a VOR radial can determine the position of the aircraft	x
LO	Explain that military TACAN stations may be used for DME information	x
062 02 04 02	Presentation and interpretation	
LO	Explain that when identifying a DME station co-located with a VOR station, the identification signal with the higher tone frequency is the DME which idents approximately every 40 seconds	x
LO	Calculate ground distance given slant range and altitude	x
LO	Describe the use of DME to fly a DME arc in accordance with DOC 8168 Vol. 1	x
LO	State that a DME system may have a groundspeed read out combined with the DME read out	x
062 02 04 03	Coverage and Range	
LO	Explain why a ground station can generally respond to a maximum of 100 aircraft.	x
LO	Explain which aircraft will be denied a DME range first when more than 100 interrogations are being made	x
062 02 04 05	Factors affecting range and accuracy	
LO	State that the groundspeed read out combined with DME is only correct when tracking directly to or from the DME station	x
LO	State that, close to the station, the groundspeed read out combined with DME is less than the actual groundspeed	x
062 02 05 00	**ILS**	
062 02 05 01	Principles	
LO	Name the three main components of an ILS: — The localiser (LLZ) — The glide path (GP) — Range information (markers or DME)	x
LO	State the site locations of the ILS components: — The localiser antenna should be located on the extension of the runway centre line at the stop-end	x

	— The glide path antenna should be located 300 metres beyond the runway threshold, laterally displaced approximately 120 metres to the side of the runway centre line	
LO	Explain that marker beacons produce radiation patterns to indicate predetermined distances from the threshold along the ILS glide path	x
LO	Explain that marker beacons are sometimes replaced by a DME paired with the LLZ frequency	x
LO	State that in the ILS frequency assigned band 108,0–111,975 MHz, only frequencies with the first decimal odd are ILS frequencies	x
LO	State that the LLZ operates in the VHF band 108,0–111,975 MHz according to ICAO Annex 10	x
LO	State that the GP operates in the UHF band	x
LO	State that both the LLZ and the GP antenna radiate side lobes (false beams) which could give rise to false centreline and false glide path indication	x
LO	Explain that the back beam from the LLZ antenna may be used as a published 'non-precision approach'	x
LO	State that according to ICAO Annex 10 the nominal glide path is 3°	x
LO	State that according to ICAO DOC 8168, the final approach area contains a fix or facility that permits verification of the ILS glide path/altimeter relationship. The outer marker or DME is usually used for this purpose.	x
062 02 05 02	Presentation and interpretation	
LO	Describe the ILS identification regarding frequency and Morse code and/or plain text	x
LO	Calculate the rate of descent for a 3° glide path angle given the groundspeed of the aircraft using the formula: Rate of descent (ROD) in ft/min = groundspeed in kt x 10 2	x
LO	Calculate the rate of descent using the following formula when flying any glide path angle: ROD ft/min = *Speed factor (SF)* x glide path angle x 100	x
LO	Interpret the markers by sound, modulation, and frequency	x
LO	State that the outer marker cockpit indicator is coloured blue, the middle marker amber and the inner marker white	x
LO	State that a failure of either the LLZ or the GP to stay within predetermined limits will cause: — Removal of identification and navigation components from the carrier — Radiation to cease — A warning to be displayed at the designated control point	x
LO	State that an ILS receiver has an automatic monitoring function	x
LO	Interpret the indications on a Course Deviation Indicator (CDI) and a Horizontal Situation Indicator (HSI):	x

	— Full scale deflection of the CDI needle corresponds to approximately 2,5° displacement from the ILS centre line — Full scale deflection on the GP corresponds to approximately 0,7° from the ILS GP centre line	
LO	Interpret the aircraft's position in relation to the extended runway centre line on a back-beam approach	x
LO	Explain the setting of the course pointer of an HSI for front-beam and back-beam approaches	x
062 02 05 03	Coverage and Range	
LO	Sketch the standard coverage area of the LLZ and GP with angular sector limits in degrees and distance limits from the transmitter in accordance with ICAO Annex 10: — LLZ coverage area is 10° on either side of the centre line to a distance of 25 NM from the runway, and 35° on either side of the centre line to a distance of 17 NM from the runway — GP coverage area is 8° on either side of the centre line to a distance of minimum 10 NM from the runway	x
062 02 05 04	Errors and accuracy	
LO	Explain that ILS approaches are divided into facility performance categories defined in ICAO Annex 10	x
LO	Explain the following in accordance with ICAO DOC 8168: — The accuracy the pilot has to fly the ILS localiser to be considered established on an ILS track is within half full scale deflection of the required track — The aircraft has to be established within half scale deflection of the LLZ before starting descent on the GP — The pilot has to fly the ILS GP to a maximum of half scale fly-up deflection of the GP in order to stay in protected airspace	x
LO	State that if a pilot deviates by more than half scale deflection on the LLZ or by more than half course fly-up deflection on the GP, an immediate missed approach should be executed, because obstacle clearance may no longer be guaranteed	x
062 03 00 00	**RADAR**	
062 03 01 00	**Pulse techniques and associated terms**	
LO	Name the different applications of radar with respect to ATC, MET observations and airborne weather radar	x
LO	Describe the pulse technique and echo principle on which primary radar systems are based.	x
LO	Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display: — Atmospheric conditions; super refraction and sub refraction — Attenuation with distance	x

	— Condition and size of the reflecting surface	
062 03 02 00	**Ground Radar**	
062 03 02 01	Principles	
LO	Explain that primary radar provides bearing and distance of targets.	x
LO	Explain that primary ground radar is used to detect aircraft that are not equipped with a secondary radar transponder.	x
LO	Explain why Moving Target Indicator (MTI) is used	x
062 03 02 02	Presentation and interpretation	
LO	State that modern ATC systems use computer generated display.	x
LO	Explain that the radar display enables the ATS controller to provide information, surveillance or guidance service.	x
062 03 03 00	**Airborne Weather Radar**	
062 03 03 01	Principles	
LO	List the two main tasks of the weather radar in respect of weather and navigation	x
LO	Explain how the antenna is attitude-stabilised in relation to the horizontal plane using the aircraft's attitude reference system	x
LO	Describe the cone shaped pencil beam of about 3° to 5° beam width used for weather depiction	x
LO	Explain that in modern AWRs a single radiation pattern is used for both mapping and weather with the scanning angle being changed between them	x
062 03 03 02	Presentation and interpretation	
LO	Explain the functions of the following different modes on the radar control panel — Off/on switch — Function switch, with modes WX, WX+T and MAP. — Gain control setting (auto/manual) — Tilt/auto tilt switch.	x
LO	Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red and magenta) indicating the increasing intensity of precipitation	x
LO	Illustrate the use of azimuth marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm or to a landmark on the screen	x
062 03 03 03	Coverage and Range	
LO	Explain how the radar is used for weather detection and for mapping (range, tilt and gain if available)	x
062 03 03 04	Errors, accuracy, limitations	
LO	Explain why AWR should be used with extreme caution when on the ground	x

062 03 03 05	Factors affecting range and accuracy	
LO	Explain the danger of the area behind heavy rain (shadow area) where no radar waves will penetrate	x
LO	Explain why the tilt setting should be higher when the aircraft descends to a lower altitude	x
LO	Explain why the tilt setting should be lower when the aircraft climbs to a higher altitude	x
LO	Explain why a thunderstorm may not be detected when the tilt is set too high	x
062 03 03 06	Application for navigation	
LO	Describe the navigation function of the radar in the mapping mode	x
LO	Describe the use of the weather radar to avoid a thunderstorm (Cb)	x
LO	Explain how turbulence (not CAT) can be detected by a modern weather radar	x
LO	Explain how wind shear can be detected by a modern weather radar	x
062 03 04 00	**Secondary Surveillance Radar and transponder**	
062 03 04 01	Principles	
LO	Explain that the Air Traffic Control (ATC) system is based on the replies provided by the airborne transponders in response to interrogations from the ATC secondary radar	x
LO	Explain that the ground ATC secondary radar uses techniques which provide the ATC with information that cannot be acquired by primary radar	x
LO	Explain that an airborne transponder provides coded reply signals in response to interrogation signals from the ground secondary radar and from aircraft equipped with TCAS.	x
LO	Explain the advantages of SSR over a primary radar	x
062 03 04 02	Modes and codes	
LO	Explain that the interrogator transmits its interrogations in the form of a series of pulses.	x
LO	Name and explain the Interrogation modes: 1. Mode A and C 2. Intermode: Mode A/C/S all call Mode A/C only all call 3. Mode S: Mode S only all call Broadcast (no reply elicited) Selective	x

LO	State that Mode A designation is a sequence of four digits can be manually selected from 4096 available codes.	x
LO	State that in mode C reply the pressure altitude is reported in 100 ft increments.	x
LO	State that in addition to the information pulses provided, a special position identification pulse (SPI) can be transmitted but only as a result of a manual selection (IDENT)	x
LO	Explain the need for compatibility of Mode S with Mode A and C	x
LO	Explain that the Mode S transponders receive interrogations from other Mode S transponders and SSR ground stations	x
LO	State that Mode S surveillance protocols implicitly use the principle of selective addressing	x
LO	Explain that every aircraft will have been allocated an ICAO Aircraft Address which is hard coded into the airframe (Mode S address)	x
LO	Interpret the following mode S terms: — Selective addressing — Mode 'all call' — Selective call	x
LO	State that Mode S interrogation contains either: — Aircraft address — All-call address — Broadcast address	x
LO	State that the Aircraft Address shall be transmitted in any reply except in Mode S only all-call reply	x
062 03 04 03	Presentation and interpretation	
LO	Explain how an aircraft can be identified by a unique code	x
LO	Illustrate how the following information is presented on the radar screen: — Pressure altitude — Flight level — Flight number or aircraft registration — Ground speed	x
LO	Name and interpret the codes 7700, 7600 and 7500	x
LO	Interpret the selector modes: OFF, Standby, ON (mode A), ALT (mode A and C) and TEST	x
LO	Explain the function of the emission of a SPI (Special Position Identification) pulse after pushing the IDENT button in the aircraft	x
ELEMENTARY SURVEILLANCE		

LO	Explain that the elementary surveillance provides the ATC controller with aircraft position, altitude and identification	x
LO	State that the elementary surveillance needs MODE S transponders with surveillance identifier (SI) code capacity and the automatic reporting of aircraft identification, known as ICAO level 2s	x
LO	State that the SI code must correspond to the aircraft identification specified in item 7 of the ICAO flight plan or to the registration marking	x
062 03 04 04	Errors and Accuracy	
LO	Explain the following disadvantages of SSR (mode A/C): — Code garbling of aircraft less than 1.7 NM apart measured in the vertical plane perpendicular to and from the antenna — 'Fruiting' which results from reception of replies caused by interrogations from other radar stations	x
062 05 00 00	**AREA NAVIGATION SYSTEMS, RNAV/FMS**	

		Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/IR	ATPL	CPL	
'062 07 00 00	**PBN**						
062 07 01 00	PBN concept (as described in ICAO Doc 9613)						
062 07 01 01	PBN principles						
LO	List the factors used to define RNAV or RNP system performance requirements (accuracy, integrity, continuity and functionality).	x		x			x
LO	Explain the concept of continuity.	x		x			x
LO	Explain the concept of integrity.	x		x			x
LO	State that, unlike conventional navigation, performance-based navigation is not sensor-specific.	x		x			x
LO	Explain the difference between raw data and computed data.						
062 07 01 02	PBN components						

LO	List the components of PBN as NAVAID infrastructure, navigation specification and navigation application.	x		x			x
LO	Identify the components from an example.	x		x			x
062 07 01 03	PBN scope						
LO	State that in oceanic/remote, en route and terminal phases of flight PBN is limited to operations with linear lateral performance requirements and time constraints.	x		x			x
LO	State that in the approach phases of flight PBN accommodates both linear and angular laterally guided operations.	x		x			x
062 07 02 00	Navigation specifications						
062 07 02 01	RNAV and RNP						
LO	State the difference between RNAV and RNP in terms of the requirement for on-board performance monitoring and alerting.	x		x			x
062 07 02 02	Navigation functional requirements						
LO	List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, g/s or time to active waypoint, navigation data storage and failure indication).	x		x			x
062 07 02 03	Designation of RNP and RNAV specifications						
LO	Interpret “X” in RNAV X or RNP X as the lateral navigation accuracy (total system error) in nautical miles, which is expected to be achieved at least 95 per cent of the flight time by the population of aircraft operating within the airspace, route or procedure.	x		x			x

LO	State that aircraft approved to the more stringent accuracy requirements may not necessarily meet some of the functional requirements of the navigation specification having a less stringent accuracy requirement.	x		x			x
LO	State that RNAV10 and RNP4 are used in the oceanic/remote phase of flight.	x		x			x
LO	State that RNAV5 is used in the en route and arrival phase of flight.	x		x			x
LO	State that RNAV2 and RNP2 are also used as navigation specifications.	x		x			x
LO	State that RNP2 is used in the en route and oceanic/remote phases of flight.	x		x			x
LO	State that RNAV1 and RNP1 are used in the arrival and departure phases of flight.	x		x			x
LO	State that RNP APCH is used in the approach phase of flight.	x		x			x
LO	State that RNP AR APCH is used in the approach phase of flight.	x		x			x
LO	State that RNP 0.3 navigation specification is used in all phases of flight, except for oceanic/remote and final approach, primarily for helicopters.	x		x			x
062 07 03 00	Use of PBN						
062 07 03 01	Airspace planning						

LO	State that navigation performance is one factor used to determine minimum route spacing.	x		x			x
062 07 03 02	Approval						
LO	State that the airworthiness approval process assures that each item of the area navigation equipment installed is of a type and design appropriate to its intended function and that the installation functions properly under foreseeable operating conditions.	x		x			x
LO	State that some PBN specifications require operational approval.	x		x			x
062 07 03 03	Specific RNAV and RNP system functions						
LO	Recognise the definition of an RF leg.	x		x			x
LO	Recognise the definition of a fixed radius transition.	x		x			x
LO	Recognise the definition of a fly-by-turn and a fly-over.	x		x			x
LO	Recognise the definition of a holding pattern.	x		x			x
LO	Recognise the definition of an “ARINC 424 path terminator”.	x		x			x
LO	Recognise the definition of the following path terminators: IF, TF, CF, DF, FA, CA.	x		x			x
LO	Recognise the definition of an offset flight path.	x		x			x
062 07 03 04	Data processes						
LO	State that the safety of the application is contingent upon the accuracy, resolution and integrity of the data.	x		x			x

LO	State that the accuracy of the data depends upon the processes applied during data origination.	x		x			x
062 07 04 00	PBN operations						
062 07 04 01	PBN principles						
LO	Recognise the definition of path definition error.	x		x			x
LO	Recognise the definition of flight technical error.	x		x			x
LO	Recognise the definition of navigation system error.	x		x			x
LO	Recognise the definition of total system error.	x		x			x
062 07 04 02	On-board performance monitoring and alerting						
LO	State that on-board performance monitoring and alerting of flight technical error is managed by on-board systems or crew procedures.	x		x			x
LO	State that on-board performance monitoring and alerting of navigation system error is a requirement of on-board equipment for RNP.	x		x			x
LO	State that on-board performance monitoring and alerting of path definition error are managed by gross reasonableness checks of navigation data.	x		x			x
062 07 04 03	Abnormal situations						
LO	State that abnormal and contingency procedures are to be used in case of loss of the PBN capability.	x		x			x
062 07 04 04	Database management						
LO	State that, unless otherwise specified in operations documentation or AMC, the navigational database must be valid for the current AIRAC cycle.	x		x			x
062 07 05 00	Requirements of specific RNAV and RNP specifications						

062 07 05 01	RNAV10						
LO	State that RNAV10 requires that aircraft operating in oceanic and remote areas be equipped with at least two independent and serviceable LRNSs comprising an INS, an IRS FMS or a GNSS.	x		x			x
LO	State that aircraft incorporating dual inertial navigation systems (INS) or inertial reference units (IRU) have a standard time limitation.	x		x			x
LO	State that operators may extend their RNAV10 navigation capability time by updating.	x		x			x
062 07 05 02	RNAV5						
LO	State that manual data entry is acceptable for RNAV5.	x		x			x
062 07 05 03	RNAV/RNP1/2						
LO	State that pilots must not fly an RNAV/RNP1/2 SID or STAR unless it is retrievable by route name from the on-board navigation database and conforms to the charted route.	x		x			x
LO	State that the route may subsequently be modified through the insertion (from the database) or deletion of specific waypoints in response to ATC clearances.	x		x			x
LO	State that the manual entry, or creation of new waypoints by manual entry, of latitude and longitude or place/bearing/ distance values is not permitted.	x		x			x
062 07 05 04	RNP4						
LO	State that at least two LRNSs, capable of navigating to RNP4 and listed in the flight manual, must be operational at the entry point of the RNP airspace.	x		x			x

062 07 05 05	RNP APCH						
LO	State that pilots must not fly an RNP APCH unless it is retrievable by procedure name from the on-board navigation database and conforms to the charted procedure.	x		x			x
LO	State that an RNP APCH to LNAV minima is a non-precision instrument approach procedure designed for 2D approach operations.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima has lateral guidance based on GNSS and vertical guidance based on either SBAS or BaroVNAV.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima may only be conducted with vertical guidance certified for the purpose.	x		x			x
LO	Explain why an RNP APCH to LNAV/VNAV minima based on BaroVNAV may only be conducted when the aerodrome temperature is within a promulgated range.	x		x			x
LO	State that the correct altimeter setting is critical for the safe conduct of an RNP APCH using BaroVNAV.	x		x			x
LO	State that an RNP APCH to LNAV/VNAV minima is a 3D operation.	x		x			x
LO	State that an RNP APCH to LPV minima is a 3D operation.	x		x			x
LO	State that RNP APCH to LPV minima requires an FAS data-block.	x		x			x
062 07 05 06	RNP AR APCH						
LO	State that RNP AR APCH requires authorisation.	x		x			x
062 07 05 07	A-RNP						

LO	State that Advanced RNP incorporates the navigation specifications RNAV5, RNAV2, RNAV1, RNP2, RNP1 and RNP APCH.	x		x			x
LO	State that Advanced RNP may be associated with other functional elements.	x		x			x
062 07 05 08	PBN Point in Space (PinS) departure						
LO	State that a PinS departure is a departure procedure designed for helicopters only.			x			x
LO	State that a PinS departure procedure includes either a “proceed VFR” or a “proceed visually” instruction from landing location to IDF.			x			x
LO	Recognise the differences between “proceed VFR” and “proceed visually” instruction.			x			x
062 07 05 09	PBN Point in Space (PinS) approach						
LO	State that a PinS approach is an instrument RNP APCH procedure designed for helicopters only, and that may be published with LNAV minima or LPV minima.			x			x
LO	State that a PinS approach procedure includes either a “proceed VFR” or a “proceed visually” instruction from the MAPt to a landing location.			x			x
LO	Recognise the differences between “proceed VFR” and “proceed visually” instruction.			x			x

062 05 04 00	**FMS and general terms**	
062 05 04 03	Navigation data base	
LO	State that the navigation database of the FMC may contain the following data: — Reference data for airports (four letter ICAO identifier) — VOR/DME station data (three letter ICAO identifier) — Waypoint data (five letter ICAO identifier) — STAR data — SID data	x

	— Holding patterns — Airport runway data — NDB stations (alphabetic ICAO identifier) — Company flight plan routes	
LO	State that the navigation database is updated every 28 days.	x
LO	State that the navigational database is write protected, but additional space exists so that crew created navigational data may be saved in the computer memory. Such additional data will also be deleted at the 28 days navigational update of the database.	x
062 05 04 06	Determination of the FMS-position of the aircraft	
LO	State that modern FMS may use a range of sensors for calculating the position of the aircraft including VOR, DME, GPS, IRS and ILS.	x
062 06 00 00	**GLOBAL NAVIGATION SATELLITE SYSTEMS**	
062 06 01 00	**GPS/GLONASS/GALILEO**	
062 06 01 01	Principles	
LO	State that there are two main Global Navigation Satellite Systems (GNSS) currently in existence with a third which is planned to be fully operational by 2011. They are: — USA NAVSTAR GPS (NAVigation System with Timing And Ranging Global Positioning System — Russian GLONASS (GLObal NAvigation Satellite System) — European GALILEO	x
LO	State that all 3 systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position	x
062 06 01 02	Operation	
NAVSTAR GPS		
LO	State that there are currently two modes of operation, SPS (Standard Positioning Service) for civilian users, and PPS (Precise Positioning Service for authorised users	x
LO	SPS was originally designed to provide civil users with a less accurate positioning capability than PPS	x
LO	Name the three segments as: — Space segment — Control segment — User segment	x
Space segment		
LO	State that the space segment consists of a notional constellation of 24 operational satellites	x

LO	State that it takes 12½ minutes for a GPS receiver to receive all the data frames in the navigation message	x
LO	State that the almanac contains the orbital data about all the satellites in the GPS constellation	x
LO	State that the ephemeris contains data used to correct the orbital data of the satellites due to small disturbances	x
LO	State that the clock correction parameters are data for correction of the satellite time	x
LO	State that UTC parameters are factors determining the difference between GPS time and UTC	x
LO	State that an ionospheric model is currently used to calculate the time delay of the signal travelling through the ionosphere.	x

LO	State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data	x
LO	State that GPS uses the WGS 84 model	x
LO	State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference	x
Control Segment		
LO	State that the control segment comprises: — A master control station — Ground antenna — Monitoring stations	x
User Segment		
LO	State that GPS supplies three-dimensional position fixes and speed data, plus a precise time reference	x
LO	State that the GPS receiver used in aviation is a multi-channel type	x
LO	State that a GPS receiver is able to determine the distance to a satellite, by determining the difference between the time of transmission by satellite and the time of reception	x
LO	State that the initial distance calculated to the satellites is called pseudo range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range	x
LO	State that each range defines a sphere with its centre at the satellite	x
LO	State that three satellites are needed to determine a two-dimensional position	x
LO	State that four spheres are needed to calculate a three dimensional position, hence four satellites are required	x
LO	State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites	x

NAVSTAR GPS Integrity		
LO	Define RAIM (Receiver Autonomous Integrity Monitoring). A technique whereby a receiver processor determines the integrity of the navigation signals	x
LO	State that RAIM is achieved by consistency check among pseudo range measurements	x
LO	State that basic RAIM requires 5 satellites. A 6th is for isolating a faulty satellite from the navigation solution	x
LO	State that when a GPS receiver uses barometric altitude as an augmentation to RAIM, the number of satellites needed for the receiver to perform the RAIM function may be reduced by one	x
062 06 01 03	Errors and Factors affecting accuracy	
LO	List the most significant factors affecting accuracy: — Ionospheric propagation delay — Dilution of position — Satellite clock error — Satellite orbital variations — Multipath	x
062 06 02 00	**Ground, Satellite and Airborne based augmentation systems**	
Satellite Based Augmentation Systems (SBAS)		
LO	Explain the principle of a SBAS : to measure on the ground the signal errors transmitted by GNSS satellites and transmit differential corrections and integrity messages for navigation satellites	x
LO	State that the frequency band of the data link is identical to that of the GPS signals**.**	x
LO	Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas	x
LO	Explain that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites	x
LO	Stat that SBAS consists of 3 elements : — The ground infrastructure (monitoring and processing stations), — The SBAS satellites, — The SBAS airborne receivers.	x
LO	Explain that SBAS can provide approach and landing operations with Vertical guidance (APV) and precision approach service .	x
LO	Explain the difference between Coverage area and Service area	x

LO	State that Satellite Based Augmentation Systems include: — EGNOS in Western Europe and the Mediterranean — WAAS in USA — MSAS in Japan — GAGAN in India	x
EGNOS		
LO	State that (EGNOS) European Geostationary Navigation Overlay Service consists of 3 geostationary Inmarsat satellites which broadcast GPS look-alike signals	x
LO	State that EGNOS is designed to improve accuracy to 1–2 m horizontally and 3–5 m vertically	x
LO	Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hrs GPS alone)	x
Airborne Based Augmentation Systems (ABAS)		
LO	Explain the principle of ABAS: to use redundant elements within the GPS constellation (e.g. : multiplicity of distance measurements to various satellites) or the combination of GNSS measurements with those of other navigation sensors (such as inertial systems), to develop integrity control	x

LO	State that the type of ABAS using only GNSS information is RAIM (Receiver Autonomous Integrity Monitoring)	x
LO	State that a system using information from additional on-board sensors is named AAIM (Aircraft Autonomous Integrity Monitoring)	x
LO	Explain that the typical sensors used are barometric altimeter , clock and inertial navigation system	x
LO	Explain that unlike GBAS and SBAS , ABAS does not improve positioning accuracy	x

AMC8 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES

Subject IFR Communications (Competency-based modular training course (CB-IR(A)) for instrument rating according to Appendix 6 Aa and en route instrument rating (EIR) course according to FCL.825)

Syllabus reference	Syllabus details and associated Learning Objectives	CB-IR(A) and EIR
092 00 00 00	**IFR COMMUNICATIONS**	
092 01 00 00	**DEFINITIONS**	
092 01 01 00	**Meanings and significance of associated terms**	
LO	As for VFR plus terms used in conjunction with approach and holding procedures	x
092 01 02 00	**Air Traffic Control abbreviations**	
LO	As for VFR plus additional IFR related terms	x
092 01 03 00	**Q-code groups commonly used in RTF air-ground communications**	
LO	Define Q-code groups commonly used in RTF air to ground communications: — Pressure settings — Directions and bearings	x
LO	State the procedure for obtaining a bearing information in flight	x
092 01 04 00	**Categories of messages**	
LO	List the categories of messages in order of priority	x
LO	Identify the types of messages appropriate to each category	x
LO	List the priority of a message (given examples of messages to compare)	x
092 02 00 00	**GENERAL OPERATING PROCEDURES**	
092 02 01 00	**Transmission of letters**	
LO	State the phonetic alphabet used in radiotelephony	x
LO	Identify the occasions when words should be spelt	x
092 02 02 00	**Transmission of numbers (including level information)**	
LO	Describe the method of transmitting numbers	x

	— Pronunciation — Single digits, whole hundreds and whole thousands	
092 02 03 00	**Transmission of time**	
LO	Describe the ways of transmitting time — Standard time reference (UTC) — Minutes, minutes and hours, when required	x
092 02 04 00	**Transmission technique**	
LO	Explain the techniques used for making good R/T transmissions	x
092 02 05 00	**Standard words and phrases (relevant RTF phraseology included)**	
LO	Define the meaning of standard words and phrases	x
LO	Use correct standard phraseology for each phase of IFR flight — Pushback — IFR depature — Airways clearances — Position reporting — Approach procedures — IFR arrivals	x
092 02 06 00	**Radiotelephony call signs for aeronautical stations including use of abbreviated call signs**	
LO	As for VFR	x
LO	Name the two parts of the call sign of an aeronautical station	x
LO	Identify the call sign suffixes for aeronautical stations	x
LO	Explain when the call sign may be abbreviated to the use of suffix only	x
092 02 07 00	**Radiotelephony call signs for aircraft including use of abbreviated call signs**	
LO	As for VFR	x
LO	Explain when the suffix 'HEAVY' should be used with an aircraft call sign	x
LO	Explain the use of the phrase 'Change your call sign to …'	x
LO	Explain the use of of the phrase 'Revert to flight plan call sign'	x
092 02 08 00	**Transfer of communication**	
LO	Describe the procedure for transfer of communication — By ground station — By aircraft	x
092 02 09 00	**Test procedures including readability scale; establishment of RTF communication**	
LO	Explain how to test radio transmission and reception	x

LO	State the readability scale and explain its meaning	x
092 02 10 00	**Read back and acknowledgement requirements**	
LO	State the requirement to read back ATC route clearances	x
LO	State the requirement to read back clearances related to runway in use	x
LO	State the requirement to read back other clearances including conditional clearances	x
LO	State the requirement to read back data such as runway, SSR codes etc	x
092 02 11 00	**Radar procedural phraseology**	
LO	Use the correct phraseology for an aircraft receiving a radar service — Radar identification — Radar vectoring — Traffic information and avoidance — SSR procedures	x
092 02 12 00	**Level changes and reports**	
LO	Use the correct term to describe vertical position In relation to flight level (standard pressure setting) — In relation to Altitude (metres/feet on QNH) — In relation to Height (metres/feet on QFE)	x
092 03 00 00	**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**	
LO	Describe the action to be taken in communication failure on a IFR flight	x
LO	Describe the action to be taken in case of communication failure on a IFR flight when flying in VMC and the flight will be terminated in VMC	x
LO	Describe the action to be taken in case of communication failure on a IFR flight when flying in IMC	x
092 04 00 00	**DISTRESS AND URGENCY PROCEDURES**	
092 04 01 00	**PAN medical**	
LO	Describe the type of flights to which PAN MEDICAL applies	x
LO	List the content of a PAN MEDICAL message in correct sequence	x
092 04 02 00	**Distress (definition — frequencies — watch of distress frequencies — distress signal — distress message)**	
LO	State the DISTRESS procedures	x
LO	Define DISTRESS	x
LO	Identify the frequencies that should be used by aircraft in DISTRESS	x
LO	Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes	x
LO	Describe the action to be taken by the station which receives a DISTRESS message	x

LO	Describe the action to be taken by all other stations when a DISTRESS procedure is in progress	x
LO	List the content of a DISTRESS message	x
092 04 03 00	**Urgency (definition — frequencies — urgency signal — urgency message)**	
LO	State the URGENCY procedures	x
LO	Define URGENCY	x
LO	Identify the frequencies that should be used by aircraft in URGENCY	x
LO	Describe the action to be taken by the station which receives an URGENCY message	x
LO	List the content of an URGENCY signal/message in the correct sequence	x
092 05 00 00	**RELEVANT WEATHER INFORMATION TERMS (IFR)**	
092 05 01 00	**Aerodrome weather**	
LO	As for VFR plus the following	x
LO	Runway visual range	x
LO	Braking action (friction coefficient)	x
092 05 02 00	**Weather broadcast**	
LO	As for VFR plus the following	x
LO	Explain when aircraft routine meteorological observations should be made	x
LO	Explain when aircraft Special meteorological observations should be made	x
092 06 00 00	**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**	
LO	Describe the radio frequency spectrum with particular reference to VHF	x
LO	State the names of the bands into which the radio frequency spectrum is divided	x
LO	Identify the frequency range of the VHF band	x
LO	Name the band normally used for Aeronautical Mobile Service voice communications	x
LO	State the frequency separation allocated between consecutive VHF frequencies	x
LO	Describe the propagation characteristics of radio transmissions in the VHF band	x
LO	Describe the factors which reduce the effective range and quality of radio transmissions	x
LO	State which of these factors apply to the VHF band	x
LO	Calculate the effective range of VHF transmissions assuming no attenuating factors	x
092 07 00 00	**MORSE CODE**	
LO	Identify radio navigation aids (VOR, DME, NDB, ILS) from their Morse code identifiers	x
LO	SELCAL, TCAS, ACARS phraseology and procedures	x

GM1 FCL.615(b) IR – Theoretical knowledge and flight instruction

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES FOR THE EIR AND CB-IR(A)

The detailed theoretical knowledge syllabus is combined with the Learning Objectives (LOs).
The LOs refer to measurable statements of the skills and/or knowledge that a student should be able to demonstrate following a defined element of training.
The LOs define the theoretical knowledge that a student should have assimilated on successful completion of an approved theoretical knowledge course and/or prior to undertaking the theoretical knowledge examinations.
The LOs are intended to be used by the training industry when developing Part-FCL theoretical knowledge courses. It should be noted, however, that the LOs do not provide a ready-made ground training syllabus for individual approved training organisations, and should not be seen by organisations as a substitute for thorough course-design.
For the preparation of theoretical knowledge courses for the issue of instrument ratings, the following information should be taken into account:
(a) Subject Air Law

(1) Subject Air Law is primarily based on ICAO documentation but will also refer to the future European operational rules and the requirements dealing with pilot licensing.
(2) National Law should not be taken into account but remains relevant during practical training and operational flying.
(3) Abbreviations used are ICAO abbreviations listed in ICAO Doc 8400, Abbreviations and Codes.
(4) Where an LO refers to a definition e.g. 'Define the following terms' or 'Define and understand' or 'Explain the definitions in …', candidates are also expected to be able to recognise a given definition.

(b) Subject Flight Planning and Flight Monitoring

(1) To fully appreciate and understand the subject Flight Planning and Flight Monitoring, the applicant will benefit from background knowledge in subjects Air Law, Aircraft General Knowledge, Mass & Balance, Performance, Meteorology, Navigation, Operational Procedures and Principles of Flight.
(2) The reference to the relevant requirements of the Regulation on Air Operations is specifically mentioned in the LOs and should be used for reference as required.
(3) The Jeppesen Student Pilots' Training Route Manual (SPTRM), otherwise known as the Training Route Manual (TRM), contains planning data plus Aerodrome and Approach charts that may be used in theoretical knowledge training courses.

SUBPART H — CLASS AND TYPE RATINGS

GM1 FCL.700 Circumstances in which class or type ratings are required

LIST OF CLASS OR TYPE RATINGS

The following tables contain lists of aeroplanes or TMG that are included in class ratings.

(a) Class ratings (aeroplane): SP and SEP or MEP aeroplane (land or sea):

Manufacturer	Aeroplanes		Licence Endorsement
All manufacturers	SEP (land)	(D)	SEP (land)
	SEP (land) with variable pitch propellers		
	SEP (land) with retractable undercarriage		
	SEP (land) with turbo or super charged engines		
	SEP (land) with cabin pressurisation		
	SEP (land) with tail wheels		
	SEP (land) with EFIS		
	SEP (land) with SLPC		
	SEP (sea)	(D)	SEP (sea)
	SEP (sea) with variable pitch propellers		
	SEP (sea) with turbo or super charged engines		
	SEP (sea) with cabin pressurisation		
	SEP (sea) with EFIS		
	SEP (sea) with SLPC		
All manufacturers	MEP (land)	(D)	MEP (land)
	MEP (sea)	(D)	MEP (sea)

(b) Class ratings (aeroplane): SP and SEP TMG (land):

Manufacturer	Aeroplanes		Licence Endorsement
All manufacturers	All TMGs having an integrally mounted, non-retractable engine and a non-retractable propeller		**TMG**

(c) Additional class and type rating lists and endorsement lists are published by the Agency.

(d) Whenever (D) is indicated in one of the lists mentioned in paragraphs (a) to (c), it indicates that differences training in accordance with FCL.710 is required.

GM1 FCL.710 Class and type ratings — variants. Differences and familiarisation training

(a) Differences training requires the acquisition of additional knowledge and training on an appropriate training device or the aircraft.

(b) Familiarisation training requires the acquisition of additional knowledge.

AMC1 FCL.725(a) Requirements for the issue of class and type ratings

SYLLABUS OF THEORETICAL KNOWLEDGE FOR CLASS OR TYPE RATINGS

I. SE AND ME AEROPLANES

(a) Detailed listing for aeroplane structure and equipment, normal operation of systems and malfunctions:

(1) dimensions: minimum required runway width for 180 ° turn.

(2) engine including auxiliary power unit:

(i) type of engine or engines;

(ii) in general, function of the following systems or components:

(A) engine;

(B) auxiliary power unit;

(C) oil system;

(D) fuel system;

(E) ignition system;

(F) starting system;

(G) fire warning and extinguishing system;

(H) generators and generator drives;

(I) power indication;

(J) reverse thrust;

(K) water injection.

(iii) on piston or turbine-propeller engines additionally:

(A) propeller system;

(B) feathering system.

(iv) engine controls (including starter), engine instruments and indications in the cockpit, their function, interrelation and interpretation;

(v) engine operation, including APU, during engine start, start and engine malfunctions, procedures for normal operation in the correct sequence.

(3) fuel system:

(i) location of the fuel tanks, fuel pumps, fuel lines to the engines, tank capacities, valves and measuring;

(ii) location of the following systems:

(A) filtering;

(B) heating;

(C) fuelling and defueling;

(D) dumping;

(E) venting.

(iii) in the cockpit:

(A) the monitors and indicators of the fuel system;

(B) quantity and flow indication, interpretation.

(iv) procedures:

(A) fuel procedures distribution into the various tanks;

(B) fuel supply, temperature control and fuel dumping.

(4) pressurisation and air conditioning:

(i) components of the system and protection devices;

(ii) cockpit monitors and indicators;

(iii) interpretation about the operational condition;

(iv) normal operation of the system during start, cruise, approach and landing, air conditioning airflow and temperature control.

(5) ice and rain protection, windshield wipers and rain repellent:

(i) ice protected components of the aeroplane including engines, heat sources, controls and indications;

(ii) operation of the anti-icing or de-icing system during take-off, climb, cruise and descent, conditions requiring the use of the protection systems;

(iii) controls and indications of the windshield wipers and rain repellent systems operation.

(6) hydraulic system:

(i) components of the hydraulic system(s), quantities and system pressure, hydraulically actuated components associated to the respective hydraulic system;

(ii) controls, monitors and indicators in the cockpit, function and interrelation and interpretation of indications.

(7) landing gear:

(i) main components of the:

(A) main landing gear;

(B) nose gear;

(C) gear steering;

(D) wheel brake system, including anti-skid.

(ii) gear retraction and extension (including changes in trim and drag caused by gear operation);

(iii) required tyre pressure, or location of the relevant placard;

(iv) controls and indicators including warning indicators in the cockpit in relation to the retraction or extension condition of the landing gear and brakes;

(v) components of the emergency extension system.

(8) flight controls and high lift devices:

(i) (A) aileron system;

(B) elevator system;

(C) rudder system;

(D) trim system;

(E) spoiler system;

(F) lift devices;

(G) stall warning system;

(H) take-off configuration warning system.

(ii) flight control system from the cockpit controls to the flight control or surfaces;

(iii) controls, monitors and indicators including warning indicators of the systems mentioned under (8) (i), interrelation and dependencies.

(9) electrical power supply:

(i) number, power, voltage, frequency and location of the main power system (AC or DC), auxiliary power system location and external power system;

(ii) location of the controls, monitors and indicators in the cockpit;

(iii) flight instruments, communication and navigation systems, main and back-up power sources;

(iv) location of vital circuit breakers;

(v) generator operation and monitoring procedures of the electrical power supply.

(10) flight instruments, communication, radar and navigation equipment, autoflight and flight data recorders:

(i) visible antennae;

(ii) controls and instruments of the following equipment in the cockpit during normal operation:

(A) flight instruments;

(B) flight management systems;

(C) radar equipment, including radio altimeter;

(D) communication and navigation systems;

(E) autopilot;

(F) flight data recorder, cockpit voice recorder and data-link communication recording function;

(G) TAWS;

(H) collision avoidance system;

(I) warning systems.

(11) cockpit, cabin and cargo compartment:

(i) operation of the exterior, cockpit, cabin and cargo compartment lighting and the emergency lighting;

(ii) operation of the cabin and cargo doors, stairs, windows and emergency exits;

(iii) main components of the oxygen system and their location, oxygen masks and operation of the oxygen systems for the crew and passengers, required amount of oxygen by means of a table or diagram.

(12) emergency equipment operation and correct application of the following emergency equipment in the aeroplane:

(i) portable fire extinguisher;

(ii) first-aid kits;

(iii) portable oxygen equipment;

(iv) emergency ropes;

(v) life-jacket;

(vi) life rafts;

(vii) emergency transmitters;

(viii) crash axes;

(ix) megaphones;

(x) emergency signals.

(13) pneumatic system:

(i) components of the pneumatic system, pressure source and actuated components;

(ii) controls, monitors and indicators in the cockpit and function of the system;

(iii) vacuum system.

(b) Limitations:

(1) general limitations:

(i) certification of the aeroplane, category of operation, noise certification and maximum and minimum performance data for all flight profiles, conditions and aircraft systems:

(A) maximum tail and crosswind-components at take-off and landing;

(B) maximum speeds for flap extension v_{fo};

(C) at various flap settings v_{fe};

(D) for landing gear operation v_{lo}, M_{lo};

(E) for extended landing gear v_{le}, M_{le};

(F) for maximum rudder deflection v_a, M_a;

(G) for tyres;

(H) one propeller feathered.

(ii) (A) minimum control speed air v_{mca};

(B) minimum control speed ground v_{mcg};

(C) stall speed under various conditions v_{so}, v_{s1};

(D) maximum speed v_{ne}, M_{ne};

(E) maximum speed for normal operation v_{mo}, M_{mo};

(F) altitude and temperature limitations;

(G) stick shaker activation.

(iii) (A) maximum airport pressure altitude, runway slope;

(B) maximum taxi mass;

(C) maximum take-off mass;

(D) maximum lift off mass;

(E) maximum landing mass;

(F) zero fuel mass;

(G) maximum dumping speed v_{dco}, M_{dco}, v_{dce}, M_{dce};

(H) maximum load factor during operation;

(I) certificated range of centre of gravity.

(2) engine limitations:

(i) operating data of the engines:

(A) time limits and maximum temperatures;

(B) minimum RPMs and temperatures;

(C) torque;

(D) maximum power for take-off and go-around on pressure altitude or flight altitude and temperature;

(E) piston engines: certified range of mixture;

(F) minimum and maximum oil temperature and pressure;

(G) maximum starter time and required cooling;

(H) time between two start attempts for engines and auxiliary power unit;

(I) for propeller: maximum RPM of propeller triggering of automatic feathering device.

(ii) certified oil grades.

(3) systems limitations:

(i) operating data of the following systems:

(A) pressurisation, air conditioning maximum pressures;

(B) electrical power supply, maximum load of main power system (AC or DC);

(C) maximum time of power supply by battery in case of emergency;

(D) mach trim system and yaw damper speed limits;

(E) autopilot limitations of various modes;

(F) ice protection;

(G) speed and temperature limits of window heat;

(H) temperature limits of engine and wing anti-ice.

(ii) fuel system: certified fuel specifications, minimum and maximum pressures and temperature of the fuel.

(4) minimum equipment list.

(c) Performance, flight planning and monitoring:

(1) performance calculation about speeds, gradients, masses in all conditions for take-off, en-route, approach and landing according to the documentation available (for example for take-off v_1, v_{mbe}, v_r, v_{lof}, v_2, take-off distance, maximum take-off mass and the required stop distance) on the following factors:

(i) accelerate or stop distance;

(ii) take-off run and distance available (TORA, TODA);

(iii) ground temperature, pressure altitude, slope, wind;

(iv) maximum load and maximum mass (for example ZFM);

(v) minimum climb gradient after engine failure;

(vi) influence of snow, slush, moisture and standing water on the runway;

(vii) possible single or dual engine failure during cruise flight;

(viii) use of anti-icing systems;

(ix) failure of water injection system or antiskid system;

(x) speeds at reduced thrust, v_1, v_{1red}, v_{mbe}, v_{mu}, v_r, v_{lof}, v_2;

(xi) safe approach speed v_{ref}, on v_{mca} and turbulent conditions;

(xii) effects of excessive approach speed and abnormal glideslope on the landing distance;

(xiii) minimum climb gradient during approach and landing;

(xiv) limiting values for a go-around with minimum fuel;

(xv) maximum allowable landing mass and the landing distance for the destination and alternate aerodrome on the following factors:

(A) available landing distance;

(B) ground temperature, pressure altitude, runway slope and wind;

(C) fuel consumption to destination or alternate aerodrome;

(D) influence of moisture on the runway, snow, slush and standing water;

(E) failure of the water injection system or the anti skid system;

(F) influence of thrust reverser and spoilers.

(2) flight planning for normal and abnormal conditions:

(i) optimum or maximum flight level;

(ii) minimum required flight altitude;

(iii) drift down procedure after an engine failure during cruise flight;

(iv) power setting of the engines during climb, cruise and holding under various circumstances, as well as the most economic cruising flight level;

(v) calculation of a short range or long range flight plan;

(vi) optimum and maximum flight level and power setting of the engines after engine failure.

(3) flight monitoring.

(d) Load and balance and servicing:

(1) load and balance:

(i) load and trim sheet on the maximum masses for take-off and landing;

(ii) centre of gravity limits;

(iii) influence of fuel consumption on the centre of gravity;

(iv) lashing points, load clamping, maximum ground load.

(2) servicing on ground, servicing connections for:

(i) fuel;

(ii) oil;

(iii) water;

(iv) hydraulic;

(v) oxygen;

(vi) nitrogen;

(vii) conditioned air;

(viii) electric power;

(ix) start air;

(x) toilet and safety regulations.

(e) Emergency procedures:

(1) recognition of the situation as well as immediate memory actions in correct sequence and for those conditions recognised as emergencies by the manufacturer and competent authority for certification:

(i) engine failure during take-off before and after v_1, as well as in-flight;

(ii) malfunctions of the propeller system;

(iii) engine overheat, engine fire on ground and in-flight;

(iv) wheel well fire;

(v) electrical smoke or fire;

(vi) rapid decompression and emergency descent;

(vii) air-conditioning overheat, anti-ice system overheat;

(viii) fuel pump failure;

(ix) fuel freezing overheat;

(x) electric power failure;

(xi) equipment cooling failure;

(xii) flight instrument failure;

(xiii) partial or total hydraulic failure;

(xiv) failures at the lift devices and flight controls including boosters;

(xv) cargo compartment smoke or fire.

(2) actions according to the approved abnormal and emergency checklist:

(i) engine restart in-flight;

(ii) landing gear emergency extension;

(iii) application of the emergency brake system;

(iv) emergency extension of lift devices;

(v) fuel dumping;

(vi) emergency descent.

(f) Special requirements for extension of a type rating for instrument approaches down to decision heights of less than 200 ft (60 m):

(1) airborne and ground equipment:

(i) technical requirements;

(ii) operational requirements;

(iii) operational reliability;

(iv) fail operational;

(v) fail passive;

(vi) equipment reliability;

(vii) operating procedures;

(viii) preparatory measures;

(ix) operational downgrading;

(x) communications.

(2) procedures and limitations:

(i) operational procedures;

(ii) crew coordination.

(g) Special requirements for 'glass cockpit' aeroplanes with EFIS

Additional learning objectives:

(1) general rules of aeroplanes computer hardware and software design;

(2) logic of all crew information and alerting systems and their limitations;

(3) interaction of the different aeroplane computer systems, their limitations, the possibilities of computer fault recognition and the actions to be performed on computer failures;

(4) normal procedures including all crew coordination duties;

(5) aeroplane operation with different computer degradations (basic flying).

(h) Flight management systems.

II. SE AND ME HELICOPTERS

(a) Detailed listing for helicopters structure, transmissions, rotors and equipment, normal and abnormal operation of systems:

(1) dimensions.

(2) engine including aux. power unit, rotor and transmissions; if an initial type rating for a turbine engine helicopter is applied for, the applicant should have received turbine engine instruction:

(i) type of engine or engines;

(ii) in general, the function of the following systems or components:

(A) engine;

(B) auxiliary power unit;

(C) oil system;

(D) fuel system;

(E) ignition system;

(F) starting system;

(G) fire warning and extinguishing system;

(H) generators and generator drive;

(I) power indication;

(J) water or methanol injection.

(iii) engine controls (including starter), engine instruments and indications in the cockpit, their function and interrelation and interpretation;

(iv) engine operation, including APU, during engine start and engine malfunctions, procedures for normal operation in the correct sequence;

(v) transmission system:

(A) lubrication;

(B) generators and generator drives;

(C) freewheeling units;

(D) hydraulic drives;

(E) indication and warning systems.

(vi) type of rotor systems: indication and warning systems.

(3) fuel system:

(i) location of the fuel tanks, fuel pumps, fuel lines to the engines tank capacities, valves and measuring;

(ii) the following systems:

(A) filtering;

(B) fuelling and defuelling heatings;

(C) dumping;

(D) transferring;

(E) venting.

(iii) in the cockpit: the monitors and indicators of the fuel system, quantity and flow indication, interpretation;

(iv) fuel procedures distribution into the various tanks

fuel supply and fuel dumping.

(4) air conditioning:

(i) components of the system and protection devices;

(ii) cockpit monitors and indicators;

Note: interpretation about the operational condition: normal operation of the system during start, cruise approach and landing, air conditioning airflow and temperature control.

(5) ice and rain protection, windshield wipers and rain repellent:

(i) ice protected components of the helicopter, including engines and rotor systems, heat sources, controls and indications;

(ii) operation of the anti-icing or de-icing system during take-off, climb, cruise and descent, conditions requiring the use of the protection systems;

(iii) controls and indications of the windshield wipers and rain repellent system operation.

(6) hydraulic system:

(i) components of the hydraulic system(s), quantities and system pressure, hydraulically actuated components associated to the respective hydraulic system;

(ii) controls, monitors and indicators in the cockpit, function and interrelation and interpretation of indications.

(7) landing gear, skids fixed and floats:

(i) main components of the:

(A) main landing gear;

(B) nose gear;

(C) tail gear;

(D) gear steering;

(E) wheel brake system.

(ii) gear retraction and extension;

(iii) required tyre pressure, or location of the relevant placard;

(iv) controls and indicators including warning indicators in the cockpit in relation to the retraction or extension condition of the landing gear;

(v) components of the emergency extension system.

(8) flight controls, stab- and autopilot systems: controls, monitors and indicators including warning indicators of the systems, interrelation and dependencies.

(9) electrical power supply:

(i) number, power, voltage, frequency and if applicable phase and location of the main power system (AC or DC) auxiliary power system location and external power system;

(ii) location of the controls, monitors and indicators in the cockpit;

(iii) main and back-up power sources flight instruments, communication and navigation systems, main and back-up power sources;

(iv) location of vital circuit breakers;

(v) generator operation and monitoring procedures of the electrical power supply.

(10) flight instruments, communication, radar and navigation equipment, autoflight and flight data recorders:

(i) antennas;

(ii) controls and instruments of the following equipment in the cockpit:

(A) flight instruments (for example air speed indicator, pitot static system, compass system, flight director);

(B) flight management systems;

(C) radar equipment (for example weather radar, transponder);

(D) communication and navigation system (for example HF, VHF, ADF, VOR/DME, ILS, marker beacon) and area navigation systems;

(E) stabilisation and autopilot system;

(F) flight data recorder, cockpit voice recorder, data-link communication recording function and radio altimeter;

(G) collision avoidance system;

(H) TAWS;

(I) HUMS.

(11) cockpit, cabin and cargo compartment:

(i) operation of the exterior, cockpit, cabin and cargo compartment lighting and the emergency lighting;

(ii) operation of the cabin doors and emergency exits.

(12) emergency equipment:

(i) operation and correct application of the following mobile emergency equipment in the helicopter:

(A) portable fire extinguisher;

(B) first-aid kits;

(C) portable oxygen equipment;

(D) emergency ropes;

(E) life-jacket;

(F) life rafts;

(G) emergency transmitters;

(H) crash axes;

(I) megaphones;

(J) emergency signals;

(K) torches.

(ii) operation and correct application of the fixed emergency equipment in the helicopter: emergency floats.

(b) Limitations:

(1) general limitations, according to the helicopter flight manual;

(2) minimum equipment list.

(c) Performance, flight planning and monitoring:

(1) performance calculation about speeds, gradients, masses in all conditions for take-off, en-route, approach and landing:

(i) take-off:

(A) hover performance in and out of ground effect;

(B) all approved profiles, cat A and B;

(C) HV diagram;

(D) take-off and rejected take-off distance;

(E) take-off decision point (TDP) or (DPATO);

(F) calculation of first and second segment distances;

(G) climb performance.

(ii) en-route:

(A) air speed indicator correction;

(B) service ceiling;

(C) optimum or economic cruising altitude;

(D) max endurance;

(E) max range;

(F) cruise climb performance.

(iii) landing:

(A) hovering in and out of ground effect;

(B) landing distance;

(C) landing decision point (LDP) or (DPBL).

(iv) knowledge or calculation of: v_{lo}, v_{le}, v_{mo}, v_x, v_y, v_{toss}, v_{ne}, $v_{max\ range}$, v_{mini}.

(2) flight planning for normal and abnormal conditions:

(i) optimum or maximum flight level;

(ii) minimum required flight altitude;

(iii) drift down procedure after an engine failure during cruise flight;

(iv) power setting of the engines during climb, cruise and holding under various circumstances as well as at the most economic cruising flight level;

(v) optimum and maximum flight level and power setting after an engine failure.

(3) effect of optional equipment on performance.

(d) Load, balance and servicing:

(1) load and balance:

(i) load and trim sheet on the maximum masses for take-off and landing;

(ii) centre of gravity limits;

(iii) influence of the fuel consumption on the centre of gravity;

(iv) lashing points, load clamping, max ground load.

(2) servicing on the ground, servicing connections for:

(i) fuel;

(ii) oil, etc.;

(iii) and safety regulations for servicing.

(e) Emergency procedures.

(f) Special requirements for extension of a type rating for instrument approaches down to a decision height of less than 200 ft (60 m):

(1) airborne and ground equipment:

(i) technical requirements;

(ii) operational requirements;

(iii) operational reliability;

(iv) fail operational;

(v) fail passive;

(vi) equipment reliability;

(vii) operating procedures;

(viii) preparatory measures;

(ix) operational downgrading;

(x) communication.

(2) procedures and limitations:

(i) operational procedures;

(ii) crew co-ordination.

(g) Special requirements for helicopters with EFIS.

(h) Optional equipment.

III. AIRSHIPS

(a) Detailed listing for airship structure and equipment, normal operation of systems and malfunctions:

(1) dimensions;

(2) structure and envelope:

(i) internal structure;

(ii) envelope;

(iii) pressure system;

(iv) gondola;

(v) empennage.

(3) flight controls;

(4) systems:

(i) hydraulic;

(ii) pneumatic.

(5) landing gear;

(6) fuel system;

(7) fire warning and extinguishing system;

(8) emergency equipment;

(9) electrical systems;

(10) avionics, radio navigation and communication equipment;

(11) instrumentation;

(12) engines and propellers;

(13) heating, ventilation and air-condition;

(14) operational procedures during start, cruise, approach and landing:

(i) normal operations;

(ii) abnormal operations.

(b) Limitations:

(1) general limitations:

(i) certification of the airship, category of operation, noise certification and maximum and minimum performance data for all flight profiles, conditions and aircraft systems;

(ii) speeds;

(iii) altitudes.

(2) engine limitations;

(3) systems limitations;

(4) minimum equipment list.

(c) Performance and flight planning:

(1) performance calculation;

(2) flight planning.

(d) Load and balance and servicing:

(1) load and balance;

(2) servicing.

(e) Emergency procedures:

(1) recognition of emergency situations;

(2) actions according to the approved abnormal and emergency checklist.

AMC2 FCL.725(a) Requirements for the issue of class and type ratings

TRAINING COURSE

FLIGHT INSTRUCTION FOR TYPE RATINGS: HELICOPTERS

(a) The amount of flight instruction depends on:

(i) complexity of the helicopter type, handling characteristics, level of technology;

(ii) category of helicopter (SEP or SE turbine helicopter, ME turbine and MP helicopter);

(iii) previous experience of the applicant;

(iv) the availibiliy of FSTDs.

(b) FSTDs

The level of qualification and the complexity of the type will determine the amount of practical training that may be accomplished in FSTDs, including completion of the skill test. Before undertaking the skill test, a student should demonstrate competency in the skill test items during the practical training.

(c) Initial issue

The flight instruction (excluding skill test) should comprise:

Helicopter types	In helicopter	In helicopter and FSTD associated training Credits
SEP (H)	5 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 6 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 6 hrs total
SET(H) under 3175 kg MTOM	5 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 6 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 6 hrs total
SET(H) at or over 3175 kg MTOM	8 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 10 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 10 hrs total
SPH MET (H) CS and FAR 27 and 29	8 hrs	Using FFS C/D: At least 2 hrs helicopter and at least 10 hrs total Using FTD 2/3: At least 4 hrs helicopter and at least 10 hrs total
MPH	10 hrs	Using FFS C/D: At least 2 hrs helicopter, and at least 12 hrs total Using FTD 2/3: At least 4 hrs helicopter, and at least 12 hrs total

(d) Additional types

The flight instruction (excluding skill test) should comprise:

Helicopter types	In helicopter	In helicopter and FSTD associated training Credits
SEP(H) to SEP(H) within AMC1 FCL.740.H (a)(3)	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total Using FTD 2/3: At least 1 hr helicopter and at least 4 hrs total
SEP(H) to SEP(H) not included in AMC1 FCL.740.H (a)(3)	5 hrs	Using FFS C/D: At least 1 hr helicopter and at least 6 hrs total Using FTD 2/3: At least 2 hr helicopter and at least 7 hrs total
SET(H) to SET(H)	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total Using FTD 2/3: At least 1 hr helicopter and at least 4 hrs total
SE difference training	1 hr	N/A
MET(H) to MET(H)	3 hrs	Using FFS C/D: At least 1 hr helicopter and at least 4 hrs total Using FTD 2/3: At least 2 hrs helicopter and at least 5 hrs total
ME difference training	1 hrs	N/A
MPH to MPH	5 hrs	Using FFS C/D: At least 1 hr helicopter and at least 6 hrs total Using FTD 2/3: At least 2 hrs helicopter and at least 7 hrs total
Extend privileges on the same type rating from SPH to MPH (except for initial MP issue), or from MPH to SPH	2 hrs	Using FFS C/D: At least 1 hr helicopter and at least 3 hrs total

(e) Holders of an IR(H) wishing to extend the IR(H) to further types should have additionally 2 hours flight training on type by sole reference to instruments according to IFR which may be conducted in an FFS C/D or FTD 2/3. Holders of an SE IR(H) wishing to extend the IR privileges to an ME IR(H) for the first time should complete at least 5 hours training.

AMC1 FCL.740(b)(1) Validity and renewal of class and type ratings

RENEWAL OF CLASS AND TYPE RATINGS: REFRESHER TRAINING

(a) Paragraph (b)(1) of FCL.740 determines that if a class or type rating has lapsed, the applicant shall take refresher training at an ATO. The objective of the training is to reach the level of proficiency necessary to safely operate the relevant type or class of aircraft. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

   (1) the experience of the applicant. To determine this, the ATO should evaluate the pilot's log book, and, if necessary, conduct a test in an FSTD;

   (2) the complexity of the aircraft;

   (3) the amount of time lapsed since the expiry of the validity period of the rating. The amount of training needed to reach the desired level of proficiency should increase with the time lapsed. In some cases, after evaluating the pilot, and when the time lapsed is very limited (less than 3 months), the ATO may even determine that no further refresher training is necessary. When determining the needs of the pilot, the following items can be taken into consideration:

      (i) expiry shorter than 3 months: no supplementary requirements;

      (ii) expiry longer than 3 months but shorter than 1 year: a minimum of two training sessions;

      (iii) expiry longer than 1 year but shorter than 3 years: a minimum of three training sessions in which the most important malfunctions in the available systems are covered;

      (iv) expiry longer than 3 years: the applicant should again undergo the training required for the initial issue of the rating or, in case of helicopter, the training required for the 'additional type issue', according to other valid ratings held.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme that should be based on the initial training for the issue of the rating and focus on the aspects where the applicant has shown the greatest needs.

(c) After successful completion of the training, the ATO should give a certificate, or other documental evidence that the training has been successfully achieved to the applicant, to be submitted to the competent authority when applying for the renewal. The certificate or documental evidence needs to contain a description of the training programme.

AMC1 FCL.720.A(b)(2)(i) Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes

ADDITIONAL THEORETICAL KNOWLEDGE FOR A CLASS OR TYPE RATING FOR HIGH PERFORMANCE SP AEROPLANES

(a) A number of aeroplanes certificated for SP operation have similar performances, systems and navigation capabilities to those more usually associated with MP types of aeroplanes, and regularly operate within the same airspace. The level of knowledge required to operate safely in this environment is not part of, or not included to the necessary depth of knowledge in the training syllabi for the PPL, CPL or IR(A) but these licence holders may fly as PIC of such aeroplanes. The additional theoretical knowledge required to operate such aeroplanes safely is obtained by completion of a course at an ATO.

(b) The aim of the theoretical knowledge course is to provide the applicant with sufficient knowledge of those aspects of the operation of aeroplanes capable of operating at high speeds and altitudes, and the aircraft systems necessary for such operation.

COURSE SYLLABUS

(c) The course will be divided in a VFR and an IFR part, and should cover at least the following items of the aeroplane syllabus to the ATPL(A) level:

FOR VFR OPERATION:

Subject Ref.:	**Syllabus Content:**
021 00 00 00	**AIRCRAFT GENERAL KNOWLEGDE: AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**
021 02 02 01 to 021 02 02 03	Alternating current: general Generators AC power distribution
021 01 08 03	Pressurisation (Air driven systems - piston engines)
021 01 09 04	Pressurisation (Air driven systems - turbojet and turbo propeller)
021 03 01 06 021 03 01 07 021 03 01 08 021 03 01 09	Engine performance - piston engines Power augmentation (turbo or supercharging) Fuel Mixture
021 03 02 00 to 021 03 04 09	Turbine engines
021 04 05 00	Aircraft oxygen equipment
032 03 00 00	**Performance class B: ME aeroplanes**
032 03 01 00 to 032 03 04 01	Performance of ME aeroplanes not certificated under CS and FAR 25: entire subject

040 00 00 00	HUMAN PERFORMANCE
040 02 01 00 to 040 02 01 03	Basic human physiology and High altitude environment
050 00 00 00	**METEOROLOGY**
050 02 07 00 to 050 02 08 01	Jet streams CAT Standing waves
050 09 01 00 to 050 09 04 05	Flight hazards Icing and turbulence Thunderstorms
062 02 00 00	**Basic radar principles**
062 02 01 00 to 062 02 05 00	Basic radar principles Airborne radar SSR
081 00 00 00	**PRINCIPLES OF FLIGHT: AEROPLANES**
081 02 01 00 to 081 02 03 02	Transonic aerodynamics: entire subject Mach number or shockwaves buffet margin or aerodynamic ceiling

FOR IFR OPERATIONS

Subject Ref.: 010 00 00 00	Syllabus Content AIR LAW
010 06 07 00	Simultaneous Operation on parallel or near-parallel instrument Runways
010 06 08 00	Secondary surveillance radar (transponder) operating procedures
010 09 08 02 **022 00 00 00** 022 02 02 02	Radio altimeter operating areas **AIRCRAFT GENERAL KNOWLEDGE - INSTRUMENTATION** Temperature measurement - Design and operation
022 03 04 00 **022 12 00 00** 022 12 07 00	Flux valve **ALERTING SYSTEMS, PROXIMITY SYSTEMS** Altitude alert system
022 12 08 00 022 12 10 00 022 13 03 01	Radio-altimeter ACAS/TCAS principles and operation Electronic Flight Instrument System (EFIS) — Design, operation
050 00 00 00	**METEOROLOGY**
050 02 06 03 050 10 02 03 **062 00 00 00**	Clear Air turbulence (CAT) - Description, cause and location Upper air charts **RADIO NAVIGATION**
062 02 05 04	ILS — Errors and accuracy
062 02 06 00	MLS
062 02 06 01 to 062 02 06 04	Principles Presentation and Interpretation, Coverage and range Error and accuracy

(d) Demonstration of acquisition of this knowledge is undertaken by passing an examination set by an ATO. A successful pass of this examination results in the issue of a certificate indicating that the course and examination have been completed.

(e) The certificate represents a 'once only' qualification and satisfies the requirement for the addition of all future high performance aeroplanes to the holder's licence. The certificate is valid indefinitely and is to be submitted with the application for the first HPA type or class rating.

(f) A pass in any theoretical knowledge subjects as part of the HPA course will not be credited against meeting future theoretical examination requirements for issue of a CPL(A), IR(A) or ATPL(A).

(g) The applicant who has completed a competency-based modular IR(A) course according to Appendix 6 Aa or EIR course according to FCL.825 needs to complete both VFR and IFR parts of this course.

(h) The applicant who has completed a modular IR(A) course according to Appendix 6 A only needs to complete the VFR part of this course.

AMC2 FCL.720.A(b)(2)(i) Experience requirements and prerequisites for the issue of class or type ratings — aeroplanes

ADDITIONAL THEORETICAL KNOWLEDGE FOR A CLASS OR TYPE RATING FOR HIGH PERFORMANCE SP AEROPLANES

An applicant for an additional class or type rating for a single-pilot aeroplane classified as a high performance aeroplane (HPA), who:

(a) has held a single-pilot HPA class or type rating prior to the application of Commission Regulation (EU) No 245/2014; and

(b) has completed a competency-based modular IR(A) course according to Appendix 6 Aa or EIR course according to FCL.825; and

(c) does not fulfil the requirements of FCL.720.A (b)(2)(ii) or (iii);

should pass the theoretical knowledge instruction and examination for the VFR and IFR parts of the course required in accordance with FCL.720.A.(b)(2)(i).

AMC1 FCL.725.A(b) Theoretical knowledge and flight instruction for the issue of class and type ratings — aeroplanes

CLASS RATING SEA

(a) The theoretical knowledge instruction should be conducted by an instructor having appropriate experience of class rating sea.

(b) Depending on the equipment and systems installed, the instruction should include, but not be limited to, the following content:

(1) theoretical knowledge:

(i) the aim of the training is to teach:

(A) the importance of preparation for flight and the safe planning taking into consideration all the factors for manoeuvring the aircraft on the wind, tidal currents, high and low water times and water movements at sea, river estuaries and lakes In addition, icing conditions, ice covered water and broken ice flows;

(B) the techniques about the most critical moments at take-off, landing, taxiing and mooring the aircraft;

(C) the construction methods and characteristics of floats and water rudders and the importance of checking for leaks in the floats;

(D) the necessary requirements for the compliance of the rules for the avoidance of collisions at sea, in regard to sea charts, buoys and lights and horns.

(ii) after completing the training, the student should be able to:

(A) describe the factors that have significance for planning and decision about initiation of seaplane flying and alternative measures for completion of flight;

(B) describe how the water level is affected by air pressure, wind, tide, regularisations and the flight safety depending on changes in the water level;

(C) describe the origin of different ice conditions in water areas;

(D) interpret nautical charts and maps about depths and shoals and risk for water currents, shifts of the wind, turbulence;

(E) decide what required equipment to bring during seaplane flying according to the operational requirements;

(F) describe the origin and extension of water waves, swells and water currents and their effect on the aeroplane;

(G) describe how water and air forces effect the aeroplane on water;

(H) describe the effect of water resistance on the aeroplanes' performance on glassy water and during different wave conditions;

(I) describe the consequences of taxiing with too high engine RPM;

(J) describe the effect of pressure and temperature on performance at take-off and climb from lakes located at higher altitude;

(K) describe the effect of wind, turbulence, and other meteorological conditions of special importance for flight over lakes, islands in mountain areas and other broken ground;

(L) describe the function of the water rudder and its handling, including the effect of lowered water rudder at take-off and landing;

(M) describe the parts of the float installation and their function;

(N) describe the effect of the floats on the aeroplanes' aerodynamics and performance in water and in air;

(O) describe the consequences of water in the floats and fouling of float bottoms;

(P) describe aviation requirements that apply specifically for the conduct of aircraft activity on water;

(Q) describe requirements about animal, nature and environment protection of significance for flight by seaplane, including flight in national parks;

(R) describe the meaning of navigation buoys;

(S) describe the organisation and working methods of the Sea Rescue Service;

(T) describe the requirements in ICAO Annex 2 as set out in paragraph 3.2.6 'Water operation', including relevant parts of the Convention on the International Regulations for Preventing Collisions at Sea.

(2) practical training:

(i) the aim of the practical training is to learn:

(A) the skills in manoeuvring aeroplanes on water and in mooring the aeroplane;

(B) the skills required for the reconnaissance of landing and mooring areas from the air, including the take-off area;

(C) the skills for assessing the effects of different water depths, shoals, wind, height of waves and swell;

(D) the skills for flying with floats about their effect on performance and flight characteristics;

(E) the skills for flying in broken ground during different wind and turbulence conditions;

(F) the skills for take-off and landing on glassy water, different ° of swell and water current conditions.

(ii) after the training, the student should be able to:

(A) handle the equipment that shall be brought during seaplane flying;

(B) perform pre-flight daily inspection on aeroplane, float installation and special seaplane equipment, including emptying of floats;

(C) sail, taxi and turn the aeroplane at swell with correct handling of the water rudder;

(D) taxi on the step and perform turns;

(E) establish the wind direction with the aeroplane;

(F) take necessary actions if loss of steering ability and person falling overboard;

(G) make land and moor aeroplane at bridge, buoy and beach with the use of appropriate knots to secure the aircraft;

(H) maintain given rate of descent by means of variometer only;

(I) perform take-off and landing on glassy water with and without outer references;

(J) perform take-off and landing under swell;

(K) perform power-off landing;

(L) from the air, reconnaissance of landing, mooring and take-off areas, observing;

(M) wind direction and strength during landing and take-off;

(N) surrounding terrain;

(O) overhead wires and other obstacles above and under water;

(P) congested areas;

(Q) determine wind direction and assess wind strength from water level and when airborne;

(R) state, for the aeroplane type in question;

(a) maximum wave height allowed;

(b) maximum number of ERPM allowed during taxi;

(S) describe how flying with floats affects the performance and flight characteristics of the aeroplane;

(T) take corrective action at critical moments due to wind shear and turbulence;

(U) navigate on the water with reference to buoys markers, obstacles and other traffic on the water.

(c) For the initial issue of class rating sea for SP, SE and ME aeroplanes, the number of multi-choice questions in the written or computer-based examination should at least comprise thirty questions, and may be conducted by the training organisation. The pass mark should be 75 %.

AMC1 FCL.735.A; FCL.735.H; FCL.735.As

MULTI-CREW COOPERATION COURSE

(a) Competency is a combination of knowledge, skills and attitudes required to perform a task to the prescribed standard.

(b) The objectives of MCC training are to develop the technical and non-technical components of the knowledge, skills and attitudes required to operate a multi-crew aircraft.

(c) Training should comprise both theoretical and practical elements and be designed to achieve the following competencies:

Competency	Performance indicators	Knowledge	Practical exercises
Communication	(a) Know what, how much and who to communicate to; (b) Ensure the recipient is ready and able to receive the information; (c) Pass messages and information clearly, accurately, timely and adequately; (d) Check if the other person has the correct understanding when passing important information; (e) Listen actively, patiently and demonstrate understanding when receiving information; (f) Ask relevant and effective questions, and offer suggestions; (g) Use appropriate body language, eye contact and tone; (h) Open and receptive to other people's view.	(a) Human Factors, TEM and CRM; (b) Application of TEM and CRM principles to training.	In a commercial air transport environment, apply multi-crew procedures, including principles of TEM and CRM to the following: (a) Pre-flight preparation: (1) FMS initialisation; (2) radio and navigation equipment preparation; (3) flight documentation; (4) Computation of take-off performance data. (b) Take-off and climb: (1) before take-off checks; (2) normal take-offs; (3) rejected take-offs; (4) take-offs with abnormal and emergency situations included.

Competency	Performance indicators	Knowledge	Practical exercises
Leadership and team working	(a) Friendly, enthusiastic, motivating and considerate of others; (b) Use initiative, give direction and take responsibility when required; (c) Open and honest about thoughts, concerns and intentions; (d) Give and receive criticism and praise well, and admit mistakes; (e) Confidently do and say what is important to him or her; (f) Demonstrate respect and tolerance towards other people; (g) Involve others in planning and share activities fairly.		(c) Cruise: emergency descent. (d) Descent and approach: (1) instrument flight procedures; (2) holding; (3) precision approach using raw data; (4) precision approach using flight director; (5) precision approach using autopilot; (6) one-engine-inoperative approach; (7) non-precision and circling approaches; (8) computation of approach and landing data; (9) all engines go-around; (10) go-around with one engine inoperative; (11) wind shear during approach. (e) landing: transition from instrument to visual flight on reaching decision altitude or height or minimum descent altitude or height;
Situation awareness	(a) Aware of what the aircraft and its systems are doing; (b) Aware of where the aircraft is and its environment; (c) Keep track of time and fuel; (d) Aware of the condition of people involved in the operation including passengers; (e) Recognise what is likely to happen, plan and stay ahead of the game; (f) Develop what-if scenarios and make pre-decisions;		

Competency	Performance indicators	Knowledge	Practical exercises
	(g) Identify threats to the safety of the aircraft and of the people.		(f) after landing and post flight procedures; (g) selected emergency and abnormal procedures.
Workload management	(a) Calm, relaxed, careful and not impulsive; (b) Prepare, prioritise and schedule tasks effectively; (c) Use time efficiently when carrying out tasks; (d) Offer and accept assistance, delegate when necessary and ask for help early; (e) Review and monitor and cross-check actions conscientiously; (f) Follow procedures appropriately and consistently; (g) Concentrate on one thing at a time, ensure tasks are completed and does not become distracted; (h) Carry out instructions as directed.		
Problem solving and decision making	(a) Identify and verify why things have gone wrong and do not jump to conclusions or make assumptions; (b) Seek accurate and adequate information from appropriate resources; (c) Persevere in working through a problem;		

Competency	Performance indicators	Knowledge	Practical exercises
	(d) Use and agree an appropriate decision making process; (e) Agree essential and desirable criteria and prioritises; (f) Consider as many options as practicable; (g) Make decisions when they need to, reviews and changes if required; (h) Consider risks but do not take unnecessary risks.		
Monitoring and cross-checking	(a) Monitor and cross-checks all actions; (b) Monitor aircraft trajectory in critical flight phases; (c) Take appropriate actions in response to deviations from the flight path.	(a) SOPs; (b) Aircraft systems; (c) Undesired aircraft states.	
Task sharing	(a) Apply SOPs in both PF and PNF roles; (b) Makes and responds to standard callouts.	(a) PF and PNF roles; (b) SOPs.	
Use of checklists	Utilise checklists appropriately according to SOPs.	(a) SOPs; (b) Checklist philosophy.	
Briefings	Prepare and deliver appropriate briefings.	(a) SOPs; (b) Interpretation of FMS data and in-flight documentation.	

Competency	Performance indicators	Knowledge	Practical exercises
Flight management	(a) Maintain a constant awareness of the aircraft automation state; (b) Manage automation to achieve optimum trajectory and minimum workload; (c) Take effective recovery actions from automation anomalies; (d) Manage aircraft navigation, terrain clearance; (e) Manage aircraft fuel state and take appropriate actions.	(a) Understanding of aircraft performance and configuration; (b) Systems; (c) SOPs; (d) Interpretation of FMS data and in-flight documentation; (e) Minimum terrain clearance; (F) Fuel management IFR and VFR regulation.	
FMS use	Programme, manage and monitor FMS in accordance with SOPs.	(a) Systems (FMS); (b) SOPs; (c) Automation.	
Systems normal operations	Perform and monitor normal systems operation in accordance with SOPs.	(a) Systems; (b) SOPs.	
Systems abnormal and emergency operations	(a) Perform and monitor abnormal systems operation in accordance with SOPs; (b) Utilise electronic and paper abnormal checklists in accordance with SOPs.	(a) Systems; (b) SOPs; (c) Emergency and abnormal procedures and checklists; (d) Recall items.	

Competency	Performance indicators	Knowledge	Practical exercises
Environment, weather and ATC	(a) Communicate effectively with ATC; (b) Avoid misunderstandings by requesting clarification; (c) Adhere to ATC instructions; (d) Construct a mental model of the local ATC and weather environment.	(a) Systems; (b) SOPs; (c) ATC environment and phraseology; (d) Procedures for hazardous weather conditions.	

CERTIFICATE OF COMPLETION FORM

CERTIFICATE OF COMPLETION OF MCC-TRAINING

Applicant's last name(s):			First name(s):	
Type of licence:			Number:	State:
ME/IR:		***OR***	ME/IR skill test:	
Issued on:			passed on:	
	Signature of applicant:			

The satisfactory completion of MCC-Training according to requirements is certified below:

TRAINING			
Multi-crew co-operation training received during period:			
from:	to:	at:	ATO / operator*
Location and date:		Signature of head of ATO or authorised instructor*:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

* *Delete as appropriate*

AMC1 FCL.740.H(a)(3) Revalidation of type ratings — helicopters

Only the following SEP helicopter types can be considered for crediting of the proficiency check. Other SEP helicopters (for example the R22 and R44) should not be given credit for.

Manufacturer	**Helicopter type and licence endorsement**
Agusta-Bell	
SEP	Bell47
Bell Helicopters	
SEP	Bell47
Brantley	
SEP	Brantley B2
Breda Nardi	
SEP	HU269
Enstrom	
SEP	ENF28
Hélicoptères Guimbal	
SEP	Cabri G2
Hiller	
SEP	UH12
Hughes or Schweizer	
SEP	HU269
Westland	
SEP	Bell47

GM1 FCL.720.PL Experience requirements and prerequisites for the issue of type ratings — powered-lift aircraft

The endorsement of a powered-lift type rating to an aeroplane or helicopter licence does not confer upon its holder the privileges to fly helicopters or aeroplanes, respectively.

SUBPART I — ADDITIONAL RATINGS

AMC1 FCL.800 Aerobatic rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

(a) The aim of the aerobatic training is to qualify licence holders to perform aerobatic manoeuvres.

(b) The ATO should issue a certificate of satisfactory completion of the instruction to licence endorsement.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) human factors and body limitation:
   (i) spatial disorientation;
   (ii) airsickness;
   (iii) body stress and G-forces, positive and negative;
   (iv) effects of grey- and blackouts.

(2) technical subjects:
   (i) legislation affecting aerobatic flying to include environmental and noise subjects;
   (ii) principles of aerodynamics to include slow flight, stalls and spins, flat and inverted;
   (iii) general airframe and engine limitations (if applicable).

(3) limitations applicable to the specific aircraft category (and type):
   (i) air speed limitations (aeroplane, helicopter, TMG and sailplane, as applicable);
   (ii) symmetric load factors (type-related, as applicable);
   (iii) rolling Gs (type-related, as applicable).

(4) aerobatic manoeuvres and recovery:
   (i) entry parameters;
   (ii) planning systems and sequencing of manoeuvres;
   (iii) rolling manœuvres;
   (iv) looping manœuvres;
   (v) combination manœuvres;
   (vi) entry and recovery from developed spins, flat, accelerated and inverted.

(5) emergency procedures:
   (i) recovery from unusual attitudes;
   (ii) drills to include the use of parachutes (if worn) and aircraft abandonment.

(d) Flying training

The exercises of the aerobatic flying training syllabus should be repeated as necessary until the applicant achieves a safe and competent standard. Having completed the flight training, the student pilot should be able to perform a solo flight containing a sequence of aerobatic manoeuvres. The dual training and the supervised solo training flights should be tailored to the category of aircraft and limited to the permitted manoeuvres of that type of aircraft. The exercises should comprise at least the following practical training items:

(1) confidence manoeuvres and recoveries:

- (i) slow flights and stalls;
- (ii) steep turns;
- (iii) side slips;
- (iv) engine restart in-flight (if applicable);
- (v) spins and recovery;
- (vi) recovery from spiral dives;
- (vii) recovery from unusual attitudes.

(2) aerobatic manoeuvres:

- (i) Chandelle;
- (ii) Lazy Eight;
- (iii) rolls;
- (iv) loops;
- (v) inverted flight;
- (vi) Hammerhead turn;
- (vii) Immelmann.

AMC1 FCL.805 Sailplane towing and banner towing rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

(a) The aim of the towing instruction is to qualify licence holders to tow banners or sailplanes.

(b) The ATO should issue a certificate of satisfactory completion of the instruction that can be used for licence endorsement.

(c) Theoretical knowledge: towing of sailplanes

The theoretical knowledge syllabus for towing of sailplanes should cover the revision or explanation of:

(1) regulations about towing flights;

(2) equipment for the towing activity;

(3) sailplane towing techniques, including:

(i) signals and communication procedures;

(ii) take-off (normal and crosswind);

(iii) in-flight launch procedures;

(iv) descending on tow;

(v) sailplane release procedure;

(vi) tow rope release procedure;

(vii) landing with tow rope connected (if applicable);

(viii) emergency procedures during tow, including equipment malfunctions;

(ix) safety procedures;

(x) flight performance of the applicable aircraft type when towing sailplanes;

(xi) look-out and collision avoidance;

(xii) performance data sailplanes, including:

(A) suitable speeds;

(B) stall characteristics in turns.

(d) Theoretical knowledge: banner towing

The theoretical knowledge syllabus for banner towing should cover the revision or explanation of:

(1) regulations about banner towing;

(2) equipment for the banner towing activity;

(3) ground crew coordination;

(4) pre-flight procedures;

(5) banner towing techniques, including:

(i) take-off launch;

(ii) banner pickup manoeuvres;

(iii) flying with a banner in tow;

(iv) release procedure;

(v) landing with a banner in tow (if applicable);

(vi) emergency procedures during tow, including equipment malfunctions;

(vii) safety procedures;

(viii) flight performance of the applicable aircraft type when towing a heavy or light banner;

(ix) prevention of stall during towing operations.

(e) Flying training: towing of sailplanes

The exercises of the towing training syllabus for towing sailplanes should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items:

(1) take-off procedures (normal and crosswind take-offs);

(2) 360 ° circles on tow with a bank of 30 ° and more;

(3) descending on tow;

(4) release procedure of the sailplane;

(5) landing with the tow rope connected (if applicable);

(6) tow rope release procedure in-flight;

(7) emergency procedures (simulation);

(8) signals and communication during tow.

(f) Flying training: banner towing

The exercises of the towing training syllabus for banner towing should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items:

(1) pickup manoeuvres;

(2) towing in-flight techniques;

(3) release procedures;

(4) flight at critically low air speeds;

(5) maximum performance manoeuvres;

(6) emergency manoeuvres to include equipment malfunctions (simulated);

(7) specific banner towing safety procedures;

(8) go-around with the banner connected;

(9) loss of engine power with the banner attached (simulated).

AMC1 FCL.810(b) Night rating

PPL(H) NIGHT RATING COURSE

(a) The aim of the course is to qualify PPL(H) holders to exercise the privileges of the licence at night.

(b) The ATO should issue a certificate of satisfactory completion of the instruction that can be used for licence endorsement.

(c) Theoretical knowledge

The theoretical knowledge syllabus should cover the revision or explanation of:

(1) night VMC minima;

(2) rules about airspace control at night and facilities available;

(3) rules about aerodrome ground, runway, landing site and obstruction lighting;

(4) aircraft navigation lights and collision avoidance rules;

(5) physiological aspects of night vision and orientation;

(6) dangers of disorientation at night;

(7) dangers of weather deterioration at night;

(8) instrument systems or functions and errors;

(9) instrument lighting and emergency cockpit lighting systems;

(10) map marking for use under cockpit lighting;

(11) practical navigation principles;

(12) radio navigation principles;

(13) planning and use of safety altitude;

(14) danger from icing conditions, avoidance and escape manoeuvres.

(d) Flying training

The exercises of the night rating flight syllabus should be repeated as necessary until the student achieves a safe and competent standard:

(1) In all cases, exercises 4 to 6 of the night rating flight syllabus should be completed.

(2) For exercises 1 to 3, up to 50 % of the required flight training may be completed in an FSTD(H). However, all items within each exercise should be conducted in a helicopter in-flight.

(3) Items marked (*) should be completed in simulated IMC and may be completed in daylight.

(4) The flying exercises should comprise:

(i) Exercise 1:

(A) revise basic manoeuvres when flying by sole reference to instruments*;

(B) explain and demonstrate transition to instrument flight from visual flight*;

(C) explain and revise recovery from unusual attitudes by sole reference to instruments*.

(ii) Exercise 2:

Explain and demonstrate the use of radio navigation aids when flying by sole reference to instruments, to include position finding and tracking*.

(iii) Exercise 3:

Explain and demonstrate the use of radar assistance*.

(iv) Exercise 4:

(A) explain and demonstrate the use and adjustment of landing light;

(B) explain and demonstrate night hovering:

(a) higher and slower than by day;

(b) avoidance of unintended sideways or backwards movements.

(C) explain and demonstrate night take-off techniques;

(D) explain and demonstrate night circuit technique;

(E) explain and demonstrate night approaches (constant angle) with or without visual approach aids to:

(a) heliports;

(b) illuminated touchdown areas.

(F) practise take-off's, circuits and approaches;

(G) explain and demonstrate night emergency procedures to include:

(a) simulated engine failure (to be terminated with power recovery at a safe altitude);

(b) simulated engine failure, including SE approach and landing (ME only);

(c) simulated inadvertent entry to IMC (not on base leg or final);

(d) simulated hydraulic control failure (to include landing);

(e) internal and external lighting failure;

(f) other malfunctions and emergency procedures as required by the aircraft flight manual.

(v) Exercise 5:

Solo night circuits.

(vi) Exercise 6:

(A) explain and demonstrate night cross-country techniques;

(B) practise night cross-country dual and as SPIC to a satisfactory standard.

AMC1 FCL.815 Mountain rating

THEORETICAL KNOWLEDGE AND FLYING TRAINING

THEORETICAL KNOWLEDGE	
WHEEL	SKI
1. Equipment	
W.1.1 Personal equipment for the flight W.1.2 Aircraft equipment for the flight	S.1.1 Personal equipment for the flight S.1.2 Aircraft equipment for the flight
2. Take-off techniques	
W.2.1 Technique for approach and landing on a mountain surface	S.2.1 Technique for approach and landing on a mountain surface S.2.2 Landing technique on skis
W.2.2 Rolling techniques of the aircraft on various runway profiles	S.2.3 Rolling techniques of the aircraft on skis about the snow nature
W.2.3 Take-off technique	S.2.4 Take-off technique on surfaces covered with snow
W.2.4 Aircraft and engine performances about altitude	S.2.5. Aircraft and engine performances about altitude
3. Rules	
W.3.1 Mountain rating	S.3.1 Mountain rating
W.3.2 Overflight rules	S.3.2 Overflight rules
W.3.3 Surfaces classification	S.3.3 Surfaces classification
W.3.4 PIC responsibilities	S.3.4 PIC responsibilities
W.3.5 Responsibilities of the surface manager	S.3.5 Responsibilities of the surface manager
W.3.6 Flight plan	S.3.6 Flight plan
	S.3.7 Certification of the ski mounted aeroplanes
4. Meteorology	
W.4.1 Movements of the air mass	S.4.1 Movements of the air mass
W.4.2 Flight consequences	S.4.2 Flight consequences
W.4.3 Relief effect on the movement of the air masses	S.4.3 Relief effect on the movement of the air masses
W.4.4 Altimetry	S.4.4 Altimetry
5. Human Performance and Limitations	
W.5.1 The cold	S.5.1 The cold
W.5.2 The food	S.5.2 The food
W.5.3 The hypoxia	S.5.3 The hypoxia
W.5.4 The radiance	S.5.4 The radiance
W.5.5 The thirst	S.5.5 The thirst
W.5.6 The tiredness	S.5.6 The tiredness
W.5.7 Turbulence effects in altitude	S.5.7 Turbulence effects in altitude
6. Navigation	
W.6.1 Progress of the flight	S.6.1 Progress of the flight
W.6.2 Dead reckoning	S.6.2 Dead reckoning
W.6.3 The path over the relief	S.6.3 The path over the relief

W.6.4 Progress in the valleys W.6.5 Detection of obstacles (high voltage lines, chairlifts, cables, etc.).	S.6.4 Progress in the valleys S.6.5 Detection of obstacles (high voltage lines, chairlifts, cables, etc.)
7. Specific items	
	S.7.1 Knowledge of the snow and assessment of the snow nature in-flight S.7.2 Knowledge of the glacier S.7.3 Life of the glacier S.7.4 Formation of the cracks S.7.5 Snow bridges S.7.6 Avalanches
8. Survival	
	S.8.1 Ways of survival (psychological aspects) S.8.2 Use of the equipments S.8.3 Removal of snow from the aircraft S.8.4 Building of a shelter S.8.5 How to eat and feed
FLIGHT INSTRUCTION	
WHEEL	SKI
I.- Navigation	
W.I.1 Flight techniques in the valleys W.I.2 Flight over mountain passes and ridges W.I.3 U-turn in narrow valleys W.I.4 Choice of the flight path of aerology W.I.5 Map reading	S.I.I Flight techniques in the valleys S.I.2 Flight over mountain passes and ridges. S.I.3 U-turn in narrow valleys S.I.4 Choice of the flight path of aerology S.I.5 Map reading
II. – Arrival and reconnaissance	
W.II.1 Choice of the altitude of arrival W.II.2 Choice of the arrival and overflight pattern W.II.3 Choice of the landing pattern W.II.4 Aerology awareness W.II.5 Evaluation of the length of the runway W.II.6 Evaluation of the runway profile (slope and banking) W.II.7 Collision avoidance. W.II.8 Definition of the references for the landing (touchdown point) W.II.9 Determination of the circuit pattern altitude W.II.10 Choice of the final speed depending on the runway profile	S.II.1 Choice of the arrival altitude S.II.2 Choice of the arrival and overflight pattern S.II.3 Description of the circuit pattern S.II.4 Aerology awareness S.II.5 Evaluation of the runway length S.II.6 Evaluation of the runway profile (slope and banking) S.II.7 Collision avoidance S.II.8 Definition of the references for the landing (touchdown point) S.II.9 Determination of the circuit pattern altitude S.II.10 Choice of the final speed depending on the runway profile S.II.11 Choice of the take-off axis S.II.12. Choice of the landing axis S.II.13 Choice of the parking area S.II.14 Observation of the obstacles on the ground (cracks, snow bridges, avalanches) S.II.15 Estimation of the snow nature

	S.II.16 Observation of the way to reach a refuge from the landing area
III – Approach and landing	
W.III.1 Landing pattern altitude W.III.2 Precision of flight along the landing path W.III.3 Corrections on the landing path (accuracy and effectiveness) W.III.4 Landing (precision of the flare and of the touchdown point) W.III.5 Taxiing (use of the engine power) on various profiles W.III.6 Parking of the aircraft (depending on the runway profile, the traffic, etc.)	S.III.1 Landing pattern altitude S.III.2 Precision of flight along the landing path S.III.3 Corrections on the landing path (accuracy and effectiveness) S.III.4 Landing (precision of the flare and of the touchdown point) S.III.5 Taxi of the aircraft on various snows and various runway profiles S.III.6 Parking of the aircraft (depending on the snow nature and the profile of the apron) S.III.7 Turns on various snow nature and various ground profiles
IV. – Take-off	
W.IV.1 Safety checks before take-off W.IV.2 Lining up on the runway W.IV.3 Control of the runway axis during take-off W.IV.4 Choice and use of the visual references of the take-off axis	S. IV.1 Safety checks before take-off. S.IV.2 Lining up on the runway S.IV.3 Control of the runway axis during take-off S.IV.4 Choice and use of the visual references of the take-off axis S.IV.5 Acceleration depending on the nature of the snow S.IV.6 Short take-off S.IV.7 Take-off avoiding the skid of the skis
V. - Survival	
	S.V.1 Use of the snowshoes S.V.2 Use of the markings

AMC2 FCL.815 Mountain rating

SKILL TEST AND PROFICIENCY CHECK

The skill test for the issue or the proficiency check for the revalidation or renewal of a mountain rating should contain the following elements:

(a) oral examination

This part should be done before the flight and should cover all the relevant parts of the theoretical knowledge. At least one question for each of the following sections should be asked:

(1) specific equipment for a mountain flight (personal and aircraft);

(2) rules of the mountain flight.

If the oral examination reveals a lack in theoretical knowledge, the flight test should not be done and the skill test is failed.

(b) practical skill test

During the flight test, two sites different from the departure airport should be used for recognition, approach, landing and take-off. For the mountain rating ski or the extension from wheel to ski, one of the two different sites should be a glacier.

AMC1 FCL.820 Flight test rating

TRAINING COURSE
GENERAL
(a) Competency-based training:

(1) Training courses for the flight test rating should be competency-based. The training programme should follow as much as possible the syllabus outlined below, but may be adapted taking into account the previous experience, skill and theoretical knowledge level of the applicants.

(2) It should also be recognised that the syllabi below assume that suitable flight test experience will be gained subsequent to attendance at the course. Should the applicant be significantly experienced already, then consideration should be made of that experience and it is possible that course content might be reduced in areas where that experience has been obtained.

(3) Furthermore, it should be noted that flight test ratings are specific to both a certain category of aircraft (aeroplanes or helicopters) and to a certain category of flight test (category 1 or 2). Therefore, holders of a flight test rating wishing to extend their privileges to further categories of aircraft or to further categories of flight test (this is only relevant for holders of a category 2 flight test rating since the category one flight test rating includes the privileges for category 2 test flights) should not be requested to undertake the same course as an 'ab-initio' applicant. In these cases, the ATO should develop specific 'bridge courses' taking into account the same principles mentioned above.

(4) To allow proper consideration of the applicant's previous experience, a pre-entry assessment of the applicant's skills should be undertaken by the applicant, on the basis of which the ATO may evaluate the level of the applicant to better tailor the course. Thus, the syllabi listed below should be regarded as a list of individual demonstrable competencies and qualifications rather than a list of mandatory training objectives.

(b) Continuous evaluation

Training courses for the flight test rating should be built on a continuous evaluation model to guarantee that successful completion of the course ensures that the applicant has reached the level of competence (both theoretical and practical) to be issued a flight test rating.

CONTENT OF THE COURSE
(c) In addition, the content of the course should vary taking into account whether the applicant seeks privileges for a category 1 or 2 flight test rating, as well as the relevant category of aircraft, and their level of complexity. To better take these factors into account, training courses for the flight test rating have been divided into two conditions:

(1) condition 1 courses apply to category 1 flight test ratings on:

(i) helicopters certificated in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;

(ii) aeroplanes certificated in accordance with:

(A) the standards of CS-25 or equivalent airworthiness codes; or

(B) the standards of CS-23 or equivalent airworthiness codes, within the commuter category or having an M_D above 0.6 or a maximum ceiling above 25 000 ft.

(2) condition 2 training courses apply to:

(i) category 2 flight test ratings for:

(A) helicopters certificated in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;

(B) aeroplanes certificated in accordance with:

(a) the standards of CS-25 or equivalent airworthiness codes; or

(b) the standards of CS-23 or equivalent airworthiness codes (included those mentioned in (c)(1)(ii)(B)), except for aeroplanes with a maximum take-off mass of less than 2 000 kg.

(ii) category 1 flight tests for aeroplanes certificated in accordance with the standards of CS-23, with a maximum take-off mass of more than 2 000kg, with the exclusion of those mentioned in (c)(1)(ii)(B) (which are subject to condition 1 courses).

AEROPLANES

(d) Condition 1 courses for aeroplanes

(1) These courses should include approximately:

(i) 350 hours of ground training;

(ii) 100 hours of flight test training, during which at least 15 flights should be made without an instructor on board;

(iii) principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least 10 different aeroplane types, of which at least one should be certificated in accordance with CS-25 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least five substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 1 - AEROPLANES		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report	(1) air speed calibration; (2) climb ME;

	should be developed)	(3) take-off and landing, including turboprop or turbofan OEI.
	(b) engines	Turboprop or turbofan limitations and relight envelope
	(c) handling qualities (at least two flight test reports should be developed)	(1) flight controls characteristics; (2) longitudinal handling qualities; (3) longitudinal manoeuvre stability; (4) take-off and landing MET or ME turbofan, including v_{mcq} and v_{mu}; (5) lateral, directional handling qualities; (6) handling qualities evaluation; (7) variable stability demo flights including HOFCS; (8) stalls; (9) spins; (10) v_{mca}.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) autopilot or AFCS; (2) glass cockpit evaluation; (3) radio navigation, instruments qualification and integrated avionics; (4) TAWS; (5) ACAS.
	(e) high speed certification test	
	(f) final evaluation exercise (a flight test report should be developed)	

(e) Condition 2 courses for aeroplanes

(1) These courses should include approximately:

(i) 150 hours of ground training;

(ii) 50 hours of flight test training, during which at least eight flights should be made without an instructor on board.

Principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least seven different aeroplane types, of which at least one should be certificated in accordance with CS-25 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least three substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 2 - AEROPLANES		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) climb ME; (3) take-off and landing MET or ME turbofan.
	(b) handling qualities	(1) flight control characteristics; (2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities; (4) stalls; (5) spins.
	(c) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) autopilot or AFCS; (2) glass cockpit evaluation; (3) radio navigation, instruments qualification and integrated avionics; (4) TAWS; (5) ACAS.
	(d) final evaluation exercise (a) flight test report should be developed)	

HELICOPTERS

(f) Condition 1 courses for helicopters:

(1) These courses should include approximately:

(i) 350 hours of ground training;

(ii) 100 hours of flight test training, during which at least 20 flights should be made without an instructor on board.

Principles of test management and risk and safety managements should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least eight different helicopter types, of which at least one should be certificated in accordance with CS-29 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least five substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 1 - HELICOPTERS		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) level flight, climb and descent, vertical and hover performance;
	(b) engines	(1) digital engine governing; (2) turbine or piston engine evaluation.
	(c) handling qualities (at least one flight test report should be developed)	(1) flight control characteristics; (2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities; (4) ADS 33; (5) teetering rotor assessment; (6) rigid rotor assessment; (7) variable stability demo flights including HOFCS.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) navigation management systems; (2) autopilot or AFCS; (3) night vision goggles or electro-optics; (4) glass cockpit evaluation;

	(e) height and velocity envelope and EOL, including relights
	(f) category A procedure
	(g) vibrations and rotor adjustments
	(h) auto rotations
	(i) final evaluation exercise (a flight test report should be developed)

(g) Condition 2 courses for helicopters

(1) These courses should include approximately:

(i) 150 hours of ground training;

(ii) 50 hours of flight test training, during which at least eight flights should be made without an instructor on board.

Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity, as well as safety assessments should be taught.

(2) These courses should include instruction on at least four different helicopters types, of which at least one should be certificated in accordance with CS-29 standards or equivalent airworthiness codes.

(3) During the course the student should be required to develop at least three substantial flight test reports.

(4) The student should be evaluated through examinations on all of the theoretical knowledge subjects, and undertake a final in-flight test upon completion of the syllabus.

(5) Syllabus. The following subjects should be covered in the course:

CONDITION 2 - HELICOPTERS		
Theoretical knowledge	(a) aerodynamics; (b) stability and control or handling qualities; (c) engines and performance; (d) measurements and flight test instrumentation (including telemetry).	
Flight test techniques and flight training	(a) performance: (at least one flight test report should be developed)	(1) air speed calibration; (2) level flight, climb and descent, vertical and hover performance.
	(b) engines	(1) digital engines governing; (2) turbine or piston engine evaluation.
	(c) handling qualities	(1) flight control characteristics;

		(2) longitudinal static, dynamic stability and control or handling qualities; (3) lateral, directional stability and control or handling qualities.
	(d) systems (at least one flight test report should be developed)	At least three different systems, for example: (1) navigation management systems; (2) autopilot or AFCS; (3) night vision goggles or electro-optics; (4) glass cockpit evaluation.
	(e) vibration and rotor adjustments	
	(f) final evaluation exercise (a flight test report should be developed)	

AMC1 FCL.825(a) En Route instrument rating (EIR)

GENERAL

Since the privileges of the EIR are only to be exercised in the en route phase of flight, holders of an EIR should:

(a) at no time accept an IFR clearance to fly a departure, arrival or approach procedure;

(b) notify the ATS if unable to complete a flight within the limitations of their rating.

CONDITIONS FOR THE EXERCISE OF THE PRIVILEGES OF AN EN ROUTE INSTRUMENT RATING (EIR)

(c) To comply with FCL.825(a)(2), the holder of an EIR should not commence or continue a flight during which it is intended to exercise the privileges of the rating unless the appropriate weather reports or forecasts for the destination and alternate aerodrome for the period from one hour before until one hour after the planned time of arrival indicates VMC. The flight may be planned only to aerodromes for which such meteorological information is available. When filing a flight plan, the holder of an EIR should include suitable VFR to IFR and IFR to VFR transitions. In any case, the pilot needs to apply the relevant operational rules, which ever are more limiting.

(d) A suitable VFR to IFR transition is any navigational fix

(1) to which the flight can be safely conducted under VFR; and

(2) which is acceptable to ATS if available.

(e) A suitable IFR to VFR transition is any navigational fix

(1) to which the flight can be safely conducted under IFR;

(2) at which VMC conditions exist; and

(3) from where the flight can be safely continued under VFR without having to follow instrument arrival or approach procedures.

AMC1 FCL.825(c) En route instrument rating (EIR)

FLYING TRAINING

The flight instruction for the EIR should comprise the following flying exercises:

(a) pre-flight procedures for IFR flights, including the use of the flight manual, meteorological information, appropriate air traffic service documents, filing of an IFR flight plan, including VFR/IFR transitions and diversions;

(b) use of appropriate IFR and VFR charts;

(c) basic instrument flight by sole reference to instruments:

— horizontal flight,

— climbing,

— descending,

— turns in level flight, climbing, descending;

(d) steep turns and recovery from unusual attitudes on full and limited panel;

(e) normal flight on limited panel;

(f) instrument pattern;

(g) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

— transition from visual to instrument flight after departure,

— en route IFR procedures,

— en route holding procedures,

— transition from instrument flight en route to visual before reaching the Minimum Sector Altitude (MSA);

(h) radio navigation (GPS/VOR);

(i) use of advanced equipment such as autopilot, flight director, stormscope, de-icing equipment, EFIS or radar, as available;

(j) emergency procedures covering the deterioration of meteorological conditions;

(k) at least two IFR approaches in the context of an emergency situation;

(l) use of RT techniques in order to gain a competence to a high standard;

(m) if required, operation of a multi-engine aeroplane during the above range of exercises to include engine failures and cruise flight with one engine simulated inoperative;

(n) the flight instruction should also include at least two flights in controlled airspace under IFR with a high density of traffic and VFR arrivals and departures from aerodromes with a mixture of instrument and visual traffic.

AMC2 FCL.825(d) En route instrument rating (EIR)

THEORETICAL KNOWLEDGE INSTRUCTION AND EXAMINATION

(a) GENERAL

The theoretical knowledge instruction and examination is the same as for the instrument rating following the competency-based modular course according to Appendix 6 Aa.

(b) THEORETICAL KNOWLEDGE

The applicant should complete an approved competency-based IR(A) or EIR theoretical knowledge (TK) course. The approved CB-IR(A) or EIR TK course may contain computer-based training, e-learning elements, interactive video, slide/tape presentation, learning carrels and other media as approved by the authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom teaching, as required by ORA.ATO.305, has to be provided.

(c) THEORETICAL KNOWLEDGE EXAMINATION

The number of questions per subject, the distribution of questions and the time allocated to each subject is detailed in AMC2 ARA.FCL.300(b).

GM1 FCL.825(d) En route instrument rating (EIR)

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES FOR EIR

For the detailed theoretical knowledge syllabus and learning objectives, refer to GM1 FCL.615(b).

AMC1 FCL.825(e); (g) En route instrument rating (EIR)

SK**ILL TEST/PROFICIENCY CHECK FOR THE ISSUE, REVALIDATION, OR RENEWAL OF AN EN ROUTE INSTRUMENT RATING (EIR)**

(a) An applicant for an EIR should have received instrument flight instruction on the same type or class of aeroplane to be used in the test/check.

(b) An applicant should pass all the relevant sections of the skill test/proficiency check. If any item in a section is failed, that section is failed. Failure in more than one section will require the applicant to take the entire test/check again. An applicant failing only one section should only repeat the failed section. Failure in any section of the retest/recheck, including those sections that have been passed on a previous attempt, requires the applicant to take the entire test/check again. All sections of the skill test/proficiency check should be completed within six months. Failure to achieve a pass in all sections of the test/check in two attempts requires further training.

(c) Further training may be required following a failed skill test/proficiency check. There is no limit to the number of skill tests/proficiency checks that may be attempted.

CONDUCT OF THE TEST/CHECK

(d) The test/check is intended to simulate a practical flight. The route to be flown shall be chosen by the examiner. An essential element is the ability of the applicant to plan and conduct the flight from routine briefing material. The applicant should undertake the flight planning and should ensure that all equipment and documentation for the execution of the flight are on board. The duration of the flight should be at least 60 minutes.

(e) Should the applicant choose to terminate a skill test/proficiency check for reasons considered inadequate by the flight examiner, the applicant should retake the entire skill test/proficiency check. If the test/check is terminated for reasons considered adequate by the examiner, only those sections not completed should be tested in a further flight.

(f) At the discretion of the examiner any manoeuvre or procedure of the test/check may be repeated once by the applicant. The examiner may stop the test/check at any stage if it is considered that the applicant's demonstration of flying skill requires a complete retest/recheck.

(g) An applicant should fly the aeroplane from a position where the pilot-in-command functions can be performed and to carry out the test/check as if there is no other crew member. Responsibility for the flight should be allocated in accordance with national regulations.

(h) Minimum descent heights/altitudes and the transition points should be determined by the applicant and agreed by the examiner.

(i) An applicant for an EIR should indicate to the examiner the checks and duties carried out, including the identification of radio facilities. The checks should be completed in accordance with the authorised checklist for the aeroplane on which the test/check is being taken. During pre-flight preparation for the test/check the applicant should determine power settings and speeds. Performance data for take-off, approach and landing should be calculated by the applicant in compliance with the operations manual or flight manual for the aeroplane used.

FLIGHT TEST TOLERANCES

(j) The applicant should demonstrate the ability to:

– operate the aeroplane within its limitations;

– complete all manoeuvres with smoothness and accuracy;

– exercise good judgment and airmanship;

– apply aeronautical knowledge; and

– maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.

(k) The following limits should apply, corrected to make allowance for turbulent conditions, and the handling qualities and performance of the aeroplane used

Height

Generally ±100 feet

Tracking

on radio aids ±10°

Heading

all engines operating ±10° with simulated engine failure ±15°

Speed

all engines operating +10 knots/–5 knots with simulated engine failure +15 knots/–5 knots

CONTENT OF THE SKILL TEST/PROFICIENCY CHECK

SECTION 1 **PRE-FLIGHT OPERATIONS AND DEPARTURE**	
Use of checklist, airmanship, anti/de-icing procedures, etc., apply in all sections.	
a	Use of flight manual (or equivalent) especially a/c performance calculation, mass and balance
b	Use of ATC document, weather document
c	Preparation of ATC flight plan, IFR flight plan/log
d	Pre-flight inspection
e	Weather Minima
f	Taxiing
g	Pre-take-off briefing. Take-off
h	ATC liaison: compliance, R/T procedures
SECTION 2 **GENERAL HANDLING**	
a	Control of the aeroplane by reference solely to instruments, including: level flight at various speeds, trim
b	Climbing and descending turns with sustained Rate 1 turn
c	Recoveries from unusual attitudes, including sustained 45° bank turns and steep descending turns
d	Recovery from approach to stall in level flight, climbing/descending turns and in landing configuration
e	Limited panel, stabilised climb or descent at Rate 1 turn onto given headings, recovery from unusual attitudes
SECTION 3 **EN ROUTE IFR PROCEDURES**	
a	Transition to instrument flight
b	Tracking, including interception, e.g. NDB, VOR, RNAV
c	Use of radio aids
d	Level flight, control of heading, altitude and airspeed, power setting, trim technique
e	Altimeter settings
f	Timing and revision of ETAs (En route hold — if required)
g	Monitoring of flight progress, flight log, fuel usage, systems management
h	Simulated emergency situation(s)
i	Ice protection procedures, simulated if necessary
j	Simulated diversion to alternate aerodrome
k	Transition to visual flight
l	ATC liaison and compliance, R/T procedures
SECTION 4	
	Intentionally left blank
SECTION 5	
a	Setting and checking of navigational aids, identification of facilities
b	Arrival procedures, altimeter settings
c	Approach and landing briefing, including descent/approach/landing checks
d	Visual landing
e	ATC liaison: compliance, R/T procedures
SECTION 6 (multi-engine aeroplanes only) **Flight with one engine inoperative**	
a	Simulated engine failure during en route phase of flight

b	ATC liaison: compliance, R/T procedures

AMC1 FCL.825(g)(2)) En route instrument rating (EIR)

TRAINING FLIGHT FOR REVALIDATION

(a) The training flight for the revalidation of an EIR should be based on the exercise items of the EIR proficiency check as deemed relevant by the instructor and should depend on the experience of the candidate. The training flight should include a briefing including a discussion on threat and error management with a special emphasis on decision making when encountering adverse meteorological conditions, unintentional Instrument Meteorological Conditions (IMC) and navigation flight capabilities.

(b) In any case, a simulated diversion and instrument approach to an alternate aerodrome in the context of an emergency situation during the en route phase in IFR should be demonstrated by the instructor.

AMC1 FCL.825(h) En route instrument rating (EIR)

PRE-ENTRY ASSESSMENT AND TRAINING RECORD

(a) PRE-ENTRY ASSESSMENT

The assessment to establish the amount of training to be credited and to identify the training needs should be based on the EIR training syllabus established in AMC1 FCL.825(c).

(b) TRAINING RECORD

(1) Before initiating the assessment, the applicant should provide the ATO with a training record containing the details of the previous flight training provided by the IRI(A) or the FI(A). This training record should at least specify the aircraft type and registration used for the training, the number of flights and the total amount of instrument flight time under instruction. It should also specify all the exercises completed during the training by using the syllabus contained in AMC1 FCL.825(c).

(2) The instructor(s) having provided the training should keep the training records containing all the details of the flight training given for a period of at least 5 years after the completion of the training.

AMC2 FCL.825(h) En route instrument rating (EIR)

TRAINING AIRCRAF**T**

The aeroplane used for the instrument flight time under instruction provided outside an ATO by an IRI(A) or FI(A) should be:

(a) fitted with primary flight controls that are instantly accessible by both the student and the instructor (for example dual flight controls or a centre control stick). Swing-over flight controls should not be used; and

(b) suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required.

AMC1 FCL.825(i) En route instrument rating (EIR)

CREDITING ON THE BASIS OF A THIRD COUNTRY IR(A) RATING

In order to be credited in full towards the multi-engine EIR training course requirements, the applicant should:

(a) hold a multi-engine IR(A), issued in accordance with the requirements of Annex 1 to the Chicago Convention by a third country;

(b) have the minimum experience required in FCL.825 paragraph (i)(3), of which at least 4 hours should be completed in a multi-engine aeroplane.

AMC1 FCL.830 Sailplane Cloud Flying Rating

THEORETICAL KNOWLEDGE INSTRUCTION AND FLIGHT INSTRUCTION

1. THEORETICAL KNOWLEDGE INSTRUCTION

The theoretical knowledge syllabus should cover the revision and/or explanation of:

1.1. Human Factors and Body Limitations

— basic aviation physiology in regards cloud flying aspects

— basic aviation psychology

— spatial disorientation

1.2. Principles of Flight

— stability

— control

— limitations (load factor and manoeuvres)

1.3. Aircraft Instrumentation

— sensors and instruments

— measurement of air data parameters

— gyroscopic instruments

1.4. Navigation

— use of GPS

— use of charts

— dead reckoning navigation (DR)

— air traffic regulations — airspace structure

— aeronautical information service

— Member State regulations regarding cloud flying

1.5. Communications

— VHF communications

— relevant weather information terms

1.6. Hazards and Emergency Procedures

— icing

— cloud escape procedures

— anti-collision instruments/avionics

2. FLYING TRAINING

2.1. The exercises of the sailplane cloud flight instruction syllabus should be repeated as necessary until the student achieves a safe and competent standard and should comprise at least the following practical training items, flown solely by reference to instruments:

— straight flight

— turning

— achieving and maintaining heading

— return to straight flight from steeper angle of bank

— position fixing using GPS and aeronautical charts

— position estimating using DR

— basic cloud escape manoeuvre/unusual attitude

— advanced cloud escape manoeuvre on nominated heading

2.2. Only exercises under simulated IMC should be conducted in a TMG. However, at least one hour cloud flying training must be flown in a sailplane or powered sailplane (excluding TMG).

AMC2 FCL.830 Sailplane Cloud Flying Rating

SKILL TEST AND PROFICIENCY CHECK

The skill test for the issue of the cloud flying rating or the proficiency check for fulfilling the requirements in FCL.830(b)(3) and in FCL.830(e)(1) should be conducted in either a sailplane or a powered sailplane (including TMG if the test or check will be flown under simulated IMC only) and should contain the following elements:

(a) ORAL EXAMINATION

This part should be completed before the flight and should cover all the relevant parts of the theoretical knowledge syllabus. At least one question for each of the following sections should be asked:

— Human performance and body limitations;

— Principles of flight;

— Aircraft instrumentation for cloud flying;

— Navigation;

— Communications;

— Hazards and emergency procedures.

If the oral examination reveals a lack in theoretical knowledge, the flight test should not be done and the skill test/proficiency check is failed.

(b) PRACTICAL SKILL TEST/PROFICIENCY CHECK

During the practical test/check, the following limits should apply with appropriate allowance for turbulent conditions and the handling qualities and performance of the sailplane used. Artificial horizon or turn and slip instruments should be used as appropriate:

	Artificial Horizon	Turn & Slip
Straight flight	Heading + 10° IAS + 10kts	Heading + 20° IAS + 15kts
Turning	Angle of bank + 15° IAS + 10kts	Small deviations in rate of turn with a maximum
		deviation between ½ & full scale IAS + 15ts
Position fixing given:	+ 2NM	+ 3NM

GPS displaying range and bearing to a point		

During the practical test/check, the following exercises should be successfully completed by the applicant, flown solely by reference to instruments and taking into account the limits above:

— straight flight;

— turning;

— achieving and maintaining heading;

— return to straight flight from steeper angle of bank;

— position fixing using GPS and aeronautical charts;

— position estimating using DR;

— basic cloud escape manoeuvre/unusual attitude;

— advanced cloud escape manoeuvre on nominated heading.

SUBPART J — INSTRUCTORS

GM1 FCL.900 Instructor certificates

GENERAL

(a) Nine instructor categories are recognised:

(1) FI certificate: aeroplane (FI(A)), helicopter (FI(H)), airship (FI(As)), sailplane (FI(S)) and balloon (FI(B));

(2) TRI certificate: aeroplane (TRI(A)), helicopter (TRI(H)), powered-lift aircraft (TRI(PL));

(3) CRI certificate: aeroplane (CRI(A));

(4) IRI certificate: aeroplane (IRI(A)), helicopter (IRI(H)) and airship (IRI(As));

(5) SFI certificate: aeroplane (SFI(A)), helicopter (SFI(H)) and powered-lift aircraft (SFI(PL));

(6) MCCI certificate: aeroplanes (MCCI(A)), helicopters (MCCI(H)), powered-lift aircraft(MCCI(PL)) and airships (MCCI(As));

(7) STI certificate: aeroplane (STI(A)) and helicopter (STI(H));

(8) MI certificate: (MI);

(9) FTI certificate: (FTI).

(b) For categories (1) to (4) and for (8) and (9) the applicant needs to hold a pilot licence. For categories (5) to (7) no licence is needed, only an instructor certificate.

(c) A person may hold more than one instructor certificate.

SPECIAL CONDITIONS

(a) When new aircraft are introduced, requirements such as to hold a licence and rating equivalent to the one for which instruction is being given, or to have adequate flight experience, may not be possible to comply with. In this case, to allow for the first instruction courses to be given to applicants for licences or ratings for these aircraft, competent authorities need the possibility to issue a specific certificate that does not have to comply with the requirements established in this Subpart.

(b) The competent authority should only give these certificates to holders of other instruction qualifications. As far as possible, preference should be given to persons with at least 100 hours of experience in similar types or classes of aircraft.

(c) When the new aircraft type introduced in an operator's fleet already existed in a Member State, the competent authority should only give the specific certificate to an applicant that is qualified as PIC on that aircraft.

(d) The certificate should ideally be limited in validity to the time needed to qualify the first instructors for the new aircraft in accordance with this Subpart, but in any case it should not exceed the 1 year established in the rule.

AMC1 FCL.920 Instructor competencies and assessment

(a) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching and assessing threat and error management and CRM.

(b) The training and assessment of instructors should be made against the following performance standards:

Competence	Performance	Knowledge
Prepare resources	(a) ensures adequate facilities; (b) prepares briefing material; (c) manages available tools.	(a) understand objectives; (b) available tools; (c) competency-based training methods.
Create a climate conducive to learning	(a) establishes credentials, role models appropriate behaviour; (b) clarifies roles; (c) states objectives; (d) ascertains and supports trainees needs.	(a) barriers to learning; (b) learning styles.
Present knowledge	(a) communicates clearly; (b) creates and sustains realism; (c) looks for training opportunities.	teaching methods.
Integrate TEM or CRM	makes TEM or CRM links with technical training.	HF, TEM or CRM.
Manage time to achieve training objectives	allocates time appropriate to achieving competency objective.	syllabus time allocation.
Facilitate learning	(a) encourages trainee participation; (b) shows motivating, patient, confident and assertive manner; (c) conducts one-to-one coaching; (d) encourages mutual support.	(a) facilitation; (b) how to give constructive feedback; (c) how to encourage trainees to ask questions and seek advice;
Assesses trainee performance	(a) assesses and encourages trainee self-assessment of performance against competency standards; (b) makes assessment decision and provide clear feedback; (c) observes CRM behaviour.	(a) observation techniques; (b) methods for recording observations.
Monitor and review progress	(a) compares individual outcomes to defined objectives; (b) identifies individual differences in learning rates;	(a) learning styles; (b) strategies for training adaptation to meet individual needs.

	(c) applies appropriate corrective action.	
Evaluate training sessions	(a) elicits feedback from trainees; (b) tracks training session processes against competence criteria; (c) keeps appropriate records.	(a) competency unit and associated elements; (b) performance criteria.
Report outcome	reports accurately using only observed actions and events.	(a) phase training objectives; (b) individual versus systemic weaknesses.

AMC1 FCL.925 Additional requirements for instructors for the MPL

MPL INSTRUCTOR COURSE

(a) The objectives of the MPL instructors training course are to train applicants to deliver training in accordance with the features of a competency-based approach to training and assessment.

(b) Training should be both theoretical and practical. Practical elements should include the development of specific instructor skills, particularly in the area of teaching and assessing threat and error management and CRM in the multi-crew environment.

(c) The course is intended to adapt instructors to conduct competency-based MPL training. It should cover the items specified below:

THEORETICAL KNOWLEDGE

(d) Integration of operators and organisations providing MPL training:

(1) reasons for development of the MPL;

(2) MPL training course objective;

(3) adoption of harmonised training and procedures;

(4) feedback process.

(e) The philosophy of a competency-based approach to training: principles of competency-based training.

(f) Regulatory framework, instructor qualifications and competencies:

(1) source documentation;

(2) instructor qualifications;

(3) syllabus structure.

(g) Introduction to Instructional systems design methodologies (see ICAO PANS-TRG Doc):

(1) analysis;

(2) design and production;

(3) evaluation and revision.

(h) Introduction to the MPL training scheme:

(1) training phases and content;

(2) training media;

(3) competency units, elements and performance criteria.

(i) Introduction to human performance limitations, including the principles of threat and error management and appropriate countermeasures developed in CRM:

(1) definitions;

(2) appropriate behaviours categories;

(3) assessment system.

(j) Application of the principles of threat and error management and CRM principles to training:

(1) application and practical uses;

(2) assessment methods;

(3) individual corrective actions;

(4) debriefing techniques.

(k) The purpose and conduct of assessments and evaluations:

(1) basis for continuous assessment against a defined competency standard;

(2) individual assessment;

(3) collection and analysis of data;

(4) training system evaluation.

PRACTICAL TRAINING

(l) Practical training may be conducted by interactive group classroom modules, or by the use of training devices. The objective is to enable instructors to:

(1) identify behaviours based on observable actions in the following areas:

(i) communications;

(ii) team working;

(iii) situation awareness;

(iv) workload management;

(v) problem solving and decision making.

(2) analyse the root causes of undesirable behaviours;

(3) debrief students using appropriate techniques, in particular:

(i) use of facilitative techniques;

(ii) encouragement of student self-analysis.

(4) agree corrective actions with the students;

(5) determine achievement of the required competency.

AMC2 FCL.925(d)(1) Additional requirements for instructors for the MPL

RENEWAL OF PRIVILEGES: REFRESHER TRAINING

(a) Paragraph (d) of FCL.925 determines that if the applicant has not complied with the requirements to maintain his/her privileges to conduct competency-based approach training, he or she shall receive refresher training at an ATO to reach the level of competence necessary to pass the assessment of instructor competencies. The amount of refresher training needed should be determined on a case-by-case basis by the ATO, taking into account the following factors:

  (1) the experience of the applicant;

  (2) the amount of time lapsed since the last time the applicant has conducted training in an MPL course. The amount of training needed to reach the desired level of competence should increase with the time lapsed. In some cases, after evaluating the instructor, and when the time lapsed is very limited, the ATO may even determine that no further refresher training is necessary.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme, which should be based on the MPL instructor course and focus on the aspects where the applicant has shown the greatest needs.

GM1 FCL.925 Additional requirements for instructors for the MPL

MPL INSTRUCTORS

The following table summarises the instructor qualifications for each phase of MPL integrated training course:

Phase of training	Qualification
Line flying under supervision according to operational requirements	Line training captain or TRI(A)
Phase 4: Advanced base training	TRI(A)
Phase 4: Advanced skill test	TRE(A)
Phase 4: Advanced	SFI(A) or TRI(A)
Phase 3: Intermediate	SFI(A) or TRI(A)
Phase 2: Basic	(a) FI(A) or IRI(A) and IR(A)/ME/MCC and 1500 hours multi-crew environment and IR(A) instructional privileges, or (b) FI(A) and MCCI(A), or (c) FI(A) and SFI(A), or (d) FI(A) and TRI(A)
Phase 1: Core flying skills	FI(A) and 500 hours, including 200 hours of instruction Instructor qualifications and privileges should be in accordance with the training items within the phase. STI for appropriate exercises conducted in an FNPT or BITD.

AMC1 FCL.935 Assessment of competence

GENERAL

(a) The format and application form for the assessment of competence are determined by the competent authority.

(b) When an aircraft is used for the assessment, it should meet the requirements for training aircraft.

(c) If an aircraft is used for the test or check, the examiner acts as the PIC, except in circumstances agreed upon by the examiner when another instructor is designated as PIC for the flight.

(d) During the skill test the applicant occupies the seat normally occupied by the instructor (instructors seat if in an FSTD, or pilot seat if in an aircraft), except in the case of balloons. The examiner, another instructor or, for MPA in an FFS, a real crew under instruction, functions as the 'student'. The applicant is required to explain the relevant exercises and to demonstrate their conduct to the 'student', where appropriate. Thereafter, the 'student' executes the same manoeuvres (if the 'student' is the examiner or another instructor, this can include typical mistakes of inexperienced students). The applicant is expected to correct mistakes orally or, if necessary, by intervening physically.

(e) The assessment of competence should also include additional demonstration exercises, as decided by the examiner and agreed upon with the applicant before the assessment. These additional exercises should be related to the training requirements for the applicable instructor certificate.

(f) All relevant exercises should be completed within a period of 6 months. However, all exercises should, where possible, be completed on the same day. In principle, failure in any exercise requires a retest covering all exercises, with the exception of those that may be retaken separately. The examiner may terminate the assessment at any stage if they consider that a retest is required.

AMC2 FCL.935 Assessment of competence

MCCI, STI AND MI

In the case of the MCCI, STI and MI, the instructor competencies are assessed continuously during the training course.

AMC3 FCL.935 Assessment of competence

CONTENT OF THE ASSESSMENT FOR THE FI

(a) In the case of the FI, the content of the assessment of competence should be the following:

SECTION 1 THEORETICAL KNOWLEDGE ORAL	
1.1	Air law
1.2	Aircraft general knowledge
1.3	Flight performance and planning
1.4	Human performance and limitations
1.5	Meteorology
1.6	Navigation
1.7	Operational procedures
1.8	Principles of flight
1.9	Training administration

Sections 2 and 3 selected main exercises:

SECTION 2 PRE-FLIGHT BRIEFING	
2.1	Visual presentation
2.3	Technical accuracy
2.4	Clarity of explanation
2.5	Clarity of speech
2.6	Instructional technique
2.7	Use of models and aids
2.8	Student participation

SECTION 3 FLIGHT	
3.1	Arrangement of demo
3.2	Synchronisation of speech with demo
3.3	Correction of faults
3.4	Aircraft handling
3.5	Instructional technique
3.6	General airmanship and safety
3.7	Positioning and use of airspace

SECTION 4 ME EXERCISES	
4.1	Actions following an engine failure shortly after take-off[1]
4.2	SE approach and go-around[1]
4.3	SE approach and landing[1]

[1] These exercises are to be demonstrated at the assessment of competence for FI for ME aircraft.

SECTION 5 POST-FLIGHT DE-BRIEFING	
5.1	Visual presentation
5.2	Technical accuracy
5.3	Clarity of explanation
5.4	Clarity of speech
5.5	Instructional technique
5.6	Use of models and aids
5.7	Student participation

(b) Section 1, the oral theoretical knowledge examination part of the assessment of competence, is for all FI and is subdivided into two parts:

(1) The applicant is required to give a lecture under test conditions to other 'student(s)', one of whom will be the examiner. The test lecture is to be selected from items of section 1. The amount of time for preparation of

the test lecture is agreed upon beforehand with the examiner. Appropriate literature may be used by the applicant. The test lecture should not exceed 45 minutes;

(2) The applicant is tested orally by an examiner for knowledge of items of section 1 and the 'core instructor competencies: teaching and learning' content given in the instructor courses.

(c) Sections 2, 3 and 5 are for all FIs. These sections comprise exercises to demonstrate the ability to be an FI (for example instructor demonstration exercises) chosen by the examiner from the flight syllabus of the FI training courses. The applicant is required to demonstrate FI abilities, including briefing, flight instruction and de-briefing.

(d) Section 4 comprises additional instructor demonstration exercises for an FI for ME aircraft. This section, if applicable, is done in an ME aircraft, or an FFS or FNPT II simulating an ME aircraft. This section is completed in addition to sections 2, 3 and 5.

AMC4 FCL.935 Assessment of competence

CONTENT OF THE ASSESSMENT FOR THE SFI

The assessment should consist of at least 3 hours of flight instruction related to the duties of an SFI on the applicable FFS or FTD 2/3.

AMC5 FCL.935 Assessment of competence

REPORT FORMS FOR THE INSTRUCTOR CERTIFICATES

(a) Assessment of competence form for the FI, IRI and CRI certificates:

APPLICATION AND REPORT FORM FOR THE INSTRUCTOR ASSESSMENT OF COMPETENCE			
1	**Applicants personal particulars:**		
Applicant's last name(s):		First name(s):	
Date of birth:		Tel (home):	Tel (work):
Address:		Country:	

2	**Licence details**		
Licence type:		Number:	
Class ratings included in the licence:		Exp. Date:	
Type ratings included in the licence:	1.		
	2.		
	3.		
	4.		
	5.		
Other ratings included in the licence:	1.		
	2.		
	3.		
	4.		
	5.		

3	**Pre-course flying experience**			
Total flying hours	PIC SEP or TMG hours	SEP preceding 6 months	Instrument flight instruction	Cross-country hours

4	**Pre-entry flight test**
I recommend ....for the FI course.	

Name of ATO:	Date of flight test:
Name(s) of FI conducting the test (capital letters):	
Licence number:	
Signature:	

5	**Declaration by the applicant**				
I have received a course of training in accordance with the syllabus for the: *(tick as applicable)*					
FI certificate FI(A)/(H)/(As)		IRI certificate IRI(A)/(H)/(As)		CRI certificate CRI(A)	
Applicant's name(s): (capital letters)			Signature:		
6	**Declaration by the CFI**				
I certify that .... has satisfactorily completed an approved course of training for the					
FI certificate FI(A)/(H)/(As)		IRI certificate IRI(A)/(H)/(As)		CRI certificate CRI(A)	
in accordance with the relevant syllabus.					
Flying hours during the course:					
Aircraft or FSTDs used :					
Name(s) of CFI:					
Signature:					
Name of ATO:					

7	**Flight instructor examiner's certificate**		
I have tested the applicant according to to Part-FCL			
A. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT (in case of partial pass):			
Theoretical oral examination:		Skill test:	
Passed	***Failed***	***Passed***	***Failed***
	I recommend further flight or ground training with an instructor before re-test		
	I do not consider further flight or theoretical instruction necessary before re-test *(tick as applicable)*		
B. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT:			
	FI certificate		
	IRI certificate		
	CRI certificate *(tick as applicable)*		

Name(s) of FIE (capital letters):	
Signature:	
Licence number:	Date:

(b) Report form for the FI for sailplanes

APPLICATION AND REPORT FORM FOR THE FI(S) ASSESSMENT OF COMPETENCE				
1	**Applicants personal particulars:**			
Applicant's last name(s):		First name(s):		
Date of birth:		Tel (home):	Tel (work):	
Address:		Country:		
2	**Licence Details**			
Licence type:		Number:		
TMG extension:				
3	**Pre-course flying experience**			
Total hours	PIC hours	Sailplane (PIC hours and take-offs)	TMG (PIC hours and take-offs)	
4	**Pre-entry flight test**			
I recommend ....for the FI course.				
Name of ATO:	Date of flight test:			
Name(s) of FI conducting the test (capital letters):				
Licence number:				
Signature:				
5	**Declaration by the applicant**			
I have received a course of training in accordance with the syllabus for the:				
FI certificate FI(S)				
Applicant's name(s): (capital letters)	Signature:			

6	Declaration by the chief flight instructor				
I certify that .... has satisfactorily completed a course of training for the					
FI certificate FI(S)					
In accordance with the relevant syllabus.					
Flying hours during the course:	Take-offs during the course:				
Sailplanes, powered sailplanes or TMGs used :					
Name(s) of CFI:					
Signature:					
Name of ATO:					

7	Flight instructor examiner's certificate		
I have tested the applicant according to Part-FCL			
A. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT (in case of partial pass):			
Theoretical oral examination:		Skill test:	
Passed	***Failed***	***Passed***	***Failed***
	I recommend further flight or ground training with an FI before re-test		
	I do not consider further flight or theoretical instruction necessary before re-test *(tick as applicable)*		
B. FLIGHT INSTRUCTOR EXAMINER'S ASSESSMENT:			
	FI certificate		
	Date:		
Name(s) of FIE (capital letters):			
Signature:			
Licence number:		Date:	

(c) Report form for the FI for balloons:

APPLICATION AND REPORT FORM FOR THE FI(B) ASSESSMENT OF COMPETENCE			
1	**Applicants personal particulars:**		
Applicant's last name(s):		First name(s):	
Date of birth:		Tel (home):	Tel (work):
Address:		Country:	

2	**Licence Details**		
Licence type:		Number:	
Class extensions:	1.	Groups:	
	2.	Groups:	
	3.	Groups:	

3	**Pre-course flying experience**			
Total flying hours in different groups	PIC hours	Hot-air balloon	Gas balloon	Hot-air airship

4	**Pre-entry flight test**
I recommend ....for the FI course	
Name of ATO:	Date of flight test:
Name(s) of FI conducting the test (capital letters):	
Licence number:	
Signature:	

5	**Declaration by the applicant**				
I have received a course of training in accordance with the syllabus for the:					
FI certificate FI(B)					
Applicant's name(s): (capital letters)			Signature:		

6	**Declaration by the chief flight instructor**			
I certify that .... has satisfactorily completed a course of training for the				
FI certificate FI(B)				
in accordance with the relevant syllabus.				
Flying hours during the course:	Take-offs during the course:			
Balloons, hot-air airships used:				
Name(s) of CFI:				
Signature:				

<table>
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<tr><td colspan="5">I have tested the applicant according to Part-FCL</td></tr>
<tr><td colspan="5">A – FLIGHT INSTRUCTOR EXAMINER’S ASSESSMENT
in case of partial pass:</td></tr>
<tr><td colspan="2">Theoretical oral examination:</td><td colspan="3">Skill test:</td></tr>
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<tr><td></td><td colspan="4">I recommend further flight or ground training with an FI before re-test</td></tr>
<tr><td></td><td colspan="4">I do not consider further flight or theoretical instruction necessary before re-test
(tick as applicable)</td></tr>
<tr><td colspan="5">B – FLIGHT INSTRUCTOR EXAMINER’S ASSESSMENT:</td></tr>
<tr><td></td><td colspan="4">FI certificate</td></tr>
<tr><td colspan="5">Name(s) of FIE (capital letters):</td></tr>
<tr><td colspan="5">Signature:</td></tr>
<tr><td colspan="3">Licence number:</td><td colspan="2">Date:</td></tr>
</table>

AMC1 FCL.930.FI FI — Training course

FI(A), FI(H) AND FI(AS) TRAINING COURSE

GENERAL

(a) The aim of the FI training course is to train aircraft licence holders to the level of competence defined in FCL.920.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the FI task including at least the following:

  (1) refresh the technical knowledge of the student instructor;

  (2) train the student instructor to teach the ground subjects and air exercises;

  (3) ensure that the student instructor's flying is of a sufficiently high standard;

  (4) teach the student instructor the principles of basic instruction and to apply them at the PPL level.

FLIGHT INSTRUCTION

(c) The remaining 5 hours in FCL.930.FI (b)(3) may be mutual flying (that is, two applicants flying together to practice flight demonstrations).

(d) The skill test is additional to the course training time.

CONTENT

(e) The training course consists of two parts:

  (1) Part 1, theoretical knowledge, including the teaching and learning instruction that should comply with AMC1 FCL.920;

  (2) Part 2, flight instruction.

Part 1

TEACHING AND LEARNING

(a) The course should include at least 125 hours of theoretical knowledge instruction, including at least 25 hours teaching and learning instruction.

CONTENT OF THE TEACHING AND LEARNING INSTRUCTIONS (INSTRUCTIONAL TECHNIQUES):

(b) The learning process:

(1) motivation;

(2) perception and understanding;

(3) memory and its application;

(4) habits and transfer;

(5) obstacles to learning;

(6) incentives to learning;

(7) learning methods;

(8) rates of learning.

(c) The teaching process:

(1) elements of effective teaching;

(2) planning of instructional activity;

(3) teaching methods;

(4) teaching from the 'known' to the 'unknown';

(5) use of 'lesson plans'.

(d) Training philosophies:

(1) value of a structured (approved) course of training;

(2) importance of a planned syllabus;

(3) integration of theoretical knowledge and flight instruction;

(e) Techniques of applied instruction:

(1) theoretical knowledge: classroom instruction techniques:

(i) use of training aids;

(ii) group lectures;

(iii) individual briefings;

(iv) student participation or discussion.

(2) flight: airborne instruction techniques:

(i) the flight or cockpit environment;

(ii) techniques of applied instruction;

(iii) post-flight and in-flight judgement and decision making.

(f) Student evaluation and testing:

(1) assessment of student performance:

(i) the function of progress tests;

(ii) recall of knowledge;

(iii) translation of knowledge into understanding;

(iv) development of understanding into actions;

(v) the need to evaluate rate of progress.

(2) analysis of student errors:

(i) establish the reason for errors;

(ii) tackle major faults first, minor faults second;

(iii) avoidance of over criticism;

(iv) the need for clear concise communication.

(g) Training programme development:

(1) lesson planning;

(2) preparation;

(3) explanation and demonstration;

(4) student participation and practice;

(5) evaluation.

(h) Human performance and limitations relevant to flight instruction:

(1) physiological factors:

(i) psychological factors;

(ii) human information processing;

(iii) behavioural attitudes;

(iv) development of judgement and decision making.

(2) threat and error management.

(i) Specific hazards involved in simulating systems failures and malfunctions in the aircraft during flight:

(i) importance of 'touch drills';

(ii) situational awareness;

(iii) adherence to correct procedures.

(j) Training administration:

(1) flight or theoretical knowledge instruction records;

(2) pilot's personal flying logbook;

(3) the flight or ground curriculum;

(4) study material;

(5) official forms;

(6) flight manual or equivalent document (for example owner's manual or pilot's operating handbook);

(7) flight authorisation papers;

(8) aircraft documents;

(9) the private pilot's licence regulations.

A. Aeroplanes

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(A) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include information on how the flight will be conducted, who is to fly the aeroplane and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

(1) the aim;

(2) principles of flight (briefest reference only);

(3) the air exercise(s) (what, and how and by whom);

(4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(A) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(A).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) If the privileges of the FI(A) certificate are to include instruction for night flying, exercises 19 and 20 of the flight instruction syllabus should be undertaken at night in addition to by day either as part of the course or subsequent to certification issue.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

LONG BRIEFINGS AND AIR EXERCISES

Note: though exercise 11b is not required for the PPL(A) course, it is a requirement for the FI course.

EXERCISE 1: FAMILIARISATION WITH tHE AEROPLANE

(a) Long briefing objectives:

- (1) introduction to the aeroplane;
- (2) explanation of the cockpit layout;
- (3) aeroplane and engine systems;
- (4) checklists, drills and controls;
- (5) propeller safety;
  - (i) precautions general;
  - (ii) precautions before and during hand turning;
  - (iii) hand swinging technique for starting (if applicable to type).
- (6) differences when occupying the instructor's seat;
- (7) emergency drills:
  - (i) action if fire in the air and on the ground: engine, cock or cabin and electrical fire;
  - (ii) system failure as applicable to type;
  - (iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

- (1) flight authorisation and aeroplane acceptance, including technical log (if applicable) and certificate of maintenance;
- (2) equipment required for flight (maps, etc.);
- (3) external checks;
- (4) internal checks;
- (5) student comfort, harness, seat or rudder pedal adjustment;
- (6) starting and warming up checks;
- (7) power checks;
- (8) running down, system checks and switching off the engine;
- (9) leaving the aeroplane, parking, security and picketing;
- (10) completion of authorisation sheet and aeroplane serviceability documents.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of primary flying controls: when laterally level and banked;

(2) further effect of ailerons and rudder;

(3) effect of inertia;

(4) effect of air speed;

(5) effect of slipstream;

(6) effect of power;

(7) effect of trimming controls;

(8) effect of flaps;

(9) operation of mixture control;

(10) operation of carburettor heat control;

(11) operation of cabin heat or ventilation systems;

(b) Air exercise:

(1) primary effects of flying controls: when laterally level and banked;

(2) further effects of ailerons and rudder;

(3) effect of air speed;

(4) effect of slipstream;

(5) effect of power;

(6) effect of trimming controls;

(7) effect of flaps;

(8) operation of mixture control;

(9) operation of carburettor heat control;

(10) operation of cabin heat or ventilation systems;

(11) effect of other controls as applicable.

EXERCISE 5: TAXIING

(a) Long briefing objectives:

(1) pre-taxiing checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) control of direction and turning (including manoeuvring in confined spaces);

(5) parking area procedures and precautions;

(6) effect of wind and use of flying controls;

(7) effect of ground surface;

(8) freedom of Rudder movement;

(9) marshalling signals;

(10) instrument checks;

(11) ATC procedures;

(12) emergencies: steering failure and brake failure.

(b) Air exercise:

(1) pre-taxiing checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) control of direction and turning;

(5) turning in confined spaces;

(6) parking area procedures and precautions;

(7) effect of wind and use of flying control;

(8) effect of ground surface;

(9) freedom of Rudder movement;

(10) marshalling signals;

(11) instrument checks;

(12) ATC procedures;

(13) emergencies: steering failure and brake failure.

EXERCISE 6: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) the forces;

(2) longitudinal stability and control in pitch;

(3) relationship of CG to control in pitch;

(4) lateral and directional stability (control of lateral level and balance);

(5) attitude and balance control;

(6) trimming;

(7) power settings and air speeds;

(8) drag and power curves;

(9) range and endurance.

(b) Air exercise:

(1) at normal cruising power;

(2) attaining and maintaining straight and level flight;

(3) demonstration of inherent stability;

(4) control in pitch, including use of elevator trim control;

(5) lateral level, direction and balance, use of rudder trim controls as applicable at selected air speeds (use of power):

(i) effect of drag and use of power (two air speeds for one power setting);

(ii) straight and level in different aeroplane configurations (flaps and landing gear);

(iii) use of instruments to achieve precision flight.

EXERCISE 7: CLIMBING

(a) Long briefing objectives:

(1) the forces;

(2) relationship between power or air speed and rate of climb (power curves maximum rate of climb (v_y));

(3) effect of mass;

(4) effect of flaps;

(5) engine considerations;

(6) effect of density altitude;

(7) the cruise climb;

(8) maximum angle of climb (v_x).

(b) Air exercise:

(1) entry and maintaining the normal maximum rate climb;

(2) levelling off;

(3) levelling off at selected altitudes;

(4) climbing with flaps down;

(5) recovery to normal climb;

(6) en-route climb (cruise climb);

(7) maximum angle of climb;

(8) use of instruments to achieve precision flight.

EXERCISE 8: DESCENDING

(a) Long briefing objectives:

(1) the forces;

(2) glide descent: angle, air speed and rate of descent;

(3) effect of flaps;

(4) effect of wind;

(5) effect of mass;

(6) engine considerations;

(7) power assisted descent: power or air speed and rate of descent;

(8) cruise descent;

(9) sideslip.

(b) Air exercise:

(1) entry and maintaining the glide;

(2) levelling off;

(3) levelling off at selected altitudes;

(4) descending with flaps down;

(5) powered descent: cruise descent (including effect of power and air speed);

(6) side-slipping (on suitable types);

(7) use of instrument to achieve precision flight.

EXERCISE 9: TURNING

(a) Long briefing objectives:

(1) the forces;

(2) use of controls;

(3) use of power;

(4) maintenance of attitude and balance;

(5) medium level turns;

(6) climbing and descending turns;

(7) slipping turns;

(8) turning onto selected headings: use of gyro heading indicator and magnetic compass.

(b) Air exercise:

(1) entry and maintaining medium level turns;

(2) resuming straight flight;

(3) faults in the turn (incorrect pitch, bank and balance);

(4) climbing turns;

(5) descending turns;

(6) slipping turns (on suitable types);

(7) turns to selected headings: use of gyro heading indicator and magnetic compass

(8) use of instruments to achieve precision flight;

Note: stall or spin awareness and avoidance training consists of exercises 10a, 10b and 11a.

EXERCISE 10a: SLOW FLIGHT

(a) Long briefing objectives:

(1) aeroplane handling characteristics during slow flight at:

(i) v_{s1} & v_{so} + 10 knots;

(ii) v_{s1} & v_{so} + 5 knots.

(2) slow flight during instructor induced distractions;

(2) effect of overshooting in configurations where application of engine power causes a strong 'nose-up' trim change.

(b) Air exercise:

(1) safety checks;

(2) introduction to slow flight;

(3) controlled slow flight in the clean configuration at:

(i) v_{s1} + 10 knots and with flaps down;

(ii) v_{so} + 10 knots;

(iii) straight and level flight;

(iv) level turns;

(v) climbing and descending;

(vi) climbing and descending turns.

(4) controlled slow flight in the clean configuration at:

(i) v_{s1} + 5 knots and with flaps down;

(ii) v_{so} + 5 knots;

(iii) straight and level flight;

(iv) level turns;

(v) climbing and descending;

(vi) climbing and descending turns;

(vii) descending 'unbalanced' turns at low air speed: the need to maintain balanced flight.

(5) 'instructor induced distractions' during flight at low air speed: the need to maintain balanced flight and a safe air speed;

(6) effect of going around in configurations where application of engine power causes a strong 'nose up' trim change.

EXERCISE 10b: STALLING

(a) Long briefing objectives:

(1) characteristics of the stall;

(2) angle of attack;

(3) effectiveness of the controls at the stall;

(4) factors affecting the stalling speed:

(i) effect of flaps, slats and slots;

(ii) effect of power, mass, CG and load factor.

(5) effects of unbalance at the stall;

(6) symptoms of the stall;

(7) stall recognition and recovery;

(8) stalling and recovery:

(i) without power;

(ii) with power on;

(iii) with flaps down;

(iv) maximum power climb (straight and turning flight to the point of stall with uncompensated yaw);

(v) stalling and recovery during manoeuvres involving more than 1 G (accelerated stalls, including secondary stalls and recoveries);

(vi) recovering from incipient stalls in the landing and other configurations and conditions;

(vii) recovering at the incipient stage during change of configuration;

(viii) stalling and recovery at the incipient stage with 'instructor induced' distractions.

Note: consideration is to be given to manoeuvre limitations and references to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance limitations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are also covered in the next exercise spinning.

(b) Air exercise:

(1) safety checks;

(2) symptoms of the stall;

(3) stall recognition and recovery:

(i) without power;

(ii) with power on;

(iii) recovery when a wing drops at the stall;

(iv) stalling with power 'on' and recovery;

(v) stalling with flap 'down' and recovery;

(vi) maximum power climb (straight and turning flight) to the point of stall with uncompensated yaw: effect of unbalance at the stall when climbing power is being used;

(vii) stalling and recovery during manoeuvres involving more than 1 G (accelerated stalls, including secondary stalls and recoveries);

(viii) recoveries from incipient stalls in the landing and other configurations and conditions;

(ix) recoveries at the incipient stage during change of configuration;

(x) instructor induced distractions during stalling.

Note: consideration of manoeuvre limitations and the need to refer to the aeroplane manual and weight (mass) and balance calculations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are to be covered in the next exercise: spinning.

EXERCISE 11a: SPIN RECOVERY AT THE INCIPIENT STAGE

(a) Long briefing objectives:

(1) causes, stages, autorotation and characteristics of the spin;

(2) recognition and recovery at the incipient stage: entered from various flight attitudes;

(3) aeroplane limitations.

(b) Air exercise:

(1) aeroplane limitations;

(2) safety checks;

(3) recognition at the incipient stage of a spin;

(4) recoveries from incipient spins entered from various attitudes with the aeroplane in the clean configuration, including instructor induced distractions.

EXERCISE 11b: SPIN RECOVERY AT THE DEVELOPED STAGE

(a) Long briefing objectives:

(1) spin entry;

(2) recognition and identification of spin direction;

(3) spin recovery;

(4) use of controls;

(5) effects of power or flaps (flap restriction applicable to type);

(6) effect of the CG upon spinning characteristics;

(7) spinning from various flight attitudes;

(8) aeroplane limitation;

(9) safety checks.

(b) Air exercise:

(1) aeroplane limitations;

(2) safety checks;

(3) spin entry;

(4) recognition and identification of the spin direction;

(5) spin recovery (reference to flight manual);

(6) use of controls;

(7) effects of power or flaps (restrictions applicable to aeroplane type);

(8) spinning and recovery from various flight attitudes.

EXERCISE 12: TAKE-OFF AND CLIMB TO DOWNWIND POSITION

(a) Long briefing objectives:

(1) handling: factors affecting the length of take-off run and initial climb;

(2) correct lift off speed, use of elevators (safeguarding the nose wheel), rudder and power;

(3) effect of wind (including crosswind component);

(4) effect of flaps (including the decision to use and the amount permitted);

(5) effect of ground surface and gradient upon the take-off run;

(6) effect of mass, altitude and temperature on take-off and climb performance;

(7) pre take-off checks;

(8) ATC procedure before take-off;

(9) drills, during and after take-off;

(10) noise abatement procedures;

(11) tail wheel considerations (as applicable);

(12) short or soft field take-off considerations or procedures;

(13) emergencies:

(i) aborted take-off;

(ii) engine failure after take-off.

(14) ATC procedures.

(b) Air exercise:

(1) take-off and climb to downwind position;

(2) pre take-off checks;

(3) into wind take-off;

(4) safeguarding the nose wheel;

(5) crosswind take-off;

(6) drills during and after take-off;

(7) short take-off and soft field procedure or techniques (including performance calculations);

(8) noise abatement procedures.

EXERCISE 13: CIRCUIT, APPROACH AND LANDING

(a) Long briefing objectives:

(1) downwind leg, base leg and approach: position and drills;

(2) factors affecting the final approach and the landing run;

(3) effect of mass;

(4) effects of altitude and temperature;

(5) effect of wind;

(6) effect of flap;

(7) landing;

(8) effect of ground surface and gradient upon the landing run;

(9) types of approach and landing:

(i) powered;

(ii) crosswind;

(iii) flapless (at an appropriate stage of the course);

(iv) glide;

(v) short field;

(vi) soft field.

(10) tail wheel aeroplane considerations (as applicable);

(11) missed approach;

(12) engine handling;

(13) wake turbulence awareness;

(14) windshear awareness;

(15) ATC procedures;

(16) mislanding and go-around;

(17) special emphasis on look-out.

(b) Air exercise:

(1) circuit approach and landing;

(2) circuit procedures: downwind and base leg;

(3) powered approach and landing;

(4) safeguarding the nose wheel;

(5) effect of wind on approach and touchdown speeds and use of flaps;

(6) crosswind approach and landing;

(7) glide approach and landing;

(8) flapless approach and landing (short and soft field);

(9) short field and soft field procedures;

(10) wheel landing (tail wheel aircraft);

(11) missed approach and go-around;

(12) mislanding and go-around;

(13) noise abatement procedures.

EXERCISE 14: FIRST SOLO AND CONSOLIDATION

Note: a summary of points to be covered before sending the student on first solo.

(a) Long briefing objectives:

During the flights immediately following the solo circuit consolidation period the following should be covered:

(1) procedures for leaving and rejoining the circuit;

(2) local area (restrictions, controlled airspace, etc.);

(3) compass turns;

(4) QDM meaning and use.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 15: ADVANCED TURNING

(a) Long briefing objectives:

(1) the forces;

(2) use of power;

(3) effect of load factor:

(i) structural considerations;

(ii) increased stalling speed.

(4) physiological effects;

(5) rate and radius of turn;

(6) steep, level, descending and climbing turns;

(7) stalling in the turn and how to avoid it;

(8) spinning from the turn: recovery at the incipient stage;

(9) spiral dive;

(10) unusual attitudes and recoveries.

Note: considerations are to be given to manoeuvre limitations and reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance, and any other restrictions for practice entries to the spin.

(b) Air exercise:

(1) level, descending and climbing steep turns;

(2) stalling in the turn;

(3) spiral dive;
(4) spinning from the turn;
(5) recovery from unusual attitudes;
(6) maximum rate turns.

EXERCISE 16: FORCED LANDING WITHOUT POWER

(a) Long briefing objectives:
- (1) selection of forced landing areas;
- (2) provision for change of plan;
- (3) gliding distance: consideration;
- (4) planning the descent;
- (5) key positions;
- (6) engine failure checks;
- (7) use of radio: R/T 'distress' procedure;
- (8) base leg;
- (9) final approach;
- (10) go-around;
- (11) landing considerations;
- (12) actions after landing: aeroplane security;
- (13) causes of engine failure.

(b) Air exercise:
- (1) forced landing procedures;
- (2) selection of landing area:
  - (i) provision for change of plan;
  - (ii) gliding distance considerations.
- (3) planning the descent;
- (4) key positions;
- (5) engine failure checks;
- (6) engine cooling precautions;
- (7) use of radio;
- (8) base leg;
- (9) final approach;
- (10) landing;
- (11) actions after landing: when the exercise is conducted at an aerodrome;
- (12) aeroplane security.

EXERCISE 17: PRECAUTIONARY LANDING

(a) Long briefing objectives:

   (1) occasions when necessary (in-flight conditions);

   (2) landing area selection and communication (R/T procedure);

   (3) overhead inspection;

   (4) simulated approach;

   (5) climb away;

   (6) landing area selection:

      (i) normal aerodrome;

      (ii) disused aerodrome;

      (iii) ordinary field;

   (7) circuit and approach;

   (8) actions after landing; aeroplane security.

(b) Air exercise:

   (1) occasions when necessary (in-flight conditions):

   (2) landing area selection

   (3) overhead inspection

   (4) simulated approach

   (5) climb away

   (6) landing area selection:

      (i) normal aerodrome;

      (ii) disused aerodrome;

      (iii) ordinary field;

   (7) circuit and approach;

   (8) actions after landing; aeroplane security;

EXERCISE 18a: NAVIGATION

(a) Long briefing objectives:

   (1) flight planning;

      (i) weather forecast and actual(s);

      (ii) map selection, orientation, preparation and use:

         (A) choice of route;

         (B) regulated or controlled airspace;

         (C) danger, prohibited and restricted areas;

         (D) safety altitude.

      (iii) calculations:

         (A) magnetic heading(s) and time(s) en-route;

         (B) fuel consumption;

(C) mass and balance;

(D) mass and performance.

(iv) flight information:

(A) NOTAMs etc.;

(B) noting of required radio frequencies;

(C) selection of alternate aerodrome(s).

(v) aeroplane documentation.

(vi) notification of the flight:

(A) pre-flight administration procedures;

(B) flight plan form (where appropriate).

(2) departure;

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) setting heading procedures;

(C) noting of ETA(s).

(iii) en-route map reading: identification of ground features;

(iv) maintenance of altitudes and headings;

(v) revisions to ETA and heading, wind effect, drift angle and groundspeed checks;

(vi) log keeping;

(vii) use of radio (including VDF if applicable);

(viii) minimum weather conditions for continuance of flight;

(ix) 'in-flight' decisions;

(x) diversion procedures;

(xi) operations in regulated or controlled airspace;

(xii) procedures for entry, transit and departure;

(xiii) navigation at minimum level;

(xiv) uncertainty of position procedure, including R/T procedure;

(xv) lost procedure;

(xvi) use of radio navaids.

(3) arrival procedures and aerodrome circuit joining procedures:

(i) ATC liaison, R/T procedure, etc.;

(ii) altimeter setting,

(iii) entering the traffic pattern (controlled or uncontrolled aerodromes);

(iv) circuit procedures;

(v) parking procedures;

(vi) security of aircraft;

(vii) refuelling;

(viii) booking in.

(b) Air exercise:

(1) flight planning:

(i) weather forecast and actual(s);

(ii) map selection and preparation:

(A) choice of route;

(B) regulated or controlled airspace;

(C) danger, prohibited and restricted areas;

(D) safety altitude.

(iii) calculations:

(A) magnetic heading(s) and time(s) en-route;

(B) fuel consumption;

(C) mass and balance;

(D) mass and performance.

(iv) flight information:

(A) NOTAMs etc.;

(B) noting of required radio frequencies;

(C) selection of alternate aerodromes.

(v) aircraft documentation;

(vi) notification of the flight:

(A) flight clearance procedures (as applicable);

(B) flight plans.

(2) aerodrome departure;

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) en-route:

(C) noting of ETA(s).

(iii) wind effect, drift angle and ground speed checks;

(iv) maintenance of altitudes and headings;

(v) revisions to ETA and heading;

(vi) log keeping;

(vii) use of radio (including VDF if applicable);

(viii) minimum weather conditions for continuance of flight;

(ix) 'in-flight' decisions;

(x) diversion procedure;

(xi) operations in regulated or controlled airspace;

(xii) procedures for entry, transit and departure;

(xiii) uncertainty of position procedure;

(xiv) lost procedure;

(xv) use of radio navaids.

(3) arrival procedures and aerodrome joining procedures:

(i) ATC liaison, R/T procedure etc.;

(ii) altimeter setting,

(iii) entering the traffic pattern;

(iv) circuit procedures;

(v) parking procedures

(vi) security of aircraft;

(vii) refuelling;

(viii) booking in.

EXERCISE 18b: NAVIGATION AT LOWER LEVELS AND IN REDUCED VISIBILITY

(a) Long briefing objectives:

(1) general considerations:

(i) planning requirements before flight in entry or exit lanes;

(ii) ATC rules, pilot qualifications and aircraft equipment;

(iii) entry or exit lanes and areas where specific local rules apply.

(2) low level familiarisation:

(i) actions before descending;

(ii) visual impressions and height keeping at low altitude;

(iii) effects of speed and inertia during turns;

(iv) effects of wind and turbulence;

(3) low level operation:

(i) weather considerations;

(ii) low cloud and good visibility;

(iii) low cloud and poor visibility;

(iv) avoidance of moderate to heavy rain showers;

(v) effects of precipitation;

(vi) joining a circuit;

(vii) bad weather circuit, approach and landing.

(b) Air exercise:

(1) general considerations: entry or exit lanes and areas where specific local rules apply;

(2) low level familiarisation:

(i) actions before descending;

(ii) visual impressions and height keeping at low altitude;
(iii) effects of speed and inertia during turns;
(iv) effects of wind and turbulence;
(v) hazards of operating at low levels;

(3) low level operation:
(i) weather considerations;
(ii) low cloud and good visibility;
(iii) low cloud and poor visibility;
(iv) avoidance of moderate to heavy rain showers;
(v) effects of precipitation (forward visibility);
(vi) joining a circuit;
(vii) bad weather circuit, approach and landing.

EXERCISE 18c: USE OF RADIO NAVIGATION AIDS UNDER VFR

(a) Long briefing objectives:

(1) use of VOR:
(i) availability, AIP and frequencies;
(ii) signal reception range;
(iii) selection and identification;
(iv) radials and method of numbering;
(v) use of OBS;
(vi) to or from indication and station passage;
(vii) selection, interception and maintaining a radial;
(viii) use of two stations to determine position.

(2) use of ADF equipment:
(i) availability of NDB stations, AIP and frequencies;
(ii) signal reception range;
(iii) selection and identification;
(iv) orientation in relation to NDP;
(v) homing to an NDP.

(3) use of VHF/DF:
(i) availability. AIP and frequencies;
(ii) R/T procedures;
(iii) obtaining QDMs and QTEs.

(4) use of radar facilities:
(i) availability and provision of service and AIS;
(ii) types of service;
(iii) R/T procedures and use of transponder:

(A) mode selection;
(B) emergency codes.

(5) use of distance DME:
   (i) availability and AIP;
   (ii) operating modes;
   (iii) slant range.

(6) use of GNSS (RNAV – SATNAV):
   (i) availability;
   (ii) operating modes;
   (iii) limitations.

(b) Air exercise:

(1) use of VOR:
   (i) availability, AIP and frequencies;
   (ii) selection and identification;
   (iii) use of OBS;
   (iv) to or from indications: orientation;
   (v) use of CDI;
   (vi) determination of radial;
   (vii) intercepting and maintaining a radial;
   (viii) VOR passage;
   (ix) obtaining a fix from two VORs.

(2) use of ADF equipment;
   (i) availability of NDB stations, AIP and frequencies;
   (ii) selection and identification;
   (iii) orientation relative to the beacon;
   (iv) homing.

(3) use of VHF/DF:
   (i) availability, AIP and frequencies;
   (ii) R/T procedures and ATC liaison;
   (iii) obtaining a QDM and homing.

(4) use of en-route or terminal radar:
   (i) availability and AIP;
   (ii) procedures and ATC liaison;
   (iii) pilot's responsibilities;
   (iv) secondary surveillance radar;
   (v) transponders;
   (vi) code selection;
   (vii) interrogation and reply.

(5) use of DME:

(i) station selection and identification;

(ii) modes of operation.

(6) use of GNSS (RNAV – SATNAV):

(i) setting up;

(ii) operation;

(iii) interpretation.

EXERCISE 19: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:

(1) flight instruments;

(i) physiological sensations;

(ii) instrument appreciation;

(iii) attitude instrument flight;

(iv) pitch indications;

(v) bank indications;

(vi) different dial presentations;

(vii) introduction to the use of the attitude indicator;

(viii) pitch attitude;

(ix) bank attitude;

(x) maintenance of heading and balanced flight;

(xi) instrument limitations (inclusive system failures).

(2) attitude, power and performance;

(i) attitude instrument flight:

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power and configuration;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan;

(3) basic flight manoeuvres (full panel);

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns onto pre-selected headings:

(A) level;

(B) climbing;

(C) descending.

(b) Air exercise:

(1) Introduction to instrument flying

(i) flight instruments;

(ii) physiological sensations;

(iii) instrument appreciation;

(iv) attitude instrument flight;

(v) pitch attitude;

(vi) bank attitude;

(vii) maintenance of heading and balanced flight;

(2) attitude, power and performance;

(i) attitude instrument flight;

(ii) effect of changing power and configuration;

(iii) cross-checking the instruments;

(iv) selective radial scan;

(3) basic flight manoeuvres (full panel);

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns onto pre-selected headings:

(A) level;

(B) climbing;

(C) descending.

EXERCISE 20: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) start up procedures;

(2) local procedures: including ATC liaison;

(3) taxiing:

(i) parking area and taxiway lighting;

(ii) judgement of speed and distances;

(iii) use of taxiway lights;

(iv) avoidance of hazards: obstruction lighting;

(v) instrument checks;

(vi) holding point: lighting procedure;

(vii) initial familiarisation at night;

(viii) local area orientation;

(ix) significance of lights on other aircraft;

(x) ground obstruction lights;

(xi) division of piloting effort: external or instrument reference;

(xii) rejoining procedure;

(xiii) aerodrome lighting: approach and runway lighting (including VASI and PAPI):

(A) threshold lights;

(B) approach lighting;

(C) visual approach slope indicator systems.

(4) night circuits;

(i) take-off and climb:

(A) line up;

(B) visual references during the take-off run;

(C) transfer to instruments;

(D) establishing the initial climb;

(E) use of flight instruments;

(F) instrument climb and initial turn.

(ii) circuit:

(A) aeroplane positioning: reference to runway lighting;

(B) the traffic pattern and look-out;

(C) initial approach and runway lighting demonstration;

(D) aeroplane positioning;

(E) changing aspect of runway lights and VASI (or PAPI);

(F) intercepting the correct approach path;

(G) the climb away.

(iii) approach and landing:

(A) positioning, base leg and final approach;

(B) diurnal wind effect;

(C) use of landing lights;

(D) the flare and touchdown;

(E) the roll out;

(F) turning off the runway: control of speed.

(iv) missed approach:

(A) use of instruments;

(B) re-positioning in the circuit pattern;

(5) night navigation:

(i) particular emphasis on flight planning;

(ii) selection of ground features visible at night:

(A) air light beacons;

(B) effect of cockpit lighting on map colours;

(C) use of radio aids;

(D) effect of moonlight upon visibility at night;

(iii) emphasis on maintaining a 'minimum safe altitude';

(iv) alternate aerodromes: restricted availability;

(v) restricted recognition of weather deterioration;

(vi) lost procedures;

(6) night emergencies;

(i) radio failure;

(ii) failure of runway lighting;

(iii) failure of aeroplane landing lights;

(iv) failure of aeroplane internal lighting;

(v) failure of aeroplane navigation lights;

(vi) total electrical failure;

(vii) abandoned take-off;

(viii) engine failure;

(ix) obstructed runway procedure.

(b) Air exercise: during the air exercise all long briefing objectives mentioned above should also be trained on site and the student instructor should demonstrate the following items:

(1) how to plan and to perform a flight at night;

(2) how to advise the student pilot to plan and prepare a flight at night;

(3) how to advise the student pilot to perform a flight at night;

(4) how to analyse and correct errors as necessary.

B. Helicopters

GROUND INSTRUCTION

Note: During ground instruction the student instructor should pay specific attention to the teaching of enhanced ground instruction in weather interpretation, planning and route assessment, decision making on encountering DVE including reversing course or conduction a precautionary landing.

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(H) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

   (1) the applicant's progress and ability;

   (2) the weather conditions affecting the flight;

   (3) the flight time available;

   (4) instructional technique considerations;

   (5) the local operating environment;

   (6) applicability of the exercises to the helicopter type.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the objectives and a brief reference to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted about who is to fly the helicopter and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

   (1) the aim;

   (2) principles of flight (briefest reference only);

   (3) the air exercise(s) (what, and how and by whom);

   (4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(H) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(H).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) If the privileges of the FI(H) certificate are to include instruction for night flying, exercise 28 should be undertaken either as part of the course or subsequent to certificate issue.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

(l) The student instructor should be trained to keep in mind that wherever possible, flight simulation should be used to demonstrate to student pilots the effects of flight into DVE and to enhance their understanding and need for avoidance of this potentially fatal flight regime.

SYLLABUS OF FLIGHT INSTRUCTION CONTENTS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: FAMILIARISATION WITH THE HELICOPTER

(a) Long briefing objectives:

(1) introduction to the helicopter;

(2) explanation of the cockpit layout;

(3) helicopter and engine systems;

(4) checklist(s) and procedures;

(3) familiarisation with the helicopter controls;

(4) differences when occupying the instructor's seat;

(5) emergency drills:

(i) action if fire in the air and on the ground: engine, cockpit or cabin and electrical fire;

(ii) system failure drills as applicable to type;

(iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

(1) flight authorisation and helicopter acceptance, including technical log (if applicable) and certificate of maintenance:

(2) equipment required for flight (maps, etc.);

(3) external checks;

(4) internal checks;

(5) student comfort, harness, seat and rudder pedal adjustment;

(6) starting and after starting checks;

(7) system, power or serviceability checks (as applicable);

(8) closing down or shutting down the helicopter (including system checks).

(9) parking and leaving the helicopter (including safety or security as applicable);

(10) completion of authorisation sheet and helicopter serviceability documents.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of the flying controls (primary and secondary effect);

(2) effect of air speed;

(3) effect of power changes (torque);

(4) effect of yaw (sideslip);

(5) effect of disc loading (bank and flare);

(6) effect on controls of selecting hydraulics on/off;

(7) effect of control friction;

(8) use of instruments;

(9) operation of carburettor heat or anti-icing control.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 5: POWER AND ATTITUDE CHANGES

(a) Long briefing objectives:

(1) relationship between cyclic control position, disc attitude, fuselage attitude and air speed flap back;

(2) power required diagram in relation to air speed;

(3) power and air speed changes in level flight;

(4) use of the instruments for precision;

(5) engine and air speed limitations;

(b) Air exercise:

(1) relationship between cyclic control position, disc attitude, fuselage attitude and air speed flap back;

(2) power and air speed changes in level flight;

(3) use of instruments for precision (including instrument scan and look-out).

EXERCISE 6: LEVEL FLIGHT, CLIMBING, DESCENDING AND TURNING

Note: for ease of training this exercise is divided into four separate parts in the PPL(H) syllabus but may be taught complete or in convenient parts.

(a) Long briefing objectives:

(1) basic factors involved in level flight;

(2) normal power settings;

(3) use of control friction or trim;

(4) importance of maintaining direction and balance;

(5) power required or power available diagram;

(6) optimum climb and descent speeds, angles or rates;

(7) importance of balance, attitude and co-ordination in the turn;

(8) effects of turning on rate of climb or descent;

(9) use of the gyro direction or heading indicator and compass;

(10) use of instruments for precision.

(b) Air exercises:

(1) maintaining straight and level flight at normal cruise power;

(2) control in pitch, including use of control friction or trim;

(3) use of the ball or yaw string to maintain direction and balance;

(4) setting and use of power for selected air speeds and speed changes;

(5) entry to climb;

(6) normal and maximum rate of climb;

(7) levelling off from climb at selected altitudes or heights;

(8) entry to descent;

(9) effect of power and air speed on rate of descent;

(10) levelling off from descent at selected altitudes or heights;

(11) entry to medium rate turns;

(12) importance of balance, attitude and co-ordination to maintain level turn;

(13) resuming straight and level flight;

(14) turns onto selected headings, use of direction indicator and compass;

(15) turns whilst climbing and descending;

(16) effect of turn on rate of climb or descent;

(17) use of instruments for precision (including instrument scan and look-out).

EXERCISE 7: AUTOROTATION

(a) Long briefing objectives:

(1) characteristics of autorotation;

(2) safety checks (including look-out and verbal warning);

(3) entry and development of autorotation;

(4) effect of AUM, IAS, disc loading, G forces and density altitude on RRPM and rate of descent;

(5) rotor and engine limitations;

(6) control of air speed and RRPM;

(7) recovery to powered flight;

(8) throttle override and control of ERPM or RRPM during re-engagement (as applicable);

(9) danger of vortex condition during recovery.

(b) Air exercise:

(1) safety checks (including verbal warning and look-out);

(2) entry to and establishing in autorotation;

(3) effect of IAS and disc loading on RRPM and rate of descent;

(4) control of air speed and RRPM;

(5) recovery to powered flight;

(6) medium turns in autorotation;

(7) simulated engine off landing (as appropriate).

EXERCISE 8: HOVERING AND HOVER TAXIING

(a) Long briefing objectives:

(1) ground effect and power required;

(2) effect of wind, attitude and surface;

(3) stability in hover and effects of over controlling;

(4) effect of control in hover;

(5) control and co-ordination during spot turns;

(6) requirement for slow hover speed to maintain ground effect;

(7) effect of hydraulic failure in hover;

(8) specific hazards, for example snow, dust, etc.

(b) Air exercise:

(1) ground effect and power or height relationship;

(2) effect of wind, attitude and surface;

(3) stability in hover and effects of over controlling;

(4) effect of control and hover technique;

(5) gentle forward running touchdown;

(6) control and co-ordination during spot (90 ° clearing) turns;

(7) control and co-ordination during hover taxi;

(8) dangers of mishandling and over pitching;

(9) (where applicable) effect of hydraulics failure in hover;

(10) simulated engine failure in the hover and hover taxi.

EXERCISE 9: TAKE-OFF AND LANDING

(a) Long briefing objectives:

(1) pre take-off checks or drills;

(2) importance of good look-out;

(3) technique for lifting to hover;

(4) after take-off checks;

(5) danger of horizontal movement near ground;

(6) dangers of mishandling and over pitching;

(7) technique for landing;

(8) after landing checks;

(9) take-off and landing crosswind and downwind.

(b) Air exercise:

(1) pre take-off checks or drills:

(2) pre take-off look-out technique;

(3) lifting to hover;

(4) after take-off checks;

(5) landing;

(6) after landing checks or drills;

(7) take-off and landing crosswind and downwind.

EXERCISE 10: TRANSITIONS FROM HOVER TO CLIMB AND APPROACH TO HOVER

(a) Long briefing objectives:

(1) revision of ground effect;

(2) translational lift and its effects;

(3) inflow roll and its effects;

(4) revision of flap back and its effects;

(5) avoidance of curve diagram and associated dangers;

(6) effect or dangers of wind speed and direction during transitions;

(7) transition to climb technique;

(8) constant angle approach;

(9) transition to hover technique.

(b) Air exercise:

(1) revision of take-off and landing;

(2) transition from hover to climb;

(3) effect of translational lift, inflow roll and flap back;

(4) constant angle approach;

(5) technique for transition from descent to hover;

(6) a variable flare simulated engine off landing.

EXERCISE 11: CIRCUIT, APPROACH AND LANDING

(a) Long briefing objectives:

(1) circuit and associated procedures;

(2) take-off and climb (including checks or speeds);

(3) crosswind leg (including checks, speeds or angles of bank in turns);

(4) downwind leg (including pre-landing checks);

(5) base leg (including checks, speeds or angles of bank in turns);

(6) final approach (including checks or speeds);

(7) effect of wind on approach and hover IGE;

(8) crosswind approach and landing technique;

(9) missed approach and go-around technique (as applicable);

(10) steep approach technique (including danger of high sink rate);

(11) limited power approach technique (including danger of high speed at touchdown);

(12) use of the ground effect;

(13) abandoned take-off technique;

(14) hydraulic failure drills and hydraulics off landing technique (where applicable);

(15) drills or technique for tail rotor control or tail rotor drive failure;

(16) engine failure drills in the circuit to include;

(17) engine failure

(18) on take-off:

(i) crosswind;

(ii) downwind;

(iii) base leg;

(iv) on final approach.

(19) noise abatement procedures (as applicable).

(b) Air exercise:

(1) revision of transitions and constant angle approach;

(2) basic training circuit, including checks;

(3) crosswind approach and landing technique;

(4) missed approach and go-around technique (as applicable);

(5) steep approach technique;

(6) basic limited power approach or run on technique;

(7) use of ground effect;

(8) hydraulic failure and approach to touchdown with hydraulics off and to recover at safe height (as applicable);

(9) simulated engine failure on take-off, crosswind, downwind, base leg and finals;

(10) variable flare simulated engine off landing.

EXERCISE 12: FIRST SOLO

(a) Long briefing objectives:

(1) warning of change of attitude due to reduced and laterally displaced weight;

(2) low tail, low skid or wheel during hover or landing;

(3) dangers of loss of RRPM and over pitching;

(4) pre take-off checks;

(5) into wind take-off;

(6) drills during and after take-off;

(7) normal circuit, approach and landing;

(8) action if an emergency.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 13: SIDEWAYS AND BACKWARDS HOVER MANOEUVRING

(a) Long briefing objectives:

(1) revision of hovering;

(2) directional stability and weather cocking effect;

(3) danger of pitching nose down on recovery from backwards manoeuvring;

(4) helicopter limitations for sideways and backwards manoeuvring;

(5) effect of CG position.

(b) Air exercise:

(1) revision of hovering and 90 ° clearing turns;

(2) manoeuvring sideways heading into wind;

(3) manoeuvring backwards heading into wind;

(4) manoeuvring sideways and backwards heading out of wind;

(5) manoeuvring backwards too fast and recovery action.

EXERCISE 14: SPOT TURNS

(a) Long briefing objectives:

(1) revision of ground effect and effect of wind;

(2) weather cocking and control actions;

(3) control of RRPM;
(4) torque effect;
(5) cyclic limiting stops due to CG position (where applicable);
(6) rate of turn limitations;
(7) spot turn about pilot position;
(8) spot turn about tail rotor position;
(9) spot turn about helicopter geometric centre;
(10) square (safe visibility) and clearing turn.

(b) Air exercise:
  (1) weather cocking, torque effect and control actions;
  (2) rate of turn;
  (3) spot turn about pilot position;
  (4) spot turn about tail rotor position;
  (5) spot turn about helicopter geometric centre;
  (6) square and clearing turn.

EXERCISE 15: HOVER OUT OF GROUND EFFECT AND VORTEX RING

(a) Long briefing objectives:
  (1) revision of ground effect and power required diagram;
  (2) drift, height and power control, look-out or scan;
  (3) vortex ring, (including dangers, recognition and recovery actions);
  (4) loss of tail rotor effectiveness.

(b) Air exercise:
  (1) to demonstrate hover OGE;
  (2) drift, height, power control and look-out, and instrument scan technique;
  (3) recognition of incipient stage of vortex ring and settling with power;
  (4) recovery action from incipient stage of vortex ring;
  (5) recognition of loss of tail rotor effectiveness and recovery actions.

EXERCISE 16: SIMULATED ENGINE OFF LANDINGS

(a) Long briefing objectives:
  (1) revision of basic autorotation;
  (2) effect of AUM, disc loading, density altitude and RRPM decay;
  (3) use of cyclic and collective to control speed or RRPM;
  (4) torque effect;
  (5) use of flare or turn to restore RRPM;
  (6) technique for variable flare simulated EOL;

(7) technique for constant attitude simulated EOL;
(8) revision of technique for hover or hover taxi simulated EOL;
(9) emergency technique for engine failure during transition;
(10) technique for low level simulated EOL.

(b) Air exercise
(1) revision of entry to and control in autorotation;
(2) variable flare simulated EOL
(3) constant attitude simulated EOL;
(4) hover simulated EOL;
(5) hover taxi simulated EOL;
(6) low level simulated EOL.

EXERCISE 17: ADVANCED AUTOROTATIONS

(a) Long briefing objectives:
(1) effect of air speed or AUM on angles or rates of descent
(2) effect of RRPM setting on angle or rate of descent;
(3) reason and technique for range autorotation;
(4) reason and technique for constant attitude autorotation;
(5) reason and technique for low speed and 'S' turns in autorotation;
(6) speed or bank limitations in turns in autorotation;
(7) revision of re-engagement or go-around procedures.

(b) Air exercise:
(1) selection of ground marker and standard datum height to determine distance covered during various autorotation techniques;
(2) revision of basic autorotation;
(3) technique for range autorotation;
(4) technique for constant attitude autorotation;
(5) technique for low speed autorotation, including need for timely speed recovery;
(6) technique for 'S' turn in autorotation;
(7) 180 and 360 ° turns in autorotation;
(8) revision of re-engagement and go-around technique.

EXERCISE 18: PRACTICE FORCED LANDINGS

(a) Long briefing objectives:
(1) types of terrain or surface options for choice of best landing area;
(2) practice forced landing procedure;
(3) forced landing checks and crash actions;

(4) rules or height for recovery and go-around.

(b) Air exercise:

(1) recognition of types of terrain from normal cruise height or altitude;

(2) practice forced landing technique;

(3) revision of recovery or go-around technique.

EXERCISE 19: STEEP TURNS

(a) Long briefing objectives:

(1) air speed or angle of bank limitations;

(2) technique for co-ordination to hold bank or attitude;

(3) revision of speed or bank limitations in autorotation including RRPM control;

(4) significance of disc loading, vibration and control feedback;

(5) effect of wind in turns at low level.

(b) Air exercise:

(1) technique for turning at 30 ° of bank;

(2) technique for turning at 45 ° of bank (where possible);

(3) steep autorotative turns;

(4) explanation of faults in the turn: balance, attitude, bank and co-ordination;

(5) effect of wind at low level.

EXERCISE 20: TRANSITIONS

(a) Long briefing objectives:

(1) revision of effect of ground cushion, translational lift and flap back;

(2) training requirement for precision exercise;

(3) technique for transition to forward flight and back to hover as precision exercise;

(4) effect of wind.

(b) Air exercise:

(1) transition from hover to minimum 50 knots IAS and back to hover;

Note: select constant height (20 - 30 ft) and maintain.

(2) effect of wind.

EXERCISE 21: QUICK STOPS

(a) Long briefing objectives:

(1) power control co-ordination;

(2) revision of effect of wind;

(3) technique for quick stop into wind;

(4) technique for quick stop from crosswind;

(5) revision of air speed and angles of bank limitations;

(6) technique for emergency turn from downwind;

(7) technique for quick stop from downwind from high speed: flare and turn;

(8) technique for quick stop from downwind from low speed: turn and flare;

Note: use reasonable datum speed for example high speed, low speed.

(9) danger of holding flare when downwind, (vortex ring) - (minimum speed 70 knots);

(10) to revise danger of high disc loading.

(b) Air exercise:

(1) technique for quick stop into wind;

(2) technique for quick stop from crosswind;

(3) danger of vortex ring and disc loading;

(4) technique for quick stop from downwind with low speed;

(5) technique for quick stop from downwind with high speed;

(6) emergency turns from downwind.

EXERCISE 22: NAVIGATION

(a) Long briefing objectives:

Note: to be broken down into manageable parts at discretion of instructor.

(1) flight planning:

(i) weather forecasts and actuals;

(ii) map selection, orientation, preparation and use:

(A) choice of route;

(B) regulated or controlled airspace;

(C) danger, prohibited and restricted areas;

(D) safety altitude.

(iii) calculations:

(A) magnetic heading(s), time(s) en route;

(B) fuel consumption;

(C) mass and balance.

(iv) flight information:

(A) NOTAMs etc;

(B) noting of required radio frequencies;

(C) selection of alternate landing sites.

(v) helicopter documentation;

(vi) notification of the flight:

(A) pre-flight administration procedures;

(B) flight plan form (where appropriate).

(2) departure:

(i) organisation of cockpit workload;

(ii) departure procedures:

(A) altimeter settings;

(B) ATC liaison in controlled or regulated airspace;

(C) setting heading procedure;

(D) noting of ETA(s);

(E) maintenance of height or altitude and heading.

(iii) procedure for revisions of ETA and headings to include:

(A) 10 ° line, double track, track error and closing angle;

(B) 1 in 60 rule;

(iv) amending an ETA;

(v) log keeping;

(vi) use of radio;

(vii) use of navaids;

(viii) weather monitoring and minimum weather conditions for continuation of flight;

(ix) significance of in-flight decision making;

(x) technique for transiting controlled or regulated airspace;

(xi) uncertainty of position procedure;

(xii) lost procedure.

(3) arrival:

(i) aerodrome joining procedure, in particular ATC liaison in controlled or regulated airspace:

(A) altimeter setting;

(B) entering traffic pattern;

(C) circuit procedures.

(ii) parking procedures, in particular:

(A) security of helicopter;

(B) refuelling;

(C) closing of flight plan, (if appropriate);

(D) post flight administrative procedures.

(4) navigation problems at low heights and reduced visibility:

(i) actions before descending;

(ii) significance of hazards, (for example obstacles and other traffic);

(iii) difficulties of map reading;

(iv) effects of wind and turbulence;

(v) significance of avoiding noise sensitive areas;

(vi) procedures for joining a circuit from low level;

(vii) procedures for a bad weather circuit and landing;

(viii) actions in the event of encountering DVE;

(ix) appropriate procedures and choice of landing area for precautionary landings;

(x) decision to divert or conduct precautionary landing;

(xi) precautionary landing.

(5) radio navigation:

(i) use of VOR:

(A) availability, AIP and frequencies;

(B) selection and identification;

(C) use of OBS;

(D) to or from indications: orientation;

(E) use of CDI;

(F) determination of radial;

(G) intercepting and maintaining a radial;

(H) VOR passage;

(I) obtaining a fix from two VORs.

(ii) use of ADF equipment:

(A) availability of NDB stations, AIP and frequencies;

(B) selection and identification;

(C) orientation relative to beacon;

(D) homing.

(iii) use of VHF/DF

(A) availability, AIP and frequencies;

(B) R/T procedures and ATC liaison;

(C) obtaining a QDM and homing.

(iv) use of en-route or terminal radar:

(A) availability and AIP;

(B) procedures and ATC liaison;

(C) pilots responsibilities;

(D) secondary surveillance radar:

(a) transponders;

(b) code selection;

(E) interrogation and reply.

(iv) use of DME:

(A) station selection and identification;

(B) modes of operation: distance, groundspeed and time to run.

(v) use of GNSS:

(A) selection of waypoints;

(B) to or from indications and orientation;

(C) error messages;

(D) hazards of over-reliance in the continuation of flight in DVE.

(b) Air exercise:

(1) navigation procedures as necessary;

(2) to advise student and correct errors as necessary;

(3) map reading techniques;

(4) the significance of calculations;

(5) revision of headings and ETA's;

(6) use of radio;

(7) use of navaids: ADF/NDB, VOR, VHF/DF, DME and transponder;

(8) cross-country flying by using visual reference, DR, GNNS and, where available, radio navigation aids; simulation of deteriorating weather conditions and actions to divert or conduct precautionary landing;

(8) log keeping;

(9) importance of decision making;

(10) procedure to deal with uncertainty of position;

(11) lost procedure;

(12) appropriate procedures and choice of landing area for precautionary landings;

(13) aerodrome joining procedure;

(14) parking and shut-down procedures;

(15) post-flight administration procedures.

EXERCISE 23: ADVANCED TAKE-OFF, LANDINGS AND TRANSITIONS

(a) Long briefing objectives:

(1) revision of landing and take-off out of wind (performance reduction);

(2) revision of wind limitations;

(3) revision of directional stability variation when out of wind;

(4) revision of power required diagram;

(5) technique for downwind transitions;

(6i) technique for vertical take-off over obstacles;

(7) reconnaissance technique for landing site;

(8) power checks;

(9) technique for running landing;

(10) technique for zero speed landing;

(11) technique for crosswind and downwind landings;

(12) steep approach, including dangers;

(13) revision of go-around procedures.

(b) Air exercise

(1) technique for downwind transition;

(2) technique for vertical take-off over obstacles;

(3) reconnaissance technique for landing site;

(4) power check and assessment;

(5) technique for running landing;

(6) technique for zero speed landing;

(7) technique for crosswind and downwind landings;

(8) technique for steep approach;

(9) go-around procedures.

EXERCISE 24: SLOPING GROUND

(a) Long briefing objectives:

(1) limitations;

(2) wind and slope relationship, including blade and control stops;

(3) effect of CG when on slope;

(4) ground effect and power required when on slope;

(5) landing technique when on slope, left, right and nose-up;

(6) avoidance of dynamic rollover, dangers of soft ground and sideways movement;

(7) dangers of over controlling near ground on slope;

(8) danger of striking main or tail rotor on up slope.

(b) Air exercise

(1) technique for assessing slope angle;

(2) technique for landing and take-off left skid up slope;

(3) technique for landing and take-off right skid up slope;

(4) technique for landing nose up slope;

(5) dangers of over controlling near ground.

EXERCISE 25: LIMITED POWER

(a) Long briefing objectives:

(1) use of appropriate helicopter performance graphs;
(2) selection of technique according to available power;
(3) effect of wind on available power.

(b) Air exercise: to revise and refine techniques demonstrated in exercise 23.

EXERCISE 26: CONFINED AREAS

(a) Long briefing objectives:
(1) revision of use of helicopter performance graphs;
(2) procedure for locating landing site and selecting site marker;
(3) procedures for assessing wind speed and direction;
(4) landing site reconnaissance techniques;
(5) reason for selecting landing markers;
(6) procedure for selecting direction and type of approach;
(7) dangers of out of wind approach;
(8) circuit procedures;
(9) reason for approach to committal point and go-around, (practice approach);
(10) approach technique;
(11) revision of clearing turn and landing (sloping ground technique);
(12) hover power check or performance assessment IGE and OGE (if necessary);
(13) take-off procedures.

(b) Air exercise
(1) procedures for locating landing site and selecting site marker;
(2) procedures for assessing wind speed and direction;
(3) landing site reconnaissance techniques;
(4) selecting landing markers, direction and type of approach;
(5) circuit procedure;
(6) practice approach, go-around and approach technique;
(7) revision of clearing turn and landing (sloping ground technique);
(8) hover power check or performance assessment IGE and OGE (if necessary);
(9) take-off procedures.

EXERCISE 27: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:
(1) physiological sensations;
(2) instrument appreciation;
(3) attitude instrument flight;

(4) instrument scan;

(5) instrument limitations;

(6) basic manoeuvres by sole reference to instruments:

(i) straight and level flight at various air speeds and configurations;

(ii) climbing and descending;

(iii) standard rate turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns (unusual attitudes).

(b) Air exercise:

(1) attitude instrument flight and instrument scan;

(2) basic manoeuvres by sole reference to instruments:

(i) straight and level flight at various air speeds and configurations;

(ii) climbing and descending;

(iii) standard rate turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns (unusual attitudes).

EXERCISE 28: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) medical or physiological aspects of night vision;

(2) requirement for torch to be carried (pre-flight inspection, etc.);

(3) use of the landing light;

(4) take-off and hover taxi procedures at night;

(5) night take-off procedure;

(6) cockpit procedures at night;

(7) approach techniques;

(8) night landing techniques;

(9) night autorotation techniques (power recovery at safe height);

(10) technique for practice forced landing at night (using appropriate illumination);

(11) emergency procedures at night;

(12) navigation principles at night;

(13) map marking for night use (highlighting built up or lit areas with thicker lines, etc.).

(b) Air exercise:

(1) use of torch for pre-flight inspection;

(2) use of landing light;

(3) night take-off to hover (no sideways or backwards movement);

(4) night hover taxi (higher and slower than by day);

(5) night transition procedure;

(6) night circuit;

(7) night approach and landing (including use of landing light);

(8) night autorotation (power recovery at safe height);

(9) practice forced landing at night (using appropriate illumination);

(10) night emergency procedures;

(11) night cross country techniques, as appropriate.

C. Airships

Part 2

AIR EXERCISES

(a) The air exercises are similar to those used for the training of PPL(As) but with additional items designed to cover the needs of an FI.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment.

(c) It follows that student instructors will eventually be faced with similar interrelated factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(d) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted about who is to fly the airship and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(e) The four basic components of the briefing will be:

(1) the aim;

(2) principles of flight (briefest reference only);

(3) the air exercise(s) (what, and how and by whom);

(4) airmanship (weather, flight safety etc.).

PLANNING OF FLIGHT LESSONS

(f) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(g) The student instructor should complete flight training to practise the principles of basic instruction at the PPL(As) level.

(h) During this training, except when acting as a student pilot for mutual flights, the student instructor occupies the seat normally occupied by the FI(As).

(i) It is to be noted that airmanship and look-out is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at all times.

(j) The exercises 15 and 16 of the flight instruction syllabus should be undertaken at night in addition to by day as part of the course.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

LONG BRIEFINGS AND AIR EXERCISES

Note: although exercise 16 is not required for the PPL(As) course it is a requirement for the FI(As) course.

EXERCISE 1: FAMILIARISATION WITH THE AIRSHIP

(a) Long briefing objectives:

(1) introduction to the airship;

(2) characteristics of the airship;

(3) cockpit layout;

(4) airship and engine systems;

(5) use of the checklist(s) and procedures;

(6) to familiarise the student with the airship controls;

(7) differences when occupying the instructor's seat;

(8) emergency drills:

(i) action if fire in the air or on the ground: engine, cockpit or cabin and electrical fire;

(ii) system failure drills as applicable to type;

(iii) escape drills: location and use of emergency equipment and exits.

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 2: PREPARATION FOR AND ACTION AFTER FLIGHT

(a) Long briefing objectives:

(1) flight authorisation and airship acceptance including tech log (if applicable) and certificate of maintenance;

(2) equipment required for flight (maps, etc.);

(3) external checks;

(4) internal checks;

(5) student comfort, harness, seat and rudder pedal adjustment;

(6) starting and after starting checks;

(7) system, power or serviceability checks (as applicable);

(8) closing down or shutting down the airship (including system checks);

(9) parking, masting and unmasting, leaving the airship (including safety or security as applicable);

(10) completion of the authorisation sheet and airship serviceability documents;

(b) Air exercise: all long briefing objectives mentioned above should also be trained on site during the air exercise.

EXERCISE 3: AIR EXPERIENCE

(a) Long briefing objectives:

Note: there is no requirement for a long briefing for this exercise.

(b) Air exercise:

(1) air experience;

(2) cockpit layout, ergonomics and controls;

(3) cockpit procedures: stability and control.

EXERCISE 4: EFFECTS OF CONTROLS

(a) Long briefing objectives:

(1) function of the flying controls (primary and secondary effect);

(2) effect of air speed;

(3) effect of power changes;

(4) effect of trimming and other controls;

(5) use of instruments;

(6) use of carburettor heat.

(b) Air exercise:

(1) function of the flying controls;

(2) effect of air speed;

(3) effect of power changes;

(4) effect of trimming and other controls;

(5) use of instruments (including instrument scan);

(6) use of carburettor heat.

EXERCISE 5: GROUND MANOEUVERING

(a) Long briefing objectives:

(1) pre-taxi checks;

(2) starting, control of speed and stopping;

(3) engine handling;

(4) masting procedures;

(5) control of direction and turning;

(6) effects of wind;

(7) effects of ground surface;

(8) marshalling signals;

(9) instrument checks;

(10) ATC procedures;

(11) emergencies.

(b) Air exercise:

(1) starting, control of speed and stopping;

(2) engine handling;

(3) masting procedures;

(4) control of direction and turning;

(5) effect of wind.

EXERCISE 6: TAKE-OFF PROCEDURES

(a) Long briefing objectives:

(1) pre take-off checks;

(2) take-off with different static heaviness;

(3) drills during and after take-off;

(4) noise abatement procedures.

(b) Air exercise:

(1) take-off with different static heaviness;

(2) drills during and after take-off.

EXERCISE 6e: EMERGENCIES

(a) Long briefing objectives:

(1) abandoned take-off;

(2) engine failures and actions after take-off;

(3) malfunctions of thrust vector control;

(4) aerodynamic control failures;

(5) electrical and system failures.

(b) Air exercise:

(1) how to abandon a take-off;

(2) engine failure and suitable action;

(3) malfunctions of thrust vector control;

(4) aerodynamic control failures.

EXERCISE 7: CLIMBING

(a) Long briefing objectives:

(1) entry and how to maintain the normal and max rate of climb;

(2) levelling off procedure;

(3) how to level off at selected altitudes;

(4) maximum angle of climb;

(5) maximum rate of climb.

(b) Air exercise:

(1) how to level off at selected altitudes;

(2) maximum angle of climb.

EXERCISE 8: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) how to attain and maintain straight and level flight;

(2) flight at or close to pressure height;

(3) control in pitch, including use of trim;
(4) at selected air speeds (use of power);
(5) during speed changes;
(6) use of instruments for precision.

(b) Air exercise:
(1) how to attain and maintain straight and level flight;
(2) flight at or close to pressure height;
(3) control in pitch, including use of trim;
(4) at selected air speeds (use of power);
(5) during speed changes.

EXERCISE 9: DESCENDING

(a) Long briefing objectives:
(1) entry, maintaining and levelling off techniques;
(2) levelling off at selected altitudes;
(3) maximum rate of descent;
(4) maximum angle of descent;
(5) use of instruments for precision flight.

(b) Air exercise:
(1) levelling off at selected altitudes;
(2) maximum rate of descent;
(3) maximum angle of descent.

EXERCISE 10: TURNING

(a) Long briefing objectives:
(1) entry and maintaining level turns;
(2) resuming straight flight;
(3) faults in the turn;
(4) climbing turns;
(5) descending turns;
(6) turns to selected headings: use of gyro heading indicator and compass;
(7) use of instruments for precision.

(b) Air exercise
(1) faults in the turn and correction techniques;
(2) climbing turns;
(3) descending turns.

EXERCISE 11: HOVERING

(a) Long briefing objectives: hovering manoeuvres (as applicable).

(b) Air exercise: hovering manoeuvres (as applicable).

EXERCISE 12: APPROACH AND LANDING

(a) Long briefing objectives:
   (1) effect of wind on approach and touchdown speeds;
   (2) landing with different static heaviness;
   (3) missed approach and go-around procedures;
   (4) noise abatement procedures.
(b) Air exercise
   (1) a landing with different static heaviness;
   (2) missed approach and go-around procedures.

EXERCISE 12e: EMERGENCIES

(a) Long briefing objectives:
   (1) aborted approach or go-around;
   (2) malfunction of thrust vector control;
   (3) envelope emergencies;
   (4) fire emergencies;
   (5) aerodynamic control failures;
   (6) electrical and system failures.
(b) Air exercise: emergency drills and actions.

EXERCISE 13: PRECAUTIONARY LANDING

(a) Long briefing objectives:
   (1) occasions necessitating a precautionary landing;
   (2) in-flight conditions;
   (3) landing area selection;
   (4) circuit and approach.
(b) Air exercise:
   (1) how to perform the landing area selection;
   (2) circuit and approach.

EXERCISE 14a: NAVIGATION

(a) Long briefing objectives:
   (1) how to do the flight planning;
   (2) departure for a navigation flight;
   (3) in-flight navigational techniques;
   (4) arrival and aerodrome joining procedures;
(b) Air exercise:
   (1) complete flight planning of a navigation flight;
   (2) departure for a navigation flight;
   (3) in-flight navigational techniques;

(4) arrival and aerodrome joining procedures.

EXERCISE 14b: NAVIGATION AT LOWER LEVELS AND IN REDUCED VISIBILITY

(a) Long briefing objectives:

(1) actions before descending;

(2) possible hazards (for example obstacles and terrain) and actions;

(3) student difficulties of map reading;

(4) effects of winds, turbulence and precipitation;

(5) vertical situational awareness;

(6) avoidance of noise sensitive areas;

(7) joining the circuit;

(8) bad weather circuit and landing.

(b) Air exercise:

(1) actions before descending;

(2) map reading techniques;

(3) vertical situational awareness;

(4) avoidance of noise sensitive areas;

(5) joining the circuit;

(6) bad weather circuit and landing.

EXERCISE 14c: RADIO NAVIGATION

(a) Long briefing objectives:

(1) use of VOR;

(2) use of ADF equipment;

(3) use of NDB stations;

(4) use of VHF/DF;

(5) use of en-route or terminal radar;

(6) use of DME equipment.

(b) Air exercise

(1) use of navaids;

(2) procedure to deal with uncertainty of position.

EXERCISE 15: BASIC INSTRUMENT FLIGHT

(a) Long briefing objectives:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) instrument scan;

(5) instrument limitations;

(6) basic manoeuvres by sole reference to the instruments:

(i) straight and level;

(ii) climbing and descending;

(iii) turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns.

(b) Air exercise:

(1) attitude instrument flight and instrument scan;

(2) the basic manoeuvres:

(i) straight and level;

(ii) climbing and descending;

(iii) turns, climbing and descending, onto selected headings;

(iv) recoveries from climbing and descending turns.

EXERCISE 16: NIGHT FLYING (if night instructional qualification required)

(a) Long briefing objectives:

(1) medical and physiological aspects of night vision;

(2) requirement for torch to be carried (pre-flight inspection, etc.);

(3) use of the landing light;

(4) ground manoeuvring procedures at night;

(5) night take-off procedure;

(6) cockpit procedures at night;

(7) approach techniques;

(8) night landing techniques

(9) emergency procedures at night;

(10) navigation principles at night.

(b) Air exercise:

(1) use of landing light;

(2) night ground manoeuvring;

(3) night take-off, circuit or approach and landing (including use of landing light).

AMC2 FCL.930.FI FI — Training course

FI(S) AND FI(B) TRAINING COURSE

GENERAL

(a) The aim of the FI(S) and FI(B) training course is to train SPL and BPL holders to the level of competence defined in FCL.920 as instructor competencies.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the FI task including at least the following:

(1) refresh the technical knowledge of the student instructor;

(2) train the student instructor to teach the ground subjects and air exercises;

(3) ensure that the student instructor's flying is of a sufficiently high standard; and

(4) teach the student instructor the principles of basic instruction and to apply them at all training levels.

(c) With the exception of the section on teaching and learning, all the subject detail contained in the ground and flight training syllabus is complementary to the SPL and BPL course syllabus.

(d) The FI training course should give particular stress to the role of the individual in relation to the importance of human factors in the man-machine and theoretical knowledge environment interaction. Special attention should be paid to the applicant's maturity and judgement including an understanding of adults, their behavioural attitudes and variable levels of education.

(e) During the training course, the applicants should be made aware of their own attitudes to the importance of flight safety. Improving safety awareness should be a fundamental objective throughout the training course. It will be of major importance for the training course to aim at giving applicants the knowledge, skills and attitudes relevant to a flight instructor's task.

(f) On successful completion of the training course and final test the applicant may be issued with an FI certificate.

CONTENT

(g) The training course consists of two parts:

(1) Part 1, theoretical knowledge including the teaching and learning instruction that should comply with AMC1 FCL.920;

(2) Part 2, flight instruction.

Part 1
The content of the teaching and learning part of the FI course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

The course should include at least 55 hours of theoretical knowledge including at least 25 hours teaching and learning instructions for the FI (S) and FI(B) certificate.

Part 2

FLIGHT INSTRUCTION SYLLABUS

An approved FI training course should comprise at least the minimum hours of flight instruction as defined in FCL.930.FI.

AIR EXERCISES

(a) The air exercises are similar to those used for the training of SPL or BPL but with additional items designed to cover the needs of a flight instructor.

(b) The numbering of exercises should be used primarily as an exercise reference list and as a broad instructional sequencing guide: therefore the demonstrations and practices need not necessarily be given in the order listed. The actual order and content will depend upon the following interrelated factors:

(1) the applicant's progress and ability;

(2) the weather conditions affecting the flight;

(3) the flight time available;

(4) instructional technique considerations;

(5) the local operating environment;

(6) Applicability of the exercises to the aircraft type.

(c) At the discretion of the instructors some of the exercises may be combined whereas some other exercises may be done in several flights.

(d) It follows that student instructors will eventually be faced with similar inter-related factors. They should be shown and taught how to construct flight lesson plans, taking these factors into account, so as to make the best use of each flight lesson, combining parts of the set exercises as necessary.

GENERAL

(e) The briefing normally includes a statement of the aim and a brief allusion to principles of flight only if relevant. An explanation is to be given of exactly what air exercises are to be taught by the instructor and practised by the student during the flight. It should include how the flight will be conducted with regard to who is to fly the aircraft and what airmanship, weather and flight safety aspects currently apply. The nature of the lesson will govern the order in which the constituent parts are to be taught.

(f) The five basic components of the briefing will be:

(1) the aim;

(2) the air exercise(s) (what, and how and by whom);

(3) flight briefing;

(4) check of understanding;

(5) airmanship.

PLANNING OF FLIGHT LESSONS

(g) The preparation of lesson plans is an essential prerequisite of good instruction and the student instructor is to be given supervised practice in the planning and practical application of flight lesson plans.

GENERAL CONSIDERATIONS

(h) The student instructor should complete flight training in order to practise the principles of basic instruction at the SPL or BPL level. During this training the student instructor occupies the seat normally occupied by the FI.

(i) The instructor providing this instructor training is normally taking over the role of the student pilot. In the case of the course for the FI(B) an additional person holding a BPL or LAPL(B) licence or a student pilot for these licences may be on board in order to function as a student pilot under the supervision of the instructor.

(j) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(k) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

A. SAILPLANES

LONG BRIEFINGS AND AIR EXERCISES

Note: although the fully developed spin in exercise 10 is not required for the LAPL course, it is a requirement for the FI course.

EXERCISE 1: FAMILIARISATION WITH THE SAILPLANE

(a) Objective:

To advise the student instructor on how to familiarise the student with the sailplane which will be used for the training and to test his/her position in the sailplane for comfort, visibility, and ability to use all controls and equipment.

(b) Briefing and exercise:

The student Instructor has to:

(1) present the type of sailplane which will be used;

(2) explain the cockpit layout: instruments and equipment;

(3) explain the flight controls: stick, pedals, airbrakes, flaps, cable release, undercarriage;

(4) check the position of the student on the seat for comfort, visibility, ability to use all controls;

(5) explain the use of the harness;

(6) demonstrate how to adjust the rudder pedal;

(7) explain the differences when occupying the instructor's position;

(8) explain all checklists, drills, controls.

EXERCISE 2: PROCEDURE IN THE EVENT OF EMERGENCIES

(a) Objective:

To advise the student instructor on how to familiarise the student with the use of the parachute and how to explain the bail out procedure in case of emergency.

(b) Briefing and exercise:

The student instructor has to:

(1) explain how to handle the parachute with care (transport, storage and drying after use);

(2) demonstrate the adjustment of the parachute harness;

(3) explain the bail out procedure (especially from a sailplane in unusual attitude);

(4) explain the procedure for landing with a parachute in normal conditions and with a strong wind.

EXERCISE 3: PREPARATION FOR FLIGHT

(a) Objective:

To advise the student instructor on how to explain all the operations to be completed prior to flight. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the need for a pre-flight briefing;

(2) the structure and the content of this briefing;

(3) which documents are required on board;

(4) which equipment are required for a flight;

(5) how to handle the sailplane on the ground, how to move it, how to tow it out and how to park it;

(6) how to do the pre-flight external and internal checks;

(7) the procedure for verifying in-limits mass and balance;

(8) the pre-launch checks (checklist).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the need for a pre-flight briefing;

(2) that the required documents are on board;

(3) that the equipment required for the intended flight is on board;

(4) how to handle the sailplane on the ground, move it to the start position, tow it out and park it;

(5) how to perform a pre-flight external and internal check;

(6) how to verify in-limits mass and balance;

(7) how to adjust harness as well as seat or rudder pedals;

(8) the pre-launch checks;

(9) how to advise the student pilot in performing the pre-flight preparation;

(10) how to analyse and correct pre-flight preparation errors as necessary.

EXERCISE 4: INITIAL AIR EXPERIENCE

(a) Objective:

To advise the student instructor on how to familiarise the student with being in the air, with the area around the airfield, to note his/her reactions in this situation, and to draw his/her attention to safety and look-out procedures.

(b) Briefing:

The student instructor has to explain:

(1) the area around the airfield;

(2) the need for looking out;

(3) the change of aircraft control.

(c) Air exercise:

The student instructor has to:

(1) show the noteworthy references on the ground;

(2) analyse the reactions of the student;

(3) check that the student looks out (safety).

EXERCISE 5: PRIMARY EFECTS OF CONTROLS

(a) Objective:

To advise the student instructor on how to:

(1) demonstrate the primary effects of each control with the help of visual references;

(2) train the student pilot to recognise when the sailplane is no longer in a normal attitude along one of the axes and to return to the normal attitude;

(3) train continuous and efficient look-out during these exercises;

(4) analyse and correct errors and student pilot mistakes as necessary.

(b) Briefing:

The student instructor has to explain:

(1) define the axes of a sailplane;

(2) the look-out procedures;

(3) the visual references along each axis;

(4) the primary effects of controls when laterally level;

(5) the relationship between attitude and speed;

(6) the use of flaps;

(7) the use of airbrakes.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the visual references in flight;

(2) the primary effect of the elevator;

(3) the relationship between attitude and speed (inertia);

(4) the primary effect of rudder on the rotation of the sailplane around the vertical axis;

(5) the primary effect of ailerons on banking;

(6) the effect of airbrakes (including changes in pitch when airbrakes are extended or retracted);

(7) the effects of flaps (provided the sailplane has flaps);

(8) the look-out procedures during all the exercises;

(9) how to advise the student pilot to recognise the primary effects of each control;

(10) how to analyse and correct errors as necessary.

EXERCISE 6: CO-ORDINATED ROLLING TO AND FROM MODERATE ANGLES OF BANK

(a) Objective:

To advise the student instructor on secondary effects of controls and on how to teach the student to coordinate ailerons and rudder in order to compensate for the adverse yaw effect. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the secondary effects of controls;

(2) the adverse yaw effect;

(3) how to compensate for the adverse yaw;

(4) the further effect of the rudder (roll).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the adverse yaw effect with a reference on ground;

(2) the further effect of the rudder (roll);

(3) the coordination of ruder and aileron controls to compensate for the adverse yaw effects;

(4) rolling to and from moderate angles of bank (20 to 30 °) and returning to the straight flight;

(5) how to advise the student pilot to coordinate ailerons and rudder;

(6) how to analyse and correct errors as necessary.

EXERCISE 7: STRAIGHT FLYING

(a) Objective:

To advise the student instructor on how to train the student to maintain straight flight with a constant heading without slipping and skidding. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to:

(1) explain how to maintain straight flight;

(2) explain different air speed limitations;

(3) explain the pitch stability of the sailplane;

(4) explain the effect of trimming.

(c) Air exercise:

The instructor student has to demonstrate:

(1) maintaining straight flight;

(2) inherent pitch stability;

(3) the control of the sailplane in pitch, including use of trim with visual references and speed;

(4) how to perform the instrument monitoring;

(5) the control of level attitude with visual references;

(6) the control of the heading with a visual reference on the ground;

(7) the look-out procedures during all the exercises;

(8) how to advise the student pilot to maintain straight flight;

(9) how to analyse and correct errors as necessary.

EXERCISE 8: TURNING

(a) Objective:

To advise the student instructor on how to teach students to fly turns and circles with a moderate constant bank of about 30 ° with constant attitude (speed) and coordinated flight. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the forces on the sailplane during a turn;

(2) the need to look out before turning;

(3) the sequences of a turn (entry, stabilizing and exiting);

(4) the common faults during a turn;

(5) how to turn on to selected headings, use of compass;

(6) the use of instruments (ball indicator or slip string) for precision.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the look-out procedure before turning;

(2) entering a turn (correction of adverse yaw);

(3) the stabilisation of a turn (keeping the attitude and compensating the induced roll);

(4) the exit from a turn;

(5) the most common faults in a turn;

(6) turns on to selected headings (use landmarks as reference);

(7) use of instruments (ball indicator or slip string) for precision:

(8) how to advise the student pilot to fly a turn or circle with a moderate bank;

(9) how to analyse and correct errors as necessary.

EXERCISE 9a: SLOW FLIGHT

(a) Objective:

To advise the student instructor on how to improve the student's ability to recognise inadvertent flight at critically low speeds (high angle of attack) and to provide practice in maintaining the sailplane in balance while returning to normal attitude (speed). Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the characteristics of slow flight;

(2) the risks of stalling.

(c) Air Exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft before starting the exercise.

The student instructor has to demonstrate:

(1) a controlled flight down to critically high angle of attack (slow air speed), and draw the attention of the student to the nose up attitude, reduction of noise, reduction of speed;

(2) a return to the normal attitude (speed);

(3) how to advise the student pilot to recognise inadvertent flight at critically low speeds;

(4) how to provide practice in maintaining the sailplane in balance while returning to normal attitude;

(5) how to analyse and correct errors as necessary.

EXERCISE 9b: STALLING

(a) Objective:

To advise the student Instructor on how to improve the student's ability to recognize a stall and to recover from it. This includes stall from a level flight and stalls when a wing drops. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the mechanism of a stall;

(2) the effectiveness of the controls at the stall;

(3) pre-stall symptoms, recognition and recovery;

(4) factors affecting the stall (importance of the angle of attack and high speed stall);

(5) effect of flaps if any on the sailplane;

(6) the effects of unbalance at the stall safety checks;

(7) stall symptoms, recognition and recovery;

(8) recovery when a wing drops;

approach to stall in the approach and in the landing configurations: recognition and recovery from accelerated stalls.

(c) Air Exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to demonstrate:

(1) stall from a level flight;

(2) pre-stall symptoms, recognition and recovery;

(3) stall symptoms, recognition and recovery;

(4) recovery when a wing drops;

(5) approach to stall in the approach and in the landing configurations;

(6) recognition and recovery from accelerated stalls;

(7) stalling and recovery at the incipient stage with 'instructor induced' distractions;

(8) how to improve the student pilot's ability to recognise a stall and to recover from it;

(9) how to analyse and correct errors as necessary.

Note: consideration is to be given to manoeuvre limitations and references to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) in relation to mass and balance limitations. The safety checks should take into account the minimum safe altitude for initiating such exercises in order to ensure an adequate margin of safety for the recovery. If specific procedures for stalling or spinning exercises and for the recovery techniques are provided by the flight manual or equivalent document (for example owner's manual or pilot's operating handbook), they have to be taken into consideration. These factors are also covered in the next exercise.

EXERCISE 10a: SPIN RECOGNITION AND AVOIDANCE

(a) Objective:

To advise the student Instructor on how to improve the student's ability to recognize a spin at the incipient stage and to recover from it. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) why a sailplane spins;

(2) how to recognise the symptoms of a spin (not to be confused with spiral dive);

(3) what are the parameters influencing the spin;

(4) how to recover from a spin.

(c) Air exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to:

(1) demonstrate stalling and recovery at the incipient spin stage (stall with excessive wing drop, about 45 °);

(2) make sure that the student recognises the spin entry;

(3) make sure that the student pilot is able to recover from the spin;

(4) check if the student still reacts properly if the instructor induces distractions during the spin entry;

(5) demonstrate how to analyse and correct errors as necessary.

Note: consideration of manoeuvre limitations and the need to refer to the sailplane manual and mass and balance calculations.

EXERCISE 10b: DEVELOPED SPINS: ENTRY AND RECOVERY

(a) Objective:

To advise the student instructor on how to recognize a developed spin and to recover from it. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the spin entry;

(2) the symptoms of a real spin and the recognition and identification of spin direction;

(3) the spin recovery;

(4) use of controls;

(5) effects of flaps (flap restriction applicable to type);

(6) the effect of the CG upon spinning characteristics;

(7) the spinning from various flight attitudes;

(8) the sailplane limitations;

(9) safety checks;

(10) common errors during recovery.

(c) Air exercise:

The student instructor has to check that the airspace below the sailplane is free of other aircraft or traffic before starting the exercise.

The student instructor has to demonstrate:

(1) safety checks;

(2) the spin entry;

(3) the recognition and identification of the spin direction;

(4) the spin recovery (reference to flight manual);

(5) the use of controls;

(6) the effects of flaps (restrictions applicable to sailplane type);

(7) spinning and recovery from various flight attitudes;

(8) how to improve the student pilot's ability to recognise a spin and how to recover from it;

(9) how to analyse and correct errors as necessary.

EXERCISE 11: TAKE OFF OR LAUNCH METHODS

Note: the student instructor has to teach at least one of the following launch methods: winch launch, aero tow, self-launch. At least three launch failure exercises should be completed. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

EXERCISE 11a: WINCH LAUNCH

(a) Objective:

To advise the student instructor on how to teach winch launches and on how to make sure that their student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the signals or communication before and during launch;

(2) the use of the launching equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for crosswind take-off;

(6) the optimum profile of winch launch and limitations;

(7) the launch failure procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of the launching equipment;

(2) the pre-take-off checks;

(3) the into wind take-off;

(4) the crosswind take-off;

(5) the optimum profile of winch launch and limitations;

(6) the procedure in case of cable break or aborted launch, launch failure procedures;

(7) how to teach the student pilot to perform safe winch launches;

(8) how to teach the student pilot to manage an aborted launch (different altitudes);

(9) how to analyse and correct errors as necessary.

EXERCISE 11b: AERO TOW

(a) Objective:

To advise the student instructor on how to teach aero towing and on how to make sure that their student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the signals or communication before and during launch;

(2) the use of the launch equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for crosswind take-off;

(6) the procedure on tow: straight flight, turning and slip stream;

(7) the recovery from out-of-position on tow;

(8) the procedures in case of launch failure and abandonment;

(9) the descending procedure on tow (towing aircraft and sailplane);

(10) the reasons for launch failures and abandonment or procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the signals before and during launch;

(2) the use of the launch equipment;

(3) the pre-take-off checks;

(4) the procedure for into wind take-off;

(5) the procedure for a crosswind take-off;

(6) the procedures on tow: straight flight, turning and slip stream;

(7) the recovery from out-of-position on tow;

(8) the procedure in case of launch failure and abandonment;

(9) the descending procedure on tow;

(10) how to teach the student pilot to perform safe aero tow launches;

(11) how to teach the student pilot to manage an aborted launch;

(12) how to analyse and correct errors as necessary.

EXERCISE 11c: SELF LAUNCH

(a) Objective:

To advise the student instructor on how to teach launching with a self launching sailplane and on how to make sure that his/her student will manage an aborted launch. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the engine extending and retraction procedures;

(2) the engine starting and safety precautions;

(3) the pre-take-off checks;

(4) the noise abatement procedures;

(5) the checks during and after take-off;

(6) the into wind take-off;

(7) the crosswind take-off;

(8) the procedure in case of power failure;

(9) the procedure in case of abandoned take-off;

(10) the maximum performance (short field and obstacle clearance) take-off;

(11) the short take-off and soft field procedure or techniques and performance calculations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the engine extending and retraction procedures;

(2) the engine starting and safety precautions;

(3) the pre-take-off checks;

(4) the noise abatement procedures;

(5) the checks during and after take off;

(6) the into wind take-off;

(7) the crosswind take-off;

(8) the power failures and procedures;

(9) the procedure in case of abandoned take-off;

(10) the maximum performance (short field and obstacle clearance) take-off;

(11) the short take-off and soft field procedure or techniques and performance calculations;

(12) how to teach the student pilot to perform safe self launches;

(13) how to teach the student pilot to manage an aborted launch (different altitudes);

(14) how to analyse and correct errors as necessary.

EXERCISE 12: CIRCUIT APPROACH AND LANDING

(a) Objective:

To advise the student instructor on how to teach their students to fly a safe circuit approach and to land the sailplane. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the procedures for rejoining the circuit;

(2) the procedures for collision avoidance and the lookout techniques;

(3) the pre-landing check;

(4) the normal circuit procedures, downwind, base leg;

(5) the effect of wind on approach and touchdown speeds ;

(6) the visualisation of a reference point;

(7) the approach control and use of airbrakes;

(8) the use of flaps (if applicable);

(9) the procedures for normal and crosswind approach and landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the procedures for rejoining the circuit;

(2) the procedures for collision avoidance and the look-out techniques;

(3) the pre-landing check;

(4) the standard circuit and contingency planning (for example running out of height);

(5) the effect of wind on approach and touchdown speeds;

(6) the visualisation of an aiming point;

(7) the approach control and use of airbrakes;

(8) the use of flaps (if applicable);

(9) the procedures for normal and crosswind approaches and landings;

(10) how to teach the student pilot to fly a safe circuit approach;

(11) how to improve the student pilot's ability to perform a safe landing;

(12) how to analyse and correct errors as necessary.

EXERCISE 13: FIRST SOLO

(a) Objective:

To advise the student instructor on how to prepare their students for the first solo flight.

(b) Briefing:

The student instructor has to explain:

(1) the limitations of the flight (awareness of local area and restrictions);

(2) the use of required equipment.

(c) Air exercise:

The student instructor has to;

(1) check with another or more senior instructor if the student can fly solo;

(2) monitor the flight;

(3) debrief the flight with the student.

EXERCISE 14 : ADVANCED TURNING

(a) Objective:

To advise the student instructor on how to fly steep turns or circles (45 ° banking) at constant attitude (speed) and with the yaw string centred. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain;

(1) the relationship between banking and speed;

(2) how to master steep turns or circles;

(3) the unusual attitudes which can occur (stalling or spinning and spiral dive);

(4) how to recover from these unusual attitudes.

(c) Air exercise:

The student has to demonstrate:

(1) steep turns (45 °) at constant speed and with the yaw string centred;

(2) common errors (slipping and skidding);

(3) unusual attitudes and how to recover from them;

(4) how to teach the student pilot to fly steep turns or circles;

(5) how to analyse and correct errors as necessary.

EXERCISE 15: SOARING TECHNIQUES

Note: if the weather conditions during the instructor training do not allow the practical training of soaring techniques, all items of the air exercises have to be discussed and explained during a long briefing exercise only.

EXERCISE 15a: THERMALLING

(a) Objective:

To advise the student instructor on how to teach their students to recognise and detect thermals, on how to join a thermal and on how to look out, in order to avoid mid-air collisions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain;

(1) the look-out procedures;

(2) the detection and recognition of thermals;

(3) the use of audio soaring instruments;

(4) the procedure for joining a thermal and giving way;

(5) how to fly in close proximity to other sailplanes;

(6) how to centre in thermals;

(7) how to leave thermals.

(c) Air exercise:

The student instructor has to demonstrate;

(1) the look-out procedures;

(2) the detection and recognition of thermals;

(3) the use of audio soaring instruments;

(4) the procedure for joining a thermal and giving way;

(5) the procedure for flying in close proximity to other sailplanes;

(6) the centering in thermals;

(7) the procedure for leaving thermals;

(8) how to improve the student pilot's ability to recognise and detect thermals;

(9) how to improve the student pilot's ability to join a thermal and how to look out;

(10) how to analyse and correct errors as necessary.

EXERCISE 15b: RIDGE FLYING

(a) Objective:

To advise the student instructor on how to teach his/her students to fly safely on ridges, to control their speed, and to apply the rules in order to avoid mid-air collisions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the look-out procedures;

(2) the ridge flying rules;

(3) the recognition of optimum flight path;

(4) speed control.

(c) Air exercise: (if applicable during training and, if possible, at training site)

The student instructor has to demonstrate:

(1) the look-out procedures;

(2) the practical application of ridge flying rules;

(3) the recognition of optimum flight path;

(4) speed control;

(5) how to teach the student pilot to fly safely on ridges;

(6) how to analyse and correct errors as necessary.

EXERCISE 15c: WAVE FLYING

(a) Objective:

To advise the student instructor on how to introduce students to wave flying and to teach them to fly safely at high altitude. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the look-out procedures;

(2) the techniques to be used to accede to a wave;

(3) the speed limitations with increasing height;

(4) the risks of hypoxia and the use of oxygen.

(c) Air exercise: (if applicable during training and if possible at training site)

The student instructor has to demonstrate:

(1) the look-out procedures;

(2) the wave access techniques;

(3) the speed limitations with increasing height;

(4) the use of oxygen (if available);

(5) how to improve the student pilot's ability to recognise and detect waves;

(6) how to teach the student pilot to fly safely in a wave;

(7) how to analyse and correct errors as necessary.

EXERCISE 16: OUT-LANDINGS

Note: if the weather conditions during the instructor training do not allow the practical training of out-landing procedures (a touring motor glider may be used) all items of the air exercise have to be discussed and explained during a long briefing exercise only. Instructors may only teach the safe out-landing exercise after they have demonstrated the practical ability to do so.

(a) Objective:

To advise the student instructor on how to teach students to select an out-landing field, to fly the circuit and how to master the unusual landing situation. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the gliding range at max L/D;

(2) the engine re-start procedures (only for self-launching and self-sustaining sailplanes);

(3) the selection of a landing area;

(4) the circuit judgement and key positions;

(5) the circuit and approach procedures;

(6) the actions to be done after landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) precision landings on the airfield;

(2) the gliding range;

(3) the procedures for joining, arrival and circuit at a remote aerodrome;

(4) the selection of an out-landing area;

(5) the procedures for circuit and approach on an out-landing field;

(6) the actions to be done after landing;

The student instructor also has to be trained:

(7) how to advise the student pilot to do perform a safe out-landing;

(8) how to master an unusual landing situation;

(9) how to analyse and correct errors as necessary.

EXERCISE 17: CROSS COUNTRY FLYING

Note: if the weather conditions during the instructor training do not allow a cross country training flight the items of the air exercise have to be discussed and explained during a long briefing exercise only.

EXERCISE 17a: FLIGHT PLANNING

(a) Objective:

To advise the student instructor on how plan and prepare a cross-country flight.

(b) Briefing:

The student instructor has to explain:

(1) the weather forecast and current situation;

(2) the selection of the amount of water to be carried as a function of the weather forecast;

(3) the method for selecting a task, taking into account the average speed to be expected;

(4) the map selection and preparation;

(5) the NOTAMs and airspace considerations;

(6) the radio frequencies (if applicable);

(7) the pre-flight administrative procedures;

(8) the procedure for filing a flight plan where required;

(9) alternate aerodromes and landing areas.

EXERCISE 17b: IN-FLIGHT NAVIGATION

(a) Objective:

To advise the student instructor on how to teach performing a cross-country flight.

(b) Briefing:

The student instructor has to explain:

(1) how to maintain track and re-route if necessary;

(2) the altimeter settings;

(3) the use of radio and phraseology;

(4) the in-flight planning;

(5) the procedures for transiting regulated airspace or ATC liaison where required;

(6) the procedure in case of uncertainty of position;

(7) the procedure in case of becoming lost;

(c) Air exercise:

The student instructor has to demonstrate:

(1) maintaining track and re-routing if necessary;

(2) altimeter settings;

(3) the use of radio and phraseology;

(4) in-flight planning;

(5) procedures for transiting regulated airspace or ATC liaison where required;

(6) uncertainty of position procedure;

(7) lost procedure;

(8) use of additional equipment where required;

(9) joining, arrival and circuit procedures at remote aerodrome;

(10) how to teach the student pilot to perform a cross-country flight;

(11) how to analyse and correct errors as necessary.

EXERCISE 17c: CROSS-COUNTRY SOARING TECHNIQUES

(a) Objective:

To advise the student instructor on the techniques for an efficient cross country flight.

(b) Briefing:

The student instructor has to explain:

(1) the speed to fly at maximal L/D ratio;

(2) the speed to fly to maximise the cruise speed (Mc Cready theory);

(3) how to select the optimal track (efficient use of cloud streets etc.);

(4) how to calculate the final glide;

(5) how to perform a safe out-landing.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a cross-country flight;

(2) the selection of the optimal track (efficient use of cloud streets, etc) ;

(3) the use of the Mc Cready ring;

(4) use of final glide computers;

(5) how to reduce risk and to react to potential dangers;

(6) how to plan and perform an out-landing;

(7) how to teach the student pilot techniques for an efficient cross-country flight;

(8) how to analyse and correct errors as necessary.

B. BALLOONS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: FAMILIARISATION WITH THE BALLOON

(a) Objective:

To advise the student Instructor on how to familiarise the student with the balloon which will be used for the training and to test his position in the basket for comfort, visibility, and ability to use all controls and equipment. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing and exercise:

The student instructor has to:

(1) present the type of balloon which will be used;

(2) explain the characteristics of the balloon;

(3) explain the components, instruments and equipment;

(4) explain the re-fuelling procedures (in the case of hot air balloons);

(5) to familiarise the student with the balloon controls;

(6) explain the differences when occupying the instructor's position;

(7) explain all checklists, drills and controls.

EXERCISE 2: PREPARATION FOR FLIGHT

(a) Objective:

To advise the student instructor on how to explain all the operations and necessary preparation to be completed before the flight. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing

The student instructor has to explain:

(1) the need for a pre-flight briefing;

(2) the structure and the content of this briefing;

(3) which documents are required on board;

(4) which equipment are required for a flight;

(5) the use of weather forecasts or actuals;

(6) the flight planning with particular regard to NOTAMs, airspace structure, sensitive areas, expected track and distance, pre-flight picture and possible landing fields;

(7) the use of load calculation chart;

(8) the selection of launch field with particular regard to permission, behaviour and adjacent fields.

(c) Air exercise:

The student instructor has to prepare and give a pre-flight briefing.

The student instructor has to demonstrate:

(1) that the required documents are on board;

(2) that the equipment required for the intended flight is on board;

(3) how to advice the student to do the pre-planning procedures for each flight;

(4) how to perform a pre-launch check;

(5) how to select a launch field with particular regard to permission, behaviour and adjacent fields;

(6) how to teach the student pilot to perform the preparation to be completed prior to flight;

(7) how to analyse and correct errors of the student pilot as necessary.

EXERCISE 3: CREW AND PASSENGER BRIEFING

(a) Objective:

To advise the student instructor on how to explain all the importance of correct clothing for pilot, passengers and crew and how to perform the briefing of ground- and retrieve crew and the briefing of passengers. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the correct clothing for passengers and crew;

(2) the briefings for ground- and retrieve crew and passengers.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to advise the passengers and crew about the correct clothing;

(2) the briefing of ground- and retrieve crew;

(3) the briefing of passengers;

(4) how to familiarise the student pilot with the different type of briefings;

(5) how to analyse and correct errors of the student pilot.

EXERCISE 4: ASSEMBLY AND LAYOUT

(a) Objective:

To advise the student instructor on how to familiarise the student pilot with the control of the crowd and how to perform the securing of launch site. Furthermore the student instructor has to demonstrate how to familiarise the student pilot with the correct rigging of envelope and basket, the burner test procedure (hot air balloons) and the pre-inflation checks. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the control of the crowd;

(2) the securing of the launch site;

(3) the correct rigging procedure;

(4) the use of the restraint line;

(5) the pre-inflation checks.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to control the crowd and securing of launch site;

(2) the correct rigging of envelope and basket;

(3) the correct use of the restraint line;

(4) the burner test procedure (hot air balloons);

(5) the pre-inflation checks;

(6) how to teach the student pilot to perform the correct rigging;

(7) how to analyse and correct assembly errors of the student pilot as necessary.

EXERCISE 5: INFLATION

(a) Objective:

To advise the student instructor on how to familiarise the student pilot with the different phases of the inflation procedure, the use of restraint line and inflation fan (hot air balloons) and the avoidance of electrostatic discharge (gas balloons). Furthermore**,** the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the different phases of the inflation procedure;

(2) the crowd control and securing procedures during inflation;

(3) the use of the inflation fan (hot air balloons);

(4) how to avoid electronic discharge (gas balloons).

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to control of crowd and securing of launch site during inflation procedure;

(2) the cold inflation procedure and use of restraint line and inflation fan (hot air balloons);

(3) the hot inflation procedure (hot air balloons);

(4) the avoidance of electrostatic discharge (gas balloons);

(5) the inflation procedure (gas balloons);

(6) how to teach the student pilot to perform the inflation procedures;

(7) how to analyse and correct errors of the student pilot during the inflation procedure as necessary.

EXERCISE 6: TAKE OFF IN DIFFERENT WIND CONDITIONS

(a) Objective:

To advise the student instructor how to explain the pre take-off checks and briefings, the preparation for controlled climb and the use of restraint equipment. Furthermore the student instructor should be able to demonstrate the assessment of wind and obstacles, the preparation for false lift and the take off techniques in different wind conditions. In addition to this the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre take-off checks and briefings;

(2) the preparation for controlled climb;

(3) the 'hands off and hands on' procedure for ground crew;

(4) the assessment of lift;

(5) the use of the restraint equipment ;

(6) the assessment of wind and obstacles;

(7) the preparation for false lift;

(8) the take off techniques from sheltered and non sheltered launch fields.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to perform the pre take-off checks and briefings;

(2) how to prepare for controlled climb;

(3) how to perform the 'hands off and hands on' procedure for ground crew;

(4) how to perform the assessment of lift without endangering the ground crew;

(5) how to use the restraint equipment;

(6) how to perform the assessment of wind and obstacles;

(7) how to prepare for false lift;

(8) how to teach the student pilot the correct take off techniques from sheltered and non sheltered launch fields;

(9) how to analyse and correct errors of the student pilot as necessary.

EXERCISE 7: CLIMB TO LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate the climb to flight level. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the climbing with a predetermined rate of climb;

(2) the effect on envelope temperature (hot air balloons);

(3) the maximum rate of climb according to manufacturer's flight manual;

(4) how to level off at selected altitude.

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to climb with a predetermined rate of climb;

(2) how to perform look out techniques;

(3) the effect on envelope temperature (hot air balloons);

(4) the maximum rate of climb according to manufacturer's flight manual;

(5) the levelling off techniques at selected altitude;

(6) how to advise the student pilot to perform the climb to level flight;

(7) how to analyse and correct faults or errors of the student pilot during the climb.

EXERCISE 8: LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate level flight. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) how to maintain level flight by use of instruments;

(2) how to maintain level flight by use of visual references;

(3) how to maintain level flight by use of all available means;

(4) the use of parachute;

(5) the use of turning vents if installed (hot air balloons).

(c) Air exercise:

The student instructor has to demonstrate:

(1) how to maintain level flight by use of instruments;

(2) how to maintain level flight by use of visual references;

(3) how to maintain level flight by use of all available means;

(4) the use of parachute;

(5) the use of turning vents if installed (hot air balloons);

(6) how to advise the student pilot to perform the level flight;

(7) how to analyse and correct faults or errors of the student pilot during the level flight.

EXERCISE 9: DESCENT TO LEVEL FLIGHT

(a) Objective:

To advise the student instructor on how to explain and demonstrate the descent to a certain flight level. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) how to descent with a predetermined rate of descent;

(2) a fast descent;

(3) the maximum rate of descent according to manufacturer's flight manual;

(4) the use of parachute;

(5) a parachute stall and cold descent (hot air balloons);

(6) the levelling off technique at selected altitude.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a descent with a predetermined rate of descent;

(2) how to perform look out techniques;

(3) a fast descent;

(4) the maximum rate of descent according to manufacturer's flight manual;

(5) the use of parachute;

(6) how to level off at selected altitudes;

(7) how to advise the student pilot to perform a descent to a certain flight level;

(8) how to analyse and correct faults or errors of the student pilot during the descent.

EXERCISE 10: EMERGENCIES

(a) Objective:

To advise the student instructor on how to explain and demonstrate the different emergency situations and how to react. Furthermore the student instructor should learn how to identify student errors during the simulated emergency exercises and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pilot light failure (hot air balloons);

(2) burner failures, valve leaks, flame out and re-light (hot air balloons);

(3) gas leaks;

(4) closed appendix during take-off and climb (gas balloons);

(5) the envelope over temperature (hot air balloons);

(6) envelope damage in flight;

(7) the parachute or rapid deflation system failure;

(8) fire on ground and in the air;

(9) how to avoid an obstacle contact including contact with electrical power lines;

(10) escape drills, location and use of emergency equipment.

(c) Air exercise:

The student instructor has to demonstrate:

(1) a pilot light failure (hot air balloons);

(2) a burner failure, valve leaks, flame out and re-light (hot air balloons);

(3) gas leaks;

(4) a closed appendix during take-off and climb (gas balloons);

(5) envelope over temperature (hot air balloons);

(6) envelope damage in flight;

(7) parachute or rapid deflation system failure;

(8) a fire on ground and in the air;

(9) the escape drills, location and use of emergency equipment;

(10) how to advise the student pilot in performing the different emergency drills;

(11) how to analyse and correct faults or errors of the student pilot.

EXERCISE 11: NAVIGATION

(a) Objective:

To advise the student instructor on how to explain and demonstrate the advanced navigational flight preparation. Furthermore the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the maps selection;

(2) the plotting of the expected track;

(3) the marking of positions and time;

(4) the calculation of distance and speed;

(5) the calculation of fuel consumption (hot air balloons);

(6) the calculation of ballast consumption (gas balloons);

(7) the ceiling limitations (ATC or weather);

(8) how to plan ahead;

(9) the monitoring of weather development;

(10) the monitoring of fuel or ballast consumption;

(11) ATC liaison (if applicable);

(12) the communication with retrieve crew;

(13) the use of GNSS.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of selected maps;

(2) the plotting of the expected track;

(3) the marking of positions and time;

(4) how to monitor of distance and speed;

(5) how to monitor the fuel or ballast consumption;

(6) the observance of ceiling limitations (ATC or weather);

(7) the planning ahead;

(8) the monitoring of weather development;

(9) the monitoring of envelope temperature (hot air balloons);

(10) ATC liaison (if applicable);

(11) communication with retrieve crew;

(12) use of GNSS;

(13) how to advise the student pilot in performing the navigational preparation;

(14) how to advise the student pilot in performing the different navigational in-flight tasks;

(15) how to analyse and correct faults or errors of the student pilot.

EXERCISE 12a: FUEL MANAGEMENT HOT AIR BALLOONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate the fuel management techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the cylinder arrangement and the burner systems;

(2) the function of the pilot light supply (vapour or liquid);

(3) the use of master cylinders (if applicable);

(4) the fuel requirement and expected fuel consumption;

(5) the fuel state and pressure;

(6) the minimum fuel reserves;

(7) cylinder contents gauge and change procedure;

(8) the use of cylinder manifolds.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the cylinder arrangement and burner systems;

(2) the pilot light supply (vapour or liquid);

(3) the use of master cylinders (if applicable);

(4) how to monitor of fuel requirement and expected fuel consumption;

(5) the monitoring of fuel state and pressure;

(6) the monitoring of fuel reserves;

(7) the use of cylinder contents gauge and change procedure;

(8) the use of cylinder manifolds;

(9) how to advise the student pilot to perform the fuel management;

(10) how to analyse and correct faults or errors of the student pilot.

EXERCISE 12b: BALLAST MANAGEMENT GAS BALLOONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate the ballast management. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the minimum ballast;

(2) the arrangement and securing of ballast;

(3) the ballast requirement and expected ballast consumption;

(4) the ballast reserves.

(c) Air exercise:

The student instructor also has to demonstrate:

(1) the arrangement of minimum ballast;

(2) the arrangement and securing of ballast;

(3) the ballast requirement calculation and expected ballast consumption;

(4) how to secure ballast reserves;

(5) how to advise the student pilot to perform the ballast management;

(6) how to analyse and correct faults or errors of the student pilot.

EXERCISE 13: APPROACH FROM LOW LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the approach from level. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre landing checks;

(2) passenger pre-landing briefing;

(3) the selection of field;

(4) the use of burner and parachute (hot air balloons);

(5) the use of ballast or parachute and valve (gas balloons);

(6) the use of trail rope (if applicable) (gas balloons);

(7) the look-out;

(8) missed approach and fly on procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of the pre landing checks;

(2) the selection of fields;

(3) the use of burner and parachute (hot air balloons);

(4) the use of ballast or parachute and valve (gas balloons);

(5) the use of trail rope (if applicable) (gas balloons);

(6) the look out procedures and how to avoid possible distractions;

(7) the missed approach and fly on techniques;

(8) how to advise the student pilot to perform an approach from low level;

(9) how to analyse and correct faults or errors of the student pilot.

EXERCISE 14: APPROACH FROM HIGH LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the approach from high level. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the pre-landing checks;

(2) passenger pre-landing briefing;

(3) the selection of field;

(4) the rate of descent;

(5) the use of burner and parachute (hot air balloons);

(6) the use of ballast and parachute (gas balloons);

(7) the use of trail rope (if applicable) (gas balloons);

(8) the look-out;

(9) the missed approach and fly on procedures.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the pre-landing checks;

(2) the selection of field;

(3) the rate of descent;

(4) the use of burner and parachute (hot air balloons);

(5) the use of ballast and parachute (gas balloons);

(6) the use of trail rope (if applicable) (gas balloons);

(7) the look out procedures and how to avoid potential distraction;

(8) the missed approach and fly on techniques;

(9) how to advise the student pilot to perform an approach from a higher level;

(10) how to analyse and correct faults or errors of the student pilot.

EXERCISE 15: OPERATING AT LOW LEVEL

(a) Objective:

To advise the student instructor on how to explain and demonstrate the operation at a low height. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the use of burner and parachute (hot air balloons);

(2) the use of ballast and parachute (gas balloons);

(3) the look out;

(4) how to avoid a contact with low level obstacles;

(5) how to avoid sensitive areas (for example nature protection areas);

(6) landowner relations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of burner and parachute (hot air balloons);

(2) the use of ballast and parachute (gas balloons);

(3) the look out procedures and how to avoid potential distraction;

(4) how to avoid low level obstacles;

(5) good landowner relations;

(6) how to advise the student pilot to operate the balloon at a low level;

(7) how to analyse and correct faults or errors of the student pilot.

EXERCISE 16: LANDING IN DIFFERENT WIND CONDITIONS

(a) Objective:

To advise the student instructor on how to explain and demonstrate landings in different wind conditions. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the correct actions for turbulences during the approach or landing;

(2) the passenger pre-landing briefing;

(3) the use of burner and pilot lights (hot air balloons);

(4) the use of ballast, parachute, valve and rip panel (gas balloons);

(5) the use of parachute and turning vents (if applicable);

(6) the look out;

(7) the landing, dragging and deflation;

(8) landowner relations.

(c) Air exercise:

The student instructor has to demonstrate:

(1) the pre-landing checks;

(2) the passenger briefing;

(3) the selection of field;

(4) the effect of turbulence;

(5) the use of burner and pilot lights (hot air balloons);

(6) the use of ballast, parachute, valve and rip panel (gas balloons);

(7) the use of parachute and turning vents (if applicable);

(8) the look out procedures and how to avoid potential distraction;

(9) the landing, dragging and deflation procedures;

(11) how to advise the student pilot to perform a safe landing in different wind conditions;

(12) how to analyse and correct faults or errors of the student pilot.

EXERCISE 17: FIRST SOLO

(a) Objective:

To advise the student instructor on how to prepare their students for the first solo flight.

(b) Briefing:

The student instructor has to explain:

(1) the limitations of the flight;

(2) the use of required equipment.

(c) Air exercise:

The student instructor has to:

(1) check with another or more senior instructor if the student can fly solo;

(2) monitor the pre-flight preparation;

(3) brief the student (expected flight time or emergency actions);

(4) monitor the flight as far as possible;

(5) debrief the flight with the student.

EXERCISE 18: TETHERED FLIGHT HOT AIR BALLOONS (if tethered flight instructional qualification is required)

(a) Objective:

To advise the student instructor on how to explain and demonstrate the tethering techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the ground preparations;

(2) the weather suitability;

(3) the tethering techniques and equipment;

(4) the maximum all-up-weight limitation;

(5) the crowd control;

(6) the pre take-off checks and briefings;

(7) the heating for controlled lift off;

(8) the 'hands off and hands on' procedure for ground crew;

(9) the assessment of wind and obstacles;

(10) the controlled climb to a pre-defined altitude (at least 60 ft).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the ground preparations;

(2) the tethering techniques;

(3) the reason for maximum all-up-weight limitation;

(4) how to perform the crowd control;

(5) the pre take-off checks and briefings;

(6) the heating for controlled lift off;

(7) the 'hands off and hands on' procedure for ground crew;

(8) the assessment of wind and obstacles;

(9) the controlled climb;

(10) the landing techniques;

(11) how to advise the student pilot to perform a tethered flight;

(12) how to analyse and correct faults or errors of the student pilot.

EXERCISE 19: NIGHT FLYING (if night instructional qualification required)

(a) Objective:

To advise the student instructor on how to explain and demonstrate the night flying techniques. Furthermore, the student instructor should learn how to identify student errors and how to correct them properly.

(b) Briefing:

The student instructor has to explain:

(1) the medical or physiological aspects of night vision;

(2) the use of lights for assembly, layout and inflation;

(3) the requirement for torch to be carried, (pre-flight inspection, etc.);

(4) the use of the external- and instrument lights;

(5) the night take-off procedure;

(6) the checklist procedures at night;

(7) the emergency procedures at night;

(8) the navigation principles at night;

(9) map marking for night use (highlighting built up or lit areas with thicker lines, etc.).

(c) Air exercise:

The student instructor has to demonstrate:

(1) the use of lights for assembly, layout and inflation;

(2) the use of torch for pre-flight inspection;

(3) the use of external- and instrument lights;

(4) the night take-off procedure;

(5) how to perform the checklist procedures at night;

(6) simulated night emergency procedures;

(7) night cross country techniques, as appropriate;

(8) how to advise the student pilot to perform a flight at night;

(9) how to analyse and correct faults or errors of the student pilot.

AMC1 FCL.940.FI(a)(2) FI — Revalidation and renewal

FI OR IRI REFRESHER SEMINAR

(a) FI or IRI refresher seminars made available in Member States should have due regard to geographical location, numbers attending, and periodicity throughout the territory of the Member State concerned.

(b) Such seminars should run for at least 2 days, and attendance from participants will be required for the whole duration of the seminar including breakout groups and workshops. Different aspects, such as inclusion of participants holding certificates in other categories of aircraft should be considered.

(c) Some experienced FIs or IRIs currently involved with flying training and with a practical understanding of the revalidation requirements and current instructional techniques should be included as speakers at these seminars.

(d) The attendance form will be completed and signed by the organiser of the seminar as approved by the competent authority, following attendance and satisfactory participation by the FI or IRI.

(e) The content of the FI or IRI refresher seminar should be selected from the following:

(1) new or current rules or regulations, with emphasis on knowledge of Part-FCL and operational requirements;

(2) teaching and learning;

(3) instructional techniques;

(4) the role of the instructor;

(5) national regulations (as applicable);

(6) human factors;

(7) flight safety, incident and accident prevention;

(8) airmanship;

(9) legal aspects and enforcement procedures;

(10) navigational skills including new or current radio navigation aids;

(11) teaching instrument flying;

(12) weather related topics including methods of distribution.

(13) any additional topic selected by the competent authority.

(f) Formal sessions should allow for a presentation time of 45 minutes, with 15 minutes for questions. The use of visual aids is recommended, with interactive video and other teaching aids (where available) for breakout groups and workshops.

GM1 FCL.940.FI(a)(2) FI — Revalidation and renewal

FI CERTIFICATE: REVALIDATION AND RENEWAL FORM

A. AEROPLANES

INSTRUCTIONAL FLYING EXPERIENCE				
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.				
SINGLE-ENGINE		MULTI-ENGINE		INSTRUMENT
DAY	NIGHT	DAY	NIGHT	
Total instructional hours (preceding 36 months):				
Total instructional hours (preceding 12 months):				

FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(A) certificate
3	**Seminar particulars:**	
Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		
PROFICIENCY CHECK		

(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.	
Flying time:	Aeroplane or FFS used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

B. HELICOPTERS

INSTRUCTIONAL FLYING EXPERIENCE		
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.		
Instrument:		
Total instructional hours (preceding 36 months):		
Total instructional hours (preceding 12 months):		
FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendees personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(H) certificate:
3	**Seminar particulars:**	

<table>
<tr><td colspan="3">Date(s) of seminar:</td><td colspan="2">Place:</td></tr>
<tr><td>4</td><td colspan="4">Declaration by the responsible organiser:</td></tr>
<tr><td colspan="5">I certify that the above data are correct and that the FI seminar was carried out.</td></tr>
<tr><td colspan="2">Date of approval:</td><td></td><td>Name(s) of organiser:
(capital letters)</td><td></td></tr>
<tr><td colspan="2">Date and place:</td><td></td><td>Signature:</td><td></td></tr>
<tr><td>5</td><td colspan="4">Declaration by the attendee:</td></tr>
<tr><td colspan="5">I confirm the data under 1 through 3</td></tr>
<tr><td colspan="5">Attendee’s signature:</td></tr>
<tr><td colspan="5">PROFICIENCY CHECK</td></tr>
<tr><td colspan="5">(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.</td></tr>
<tr><td colspan="3">Flying time:</td><td colspan="2">Helicopter or FFS used:</td></tr>
<tr><td colspan="5">Main exercise:</td></tr>
<tr><td colspan="3">Name(s) of FIE:</td><td colspan="2">Licence number:</td></tr>
<tr><td colspan="5">Date and place:
Signature:</td></tr>
</table>

C. AIRSHIPS

INSTRUCTIONAL FLYING EXPERIENCE				
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.				
SINGLE-ENGINE		MULTI-ENGINE		INSTRUMENT
DAY	NIGHT	DAY	NIGHT	
Total instructional hours (preceding 36 months):				
Total instructional hours (preceding 12 months):				

FLIGHT INSTRUCTOR REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(As) certificate:
3	**Seminar particulars:**	
Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		

PROFICIENCY CHECK

(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.

Flying time:	Airship or FFS used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

D. SAILPLANES INSTRUCTIONAL FLYING EXPERIENCE

INSTRUCTIONAL FLYING EXPERIENCE			
Instructors applying for revalidation of the FI certificate should enter the instructional hours and take-offs flown during the preceding 36 months.			
SAILPLANE (hours and take-offs)		TMG (hours and take-offs)	
DAY	NIGHT	DAY	NIGHT
Total instructional hours (preceding 36 months):			
Total instructional hours (preceding 12 months):			
Total amount of take-offs (preceding 36 months):			
Total amount of take-offs (preceding 12 months):			

FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(S) certificate:
3	**Seminar particulars:**	

Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		

PROFICIENCY CHECK	
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.	
Flying time:	Sailplane or TMG used:
Main exercise:	
Name(s) of FIE:	Licence number:
Date and place:	Signature:

E. BALLOONS

INSTRUCTIONAL FLYING EXPERIENCE					
Instructors applying for revalidation of the FI certificate should enter the instructional hours flown during the preceding 36 months.					
Balloons (gas)		Balloons (hot-air)		Hot-air airships	
DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
Total instructional hours (preceding 36 months):					

Total instructional hours (preceding 12 months):		
FI REFRESHER SEMINAR		
1	**This is to certify that the undersigned attended an FI seminar**	
2	**Attendee's personal particulars:**	
Name(s):		Address:
Licence number:		Expiration date of FI(B) certificate:
3	**Seminar particulars:**	
Date(s) of seminar:		Place:
4	**Declaration by the responsible organiser:**	
I certify that the above data are correct and that the FI seminar was carried out.		
Date of approval:		Name(s) of organiser: (capital letters)
Date and place:		Signature:
5	**Declaration by the attendee:**	
I confirm the data under 1 through 3		
Attendee's signature:		
PROFICIENCY CHECK		
(Name(s) of applicant) has given proof of flying instructional ability during a proficiency check flight. This was done to the required standard.		
Flying time:		Balloon or hot-air airship used:
Main exercise:		
Name(s) of FIE:		Licence number:
Date and place:		Signature:

AMC1 FCL.930.TRI TRI — Training course

TRI TRAINING COURSE: AEROPLANES

GENERAL

(a) The aim of the TRI(A) training course is to train aeroplane licence holders to the level of competence defined in FCL.920 and adequate for a TRI.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the TRI task, and should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for an aeroplane type rating for which the applicant is qualified.

(c) The TRI(A) training course should give particular emphasis to the role of the individual in relation to the importance of human factors in the man-machine environment and the role of CRM.

(d) Special attention should be given to the applicant's maturity and judgment including an understanding of adults, their behavioural attitudes and variable levels of learning ability. During the training course the applicants should be made aware of their own attitudes to the importance of flight safety. It will be important during the training course to aim at giving the applicant the knowledge, skills and attitudes relevant to the role of the TRI.

(e) For a TRI(A) the amount of flight training will vary depending on the complexity of the aeroplane type. A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and should be related to the type of aeroplane on which the applicant wishes to instruct. The content of the training programme should cover training exercises applicable to the aeroplane type as set out in the applicable type rating courses.

(f) A TRI(A) may instruct in a TRI(A) course once he or she has conducted a minimum of four type rating instruction courses.

(g) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(h) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(i) The training course consists of three parts:

(1) Part 1: teaching and learning instruction that should comply with AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The technical theoretical knowledge instruction should comprise of not less than 10 hours training to include the revision of technical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the TRI(A) to instruct the technical theoretical knowledge syllabus.

(b) If a TRI(A) certificate for MP aeroplanes is sought, particular attention should be given to multi-crew cooperation. If a TRI(A) certificate for SP aeroplanes is sought, particular attention should be given to the duty in SP operations.

(c) The type rating theoretical syllabus should be used to develop the TRI(A)'s teaching skills in relation to the type technical course syllabus. The course instructor should deliver example lectures from the applicable type technical syllabus and the candidate instructor should prepare and deliver lectures on topics selected by the course instructor from the type rating course.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The course should be related to the type of aeroplane on which the applicant wishes to instruct.

(b) TEM, CRM and the appropriate use of behavioural markers should be integrated throughout.

(c) The content of the training programme should cover all the significant exercises applicable to the aeroplane type.

(d) The applicant for a TRI(A) certificate should be taught and made familiar with the device, its limitations, capabilities and safety features, and the instructor station, including emergency evacuation.

FSTD TRAINING

(e) The applicant for a TRI(A) certificate should be taught and made familiar with giving instruction from the instructor station. In addition, before being checked for base training instruction, the applicant for a TRI(A) should be taught ands made familiar with giving instruction from all operating positions, including demonstrations of appropriate handling exercises.

(f) Training courses should be developed to give the applicant experience in training a variety of exercises, covering both normal and abnormal operations. The syllabus should be tailored appropriate to the aeroplane type, using exercises considered more demanding for the student. This should include engine-out handling and engine-out operations in addition to representative exercises from the type transition course.

(g) The applicant should be required to plan, brief, train and debrief sessions using all relevant training techniques.

AEROPLANE TRAINING

(h) The applicant for a TRI(A) certificate should receive instruction in an FFS to a satisfactory level in:

(1) right hand seat familiarisation, which should include at least the following as pilot flying:

(i) re-flight preparation and use of checklists;

(ii) taxiing;

(iii) take-off;

(iv) rejected take-off;

(v) engine failure during take-off, after v_1;

(vi) engine inoperative approach and go-around;

(vii) one engine (critical) simulated inoperative landing;

(viii) other emergency and abnormal operating procedures (as necessary).

(2) aeroplane training techniques:

(i) methods for giving appropriate commentary;

(ii) particularities of handling the aeroplane in touch and go manoeuvres;

(iii) intervention strategies developed from situations role-played by a TRI course instructor, taken from but not limited to:

(A) take-off configuration warning;

(B) over controlling;

(C) high flare: long float;

(D) long flare;

(E) baulked landing;

(F) immediate go-around from touch;

(G) too high on approach: no flare;

(H) incorrect configuration;

(I) TAWS warning;

(J) misuse of rudder;

(K) over control in roll axis during flare;

(L) incapacitation;

(M) actual abnormal or emergencies.

(i) Additionally, if the applicant is required to train emergency or abnormal procedures in an aeroplane, synthetic device training as follows:

(1) appropriate methods and minimum altitudes for simulating failures;

(2) incorrect rudder inputs;

(3) failure of a critical engine;

(4) approach and full-stop landing with simulated engine-out.

(j) In this case, the abnormal manoeuvres refer to engine-out handling as necessary for completion of type rating training. If the applicant is required to train other abnormal items in the transition course, additional training will be required.

(k) Upon successful completion of the training above, the applicant should receive training in an aeroplane in-flight under the supervision of a TRI(A). At the completion of training the applicant instructor should be required to conduct a training flight under the supervision and to the satisfaction of a TRI(A) nominated for this purpose by the training organisation.

TRAINING FOR ASYMMETRIC POWER FLIGHT ON SP MET AEROPLANES

(l) During this part of the training, special emphasis is to be placed on the:

(1) circumstances in which actual feathering and un-feathering practice will be done, for example safe altitude; compliance with regulations about minimum altitude or height for feathering practice, weather conditions, distance from nearest available aerodrome.

(2) procedure to use for instructor and student co-operation, for example the correct use of touch drills and the prevention of misunderstandings, especially during feathering and unfeathering practice and when zero thrust is being used for asymmetric circuits. This procedure is to include positive agreement as to which engine is being shut down or re-started or set at zero thrust and identifying each control and naming the engine it is going to affect.

(3) consideration to be given to avoid over-working the operating engine, and the degraded performance when operating the aeroplane during asymmetric flight.

(4) need to use the specific checklist for the aeroplane type.

LONG BRIEFINGS:

(m) Flight on asymmetric power

(1) introduction to asymmetric flight;

(2) feathering the propeller: method of operation;

(3) effects on aeroplane handling at cruising speed;

(4) introduction to effects upon aeroplane performance;

(5) note foot load to maintain a constant heading (no rudder trim);

(6) un-feathering the propeller: regain normal flight;

(7) finding the zero thrust setting: comparison of foot load when feathered and with zero thrust set.

(8) effects and recognition of engine failure in level flight;

(9) the forces and the effects of yaw;

(10) types of failure:

(i) sudden or gradual;

(ii) complete or partial.

(11) yaw, direction and further effects of yaw;

(12) flight instrument indications;

(13) identification of failed engine;

(14) the couples and residual out of balance forces: resultant flight attitude;

(15) use of rudder to counteract yaw;

(16) use of aileron: dangers of misuse;

(17) use of elevator to maintain level flight;

(18) use of power to maintain a safe air speed and altitude;

(19) supplementary recovery to straight and level flight: simultaneous increase of speed and reduction in power;

(20) identification of failed engine: = idle engine;

(21) use of engine instruments for identification:

(i) fuel pressure or flow;

(ii) RPM gauge response effect of CSU action at lower and higher air speed;

(iii) engine temperature gauges.

(22) confirmation of identification: close the throttle of identified failed engine;

(23) effects and recognition of engine failure in turns;

(24) identification and control;

(25) side forces and effects of yaw.

(n) During turning flight:

(1) effect of 'inside' engine failure: effect sudden and pronounced;

(2) effect of 'outside' engine failure: effect less sudden and pronounced;

(3) the possibility of confusion in identification (particularly at low power):

(i) correct use of rudder;

(ii) possible need to return to lateral level flight to confirm correct identification;

(4) visual and flight instrument indications;

(5) effect of varying speed and power;

(6) speed and thrust relationship;

(7) at normal cruising speed and cruising power: engine failure clearly recognised;

(8) at low safe speed and climb power: engine failure most positively recognised;

(9) high speed descent and low power: possible failure to notice asymmetry (engine failure);

(o) Minimum control speeds:

(1) ASI colour coding: red radial line

Note: this exercise is concerned with the ultimate boundaries of controllability in various conditions that a student can reach in a steady asymmetric power state, approached by a gradual speed reduction. Sudden and complete failure should not be given at the flight manual v_{mca}. The purpose of the exercise is to continue the gradual introduction of a student to control an aeroplane in asymmetric power flight during extreme or critical situations. It is not a demonstration of v_{mca}.

(2) techniques for assessing critical speeds with wings level and recovery – dangers involved when minimum control speed and the stalling speed are very close: use of v_{sse};

(3) establish a minimum control speed for each asymmetrically disposed engine: to establish critical engine (if applicable);

(4) effects on minimum control speeds of:

(i) bank;

(ii) zero thrust setting;

(iii) take-off configuration:

(A) landing gear down and take-off flap set;

(B) landing gear up and take-off flap set.

Note: it is important to appreciate that the use of 5 ° of bank towards the operating engine produces a lower v_{mca} and also a better performance than that obtained with the wings held level. It is now normal for manufacturers to use 5 ° of bank in this manner when determining the v_{mca} for the specific type. Thus the v_{mca} quoted in the aeroplane manual will have been obtained using the technique.

(p) Feathering and un-feathering:

(1) minimum heights for practising feathering or un-feathering drills;

(2) engine handling: precautions (overheating, icing conditions, priming, warm up and method of simulating engine failure: reference to aircraft engine manual and service instructions and bulletins).

(q) Engine failure procedure:

(1) once the maintenance of control has been achieved, the order in which the procedures are carried out will be determined by the phase of operation and the aircraft type;

(2) flight phase:

(i) in cruising flight;

(ii) critical phase such as immediately after take-off or during the approach to landing or during a go-around.

(r) Aircraft type

Variations will inevitably occur in the order of certain drills and checks due to differences between aeroplane types and perhaps between models of the same type. The flight manual or equivalent document (for example owner's manual or pilot's operating handbook) is to be consulted to establish the exact order of these procedures.

For example, one flight manual or equivalent document (for example owner's manual or pilot's operating handbook) may call for the raising of flaps and landing gear before feathering, whilst another may recommend feathering as a first step. The reason for this latter procedure could be due to the fact that some engines cannot be feathered if the rpm drops below a certain figure.

Again, in some aeroplanes, the raising of the landing gear may create more drag during retraction due to the transient position of the landing gear doors and as a result of this retraction would best be left until feathering has been accomplished and propeller drag reduced.

Therefore, the order in which the drills and checks are shown in this syllabus under immediate and subsequent actions are to be used as a general guide only and the exact order of precedence is determined by reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) for the specific aeroplane type being used on the course.

(s) In-flight engine failure in cruise or other flight phase not including take-off or landing:

(1) immediate actions:

(i) recognition of asymmetric condition;

(ii) identification and confirmation of failed engine:

(A) idle leg = idle engine;

(B) closing of throttle for confirmation.

(iii) cause and fire check:

(A) typical reasons for failure;

(B) methods of rectification.

(iv) feathering decision and procedure:

(A) reduction of other drag;

(B) need for speed but not haste;

(C) use of rudder trim.

(2) subsequent actions:

(i) live engine:

(A) temperature, pressures and power;

(B) remaining services;

(C) electrical load: assess and reduce as necessary;

(D) effect on power source for air driven instruments;

(E) landing gear;

(F) flaps and other services.

(ii) re-plan flight:

(A) ATC and weather;

(B) terrain clearance, SE cruise speed;

(C) decision to divert or continue.

(iii) fuel management: best use of remaining fuel;

(iv) dangers of re-starting damaged engine;

(v) action if unable to maintain altitude: effect of altitude on power available;

(vi) effects on performance;

(vii) effects on power available and power required;

(viii) effects on various airframe configuration and propeller settings;

(ix) use of flight or owner's manual:

(A) cruising;

(B) climbing: ASI colour coding (blue line);

(C) descending;

(D) turning.

(x) 'live' engine limitations and handling;

(xi) take-off and approach: control and performance;

(t) Significant factors:

(1) significance of take-off safety speed:

(i) effect of landing gear, flap, feathering, take-off, trim setting and systems for operating landing gear and flaps;

(ii) effect on mass, altitude and temperature (performance).

(2) significance of best SE climb speed (v_{yse}):

(i) acceleration to best engine climb speed and establishing a positive climb;

(ii) relationship of SE climb speed to normal climb speed;

(iii) action if unable to climb.

(3) significance of asymmetric committal height and speed: action if baulked below asymmetric committal height;

(u) Engine failure during take-off:

(1) below v_{mca} or unstick speed:

(i) accelerate or stop distance considerations;

(ii) prior use of flight manual data if available.

(2) above v_{mca} or unstick speed and below safety speed;

(3) immediate re-landing or use of remaining power to achieve forced landing;

(4) considerations:

(i) degree of engine failure;

(ii) speed at the time;

(iii) mass, altitude, temperature (performance);

(iv) configuration;

(v) length of runway remaining;

(vi) position of any obstacles ahead;

(v) Engine failure after take-off:

(1) simulated at a safe height and at or above take-off safety speed;

(2) considerations:

(i) need to maintain control;

(ii) use of bank towards operating engine;

(iii) use of available power achieving best SE climb speed;

(iv) mass, altitude, temperature (performance);

(v) effect of prevailing conditions and circumstances.

(3) Immediate actions:

(i) maintenance of control, including air speed and use of power;

(ii) recognition of asymmetric condition;

(iii) identification and confirmation of failed engine;

(iv) feathering and removal of drag (procedure for type);

(v) establishing best SE climb speed.

(4) Subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(i) cause and fire check;

(ii) live engine, handling considerations;

(iii) remaining services;

(iv) ATC liaison;

(v) fuel management.

Note: these procedures are applicable to aeroplane type and flight situation.

(w) Asymmetric committal height:

(1) Asymmetric committal height is the minimum height needed to establish a positive climb whilst maintaining adequate speed for control and removal of drag during an approach to a landing.

Because of the significantly reduced performance of many CS-23 aeroplanes when operating on one engine, consideration is to be given to a minimum height from which it would be safely possible to attempt a go-around procedure, during an approach when the flight path will have to be changed from a descent to a climb with the aeroplane in a high drag configuration.

Due to the height loss which will occur during the time that the operating engine is brought up to full power, landing gear and flap retracted, and the aeroplane established in a climb at v_{yse} a minimum height (often referred to as 'asymmetric committal height') is to be selected, below which the pilot should not attempt to take the aeroplane round again for another circuit. This height will be compatible with the aeroplane type, all up weight, altitude of the aerodrome being used, air temperature, wind, the height of obstructions along the climb out path, and pilot competence.

(2) Circuit approach and landing on asymmetric power:

(i) definition and use of asymmetric committal height;

(ii) use of standard pattern and normal procedures;

(iii) action if unable to maintain circuit height;

(iv) speed and power settings required;

(v) decision to land or go-around at asymmetric committal height: factors to be considered;

(3) Undershooting: importance of maintaining correct air speed, (not below v_{yse}).

(x) Speed and heading control:

(1) height, speed and power relationship: need for minimum possible drag;

(2) establishing positive climb at best SE rate of climb speed:

(i) effect of availability of systems, power for flap and landing gear;

(ii) operation and rapid clean up.

Note 1: The air speed at which the decision is made to commit the aeroplane to a landing or to go-around should normally be the best SE rate of climb speed and in any case not less than the safety speed.

Note 2: On no account should instrument approach 'decision height' and its associated procedures be confused with the selection of minimum height for initiating a go-around in asymmetric power flight.

(y) Engine failure during an all engines approach or missed approach:

(1) use of asymmetric committal height and speed considerations;

(2) speed and heading control: decision to attempt a landing, go-around or force land as circumstances dictate.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(z) Instrument flying on asymmetric power:

(1) considerations relating to aircraft performance during:

(i) straight and level flight;

(ii) climbing and descending;

(iii) standard rate turns;

(iv) level, climbing and descending turns including turns onto pre-selected headings.

(2) vacuum operated instruments: availability;

(3) electrical power source.

ADDITIONAL TRAINING FOR PRIVILEGES TO CONDUCT LINE FLYING UNDER SUPERVISION

(aa) In order to be able to conduct line flying under supervision, as provided in FCL.910.TRI(a), the TRI should have received the additional training described in paragraph (k) of this AMC.

TRAINING WHERE NO FSTD EXISTS

(ab) Where no FSTD exists for the type for which the certificate is sought, a similar course of training should be conducted in the applicable aeroplane type. This includes all elements listed under this sub paragraph, the synthetic device elements being replaced with appropriate exercises in an aeroplane of the applicable type.

AMC2 FCL.930.TRI   TRI — training course

HELICOPTERS

GENERAL

(a) The aim of the TRI(H) course is to train helicopter licence holders to the level of competence defined in FCL.920 and adequate for a TRI.

(b) The training course should develop safety awareness throughout by teaching the knowledge, skills and attitudes relevant to the TRI(H) task, and should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for a helicopter type rating for which the applicant is qualified.

(c) The TRI(H) training course should give particular emphasis to the role of the individual in relation to the importance of human factors in the man-machine environment and the role of CRM.

(d) Special attention should be given to the applicant's maturity and judgment including an understanding of adults, their behavioural attitudes and variable levels of learning ability. During the training course the applicants should be made aware of their own attitudes to the importance of flight safety. It will be important during the course of training to aim at giving the applicant the knowledge, skills and attitudes relevant to the role of the TRI.

(e) For a TRI(H) certificate the amount of flight training will vary depending on the complexity of the helicopter type.

(f) A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and should be related to the type of helicopter on which the applicant wishes to instruct. The content of the training program should cover training exercises applicable to the helicopter type as set out in the applicable type rating course syllabus.

(g) A TRI(H) may instruct in a TRI(H) course once he or she has conducted a minimum of four type rating instruction courses.

CONTENT

(h) The training course consists of three parts:

(1) Part 1: teaching and learning, that should comply with AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The technical theoretical knowledge instruction should comprise of not less than 10 hours training to include the revision of technical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the TRI(H) to instruct the technical theoretical knowledge syllabus.

(b) If a TRI(H) certificate for MP helicopters is sought, particular attention should be given to multi-crew cooperation.

(c) The type rating theoretical syllabus should be used to develop the TRI(H)'s teaching skills in relation to the type technical course syllabus. The course instructor should deliver example lectures from the applicable type technical syllabus and the candidate instructor should prepare and deliver lectures on topics selected by the course instructor from the subject list below:

(1) helicopter structure, transmissions, rotor and equipment, normal and abnormal operation of systems:

(i) dimensions;

(ii) engine including aux. power unit, rotors and transmissions;

(iii) fuel system;

(iv) air-conditioning;

(v) ice protection, windshield wipers and rain repellent;

(vi) hydraulic system;

(vii) landing gear;

(viii) flight controls, stability augmentation and autopilot systems;

(ix) electrical power supply;

(x) flight instruments, communication, radar and navigation equipment;

(xi) cockpit, cabin and cargo compartment;

(xii) emergency equipment.

(2) limitations:

(i) general limitations, according to the helicopter flight manual;

(ii) minimum equipment list.

(3) performance, flight planning and monitoring:

(i) performance;

(ii) light planning.

(4) load and balance and servicing:

(i) load and balance;

(ii) servicing on ground;

(5) emergency procedures;

(6) special requirements for helicopters with EFIS;

(7) optional equipment.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The amount of flight training will vary depending on the complexity of the helicopter type. At least 5 hours flight instruction for a SP helicopter and at least 10 hours for a MP ME helicopter should be counted. A similar number of hours should be used for the instruction and practice of pre-flight and post flight briefing for each exercise. The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently and related to the type of helicopter on which the applicant wishes to instruct. The content of the training programme should only cover training exercises applicable to the helicopter type as set out in Appendix 9 to Part-FCL.

(b) If a TRI(H) certificate for MP helicopters is sought, particular attention should be given to MCC.

(c) If a TRI(H) certificate for revalidation of instrument ratings is sought, then the applicant should hold a valid instrument rating.

FLIGHT OR FSTD TRAINING

(d) The training course should be related to the type of helicopter on which the applicant wishes to instruct.

(e) For MP helicopter type ratings MCC, CRM and the appropriate use of behavioural markers should be integrated throughout.

(f) The content of the training programme should cover identified and significant exercises applicable to the helicopter type.

FSTD TRAINING

(g) The applicant for a TRI(H) certificate should be taught and made familiar with the device, its limitations, capabilities and safety features, and the instructor station.

(h) The applicant for a TRI(H) certificate should be taught and made familiar with giving instruction from the instructor station seat as well as the pilot's seats, including demonstrations of appropriate handling exercises.

(i) Training courses should be developed to give the applicant experience in training a variety of exercises, covering both normal and abnormal operations. The syllabus should be tailored appropriate to the helicopter type, using exercises considered more demanding for the student. This should include engine-out handling and engine-out operations in addition to representative exercises from the type transition course.

(j) The applicant should be required to plan, brief, train and debrief sessions using all relevant training techniques.

HELICOPTER TRAINING

(k) The applicant for a TRI(H) certificate should receive instruction in an FSTD to a satisfactory level in:

(1) left hand seat familiarisation, and in addition right hand seat familiarisation where instruction is to be given to co-pilots operating in the left hand seat, which should include at least the following as pilot flying:

(i) pre-flight preparation and use of checklists;

(ii) taxiing: ground and air;

(iii) take-off and landings;

(iv) engine failure during take-off, before DPATO;

(v) engine failure during take-off, after DPATO;

(vi) engine inoperative approach and go-around;

(vii) one engine simulated inoperative landing;

(viii) autorotation to landing or power recovery;

(ix) other emergency and abnormal operating procedures (as necessary);

(x) instrument departure, approach and go-around with one engine simulated inoperative should be covered where TRI(H) privileges include giving instrument instruction for the extension of an IR(H) to additional types.

(2) helicopter training techniques:

(i) methods for giving appropriate commentary;

(ii) instructor demonstrations of critical manoeuvres with commentary;

(iii) particularities and safety considerations associated with handling the helicopter in critical manoeuvres such as one-engine-inoperative and autorotation exercises;

(iv) where relevant, the conduct of instrument training with particular emphasis on weather restrictions, dangers of icing and limitations on the conduct of critical manoeuvres in instrument meteorological conditions;

(v) intervention strategies developed from situations role-played by a TRI(H) course instructor, taken from but not limited to:

(A) incorrect helicopter configuration;

(B) over controlling;

(C) incorrect control inputs;

(D) excessive flare close to the ground;

(E) one-engine-inoperative take-off and landings;

(F) incorrect handling of autorotation;

(G) static or dynamic rollover on take-off or landing;

(H) too high on approach with associated danger of vortex ring or settling with power;

(I) incapacitation;

(L) abnormal and emergency procedures and appropriate methods and minimum altitudes for simulating failures in the helicopter;

(M) failure of the driving engine during OEI manoeuvres.

(l) Upon successful completion of the training above, the applicant should receive sufficient training in an helicopter in-flight under the supervision of a TRI(H) to a level where the applicant is able to conduct the critical items of the type rating course to a safe standard. Of the minimum course requirements of 5 hours flight training for a SP helicopter or 10 hours for a MP helicopter, up to 3 hours of this may be conducted in an FSTD.

TRAINING WHERE NO FSTD EXISTS

(m) Where no FSTD exists for the type for which the TRI(H) certificate is sought, a similar course of training should be conducted in the applicable helicopter type. This includes all elements listed under sub paragraphs (k)(1) and (2) of this AMC, the FSTD elements being replaced with appropriate exercises in a helicopter of the applicable type, subject to any restrictions placed on the conduct of critical exercises associated with helicopter flight manual limitations and safety considerations.

AMC1 FCL.930.CRI CRI — Training course

GENERAL

(a) The aim of the CRI training course is to train aircraft licence holders to the level of competence defined in FCL.920 and adequate to a CRI.

(b) The training course should be designed to give adequate training to the applicant in theoretical knowledge instruction, flight instruction and FSTD instruction to instruct for any class or type rating for non-complex non-high performance SP aeroplanes for which the applicant is qualified.

(c) The flight training should be aimed at ensuring that the applicant is able to teach the air exercises safely and efficiently to students undergoing a course of training for the issue of a class or type rating for non-complex non-high performance SP aeroplanes. The flight training may take place on the aeroplane or an FFS.

(d) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(e) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(f) The training course consists of three parts:

   (1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920;

   (2) Part 2: technical theoretical knowledge instruction (technical training);

   (3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

This syllabus is concerned only with the training on ME aeroplanes. Therefore, other knowledge areas, common to both SE and ME aeroplanes, should be revised as necessary to cover the handling and operating of the aeroplane with all engines operative, using the applicable sections of the ground subjects syllabus for the FI course. Additionally, the ground training should include 25 hours of classroom work to develop the applicant's ability to teach a student the knowledge and understanding required for the air exercise section of the ME training course. This part will include the long briefings for the air exercises.

THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

Suggested breakdown of course classroom hours:

Tuition hours	Practice in class	Topic	Internal progress test
1.00		Aviation legislation	1.00
2.00		Performance, all engines operating, including mass and balance	
2.00		Asymmetric flight Principles of flight	
2.00	2.00	Control in asymmetric flight Minimum control and safety speeds Feathering and un-feathering	
2.00		Performance in asymmetric flight	1.00
2.00		Specific type of aeroplane – operation of systems.	1.00
		Airframe and engine limitations	
4.00	5.00	Briefings for air exercises progress	
15.00	7.00		3.00
Course total	25.00 (including progress test)		

GENERAL SUBJECTS

(a) Air legislation:
  (1) aeroplane performance group definitions;
  (2) methods of factoring gross performance.
(b) Asymmetric power flight;
(c) Principles of flight;
(d) The problems:
  (1) asymmetry;
  (2) control;
  (3) performance;
(e) The forces and couples:
  (1) offset thrust line;
  (2) asymmetric blade effect;
  (3) offset drag line;
  (4) failed engine propeller drag;
  (5) total drag increase;
  (6) asymmetry of lift;
  (7) uneven propeller slipstream effect;
  (8) effect of yaw in level and turning flight;
  (9) thrust and rudder side force couples;
  (10) effect on moment arms.
(f) Control in asymmetric power flight:
  (1) use, misuse and limits of:
    (i) rudder;
    (ii) aileron;
    (iii) elevators.
  (2) effect of bank or sideslip and balance;
  (3) decrease of aileron and rudder effectiveness;
  (4) fin stall possibility;
  (5) effect of IAS and thrust relationship;
  (6) effect of residual unbalanced forces;
  (7) foot loads and trimming.
(g) Minimum control and safety speeds:
  (1) minimum control speed (v_{mc});
  (2) definition;
  (3) origin;
  (4) factors affecting (v_{mc}):

(i) thrust;

(ii) mass and centre of gravity position;

(iii) altitude;

(iv) landing gear;

(v) flaps;

(vi) cowl flaps or cooling gills;

(vii) turbulence or gusts;

(viii) pilot reaction or competence;

(ix) banking towards the operating engine;

(x) drag;

(xi) feathering;

(xii) critical engine.

(5) take-off safety speed;

(6) definition or origin of v_2;

(7) other relevant v codes;

(h) Aeroplane performance: one engine inoperative:

(1) effect on excess power available;

(2) SE ceiling;

(3) cruising, range and endurance;

(4) acceleration and deceleration;

(5) zero thrust, definition and purpose;

(i) Propellers:

(1) variable pitch: general principles;

(2) feathering and un-feathering mechanism and limitations (for example minimum RPM);

(j) Specific aeroplane type;

(k) Aeroplane and engine systems:

(1) operation normal;

(2) operation abnormal;

(3) emergency procedures.

(l) Limitations: airframe:

(1) load factors;

(2) landing gear and flap limiting speeds (v_{lo} and v_{fe});

(3) rough air speed (v_{ra});

(4) maximum speeds (v_{no} and v_{ne}).

(m) Limitations: engine:

(1) RPM and manifold pressure;

(2) oil temperature and pressure;

(3) emergency procedures.

(n) Mass and balance:

(to be covered in conjunction with the flight manual or equivalent document (for example owner's manual or pilot's operating handbook))

(1) mass and balance documentation for aeroplane type;

(2) revision of basic principles;

(3) calculations for specific aeroplane type.

(o) Mass and performance:

(to be covered in conjunction with the flight manual or equivalent document (for example owner's manual or pilot's operating handbook))

(1) calculations for specific aeroplane type (all engines operating);

(2) take-off run;

(3) take-off distance;

(4) accelerate and stop distance;

(5) landing distance;

(6) landing run;

(7) take-off or climb out flight path;

(8) calculations for specific aeroplane type (one engine operating);

(9) climb out flight path;

(10) landing distance;

(11) landing run.

Part 3

FLIGHT INSTRUCTION SYLLABUS: NORMAL FLIGHT

(a) This part is similar to the air exercise sections of the SE FI course, including 'Introduction to instrument flying' except that the objectives, airmanship considerations and common errors are related to the operation of an ME aeroplane.

(b) The purpose of this part is to acquaint the applicant with the teaching aspects of the operational procedures and handling of an ME aeroplane with all engines functioning.

(c) The following items should be covered:

- (1) aeroplane familiarisation;
- (2) pre-flight preparation and aeroplane inspection;
- (3) engine starting procedures;
- (4) taxiing;
- (5) pre take-off procedures;
- (6) the take-off and initial climb:
  - (i) into wind;
  - (ii) crosswind;
  - (iii) short field.
- (7) climbing;
- (8) straight and level flight;
- (9) descending (including emergency descent procedures);
- (10) turning;
- (11) slow flight;
- (12) stalling and recoveries;
- (13) instrument flight: basic;
- (14) emergency drills (not including engine failure);
- (15) circuit, approach and landing:
  - (i) into wind;
  - (ii) croswind;
  - (iii) short field;
- (16) mislanding and going round again;
- (17) actions after flight.

AIR EXERCISES

(d) The following air exercises are developments of the basic SE syllabus which are to be related to the handling of ME types to ensure that the student learns the significance and use of controls and techniques which may be strange to the student in all normal, abnormal and emergency situations, except that engine failure and flight on asymmetric power are dealt with separately in the air exercises in Part 2.

EXERCISE 1: FAMILIARISATION WITH THE AEROPLANE

(a) Long briefing objectives:

(1) introduction to the aeroplane;

(2) explanation of the cockpit layout;

(3) systems and controls;

(4) aeroplane power plant;

(5) checklists and drills;

(6) differences when occupying the instructor's seat;

(7) emergency drills:

(i) action in event of fire in the air and on the ground;

(ii) escape drills: location of exits and use of emergency equipment (for example fire extinguishers, etc.).

(8) pre-flight preparation and aeroplane inspection:

(i) aeroplane documentation;

(ii) external checks;

(iii) internal checks;

(iv) harness, seat or rudder pedal adjustment;

(9) engine starting procedures:

(i) use of checklists;

(ii) checks before starting;

(iii) checks after starting.

(b) Air exercise:

(1) external features;

(2) cockpit layout;

(3) aeroplane systems;

(4) checklists and drills;

(5) action if fire in the air and on the ground;

(i) engine;

(ii) cabin;

(iii) electrical.

(6) systems failure (as applicable to type);

(7) escape drills (location and use of emergency equipment and exits);

(8) preparation for and action after flight:

(i) flight authorisation and aeroplane acceptance;

(ii) technical log or certificate of maintenance release;

(iii) mass and balance and performance considerations;

(iv) external checks;

(v) internal checks, adjustment of harness or rudder pedals;

(vi) starting and warming up engines;

(vii) checks after starting;

(viii) radio navigation and communication checks;

(ix) altimeter checks and setting procedures;

(x) power checks;

(xi) running down and switching off engines;

(xii) completion of authorisation sheet and aeroplane serviceability documents.

EXERCISE 2: TAXIING

(a) Long briefing objectives:

(1) pre-taxiing area precautions (greater mass: greater inertia);

(2) effect of differential power;

(3) precautions on narrow taxiways;

(4) pre take-off procedures:

(i) use of checklist;

(ii) engine power checks;

(iii) pre take-off checks;

(iv) instructor's briefing to cover the procedure to be followed should an emergency occur during take-off, for example engine failure.

(5) the take-off and initial climb:

(i) ATC considerations;

(ii) factors affecting the length of the take-off run or distance;

(iii) correct lift-off speed;

(iv) importance of safety speed;

(v) crosswind take-off, considerations and procedures;

(vi) short field take-off, considerations and procedures;

(vii) engine handling after take-off: throttle, pitch and engine synchronisation.

(6) climbing:

(i) pre-climbing checks;

(ii) engine considerations (use of throttle or pitch controls);

(iii) maximum rate of climb speed;

(iv) maximum angle of climb speed;

(v) synchronising the engines.

(b) Air exercise

(1) pre-taxing checks;

(2) starting, control of speed and stopping;

(3) control of direction and turning;

(4) turning in confined spaces;

(5) leaving the parking area;

(6) freedom of rudder movement (importance of pilot ability to use full rudder travel);

(7) instrument checks;

(8) emergencies (brake or steering failure);

(9) pre take-off procedures:

(i) use of checklist;

(ii) engine power and system checks;

(iii) pre take-off checks;

(iv) instructor's briefing if emergencies during take-off.

(10) the take-off and initial climb:

(i) ATC considerations;

(ii) directional control and use of power;

(iii) lift-off speed;

(iv) crosswind effects and procedure;

(v) short field take-off and procedure.

(vi) procedures after take-off (at an appropriate stage of the course):

(A) landing gear retraction;

(B) flap retraction (as applicable);

(C) selection of manifold pressure and RPM;

(D) engine synchronisation;

(E) other procedures (as applicable).

(11) climbing:

(i) pre-climbing checks;

(ii) power selection for normal and maximum rate climb;

(iii) engine and RPM limitations;

(iv) effect of altitude on manifold pressure, full throttle;

(v) levelling off: power selection;

(vi) climbing with flaps down;

(vii) recovery to normal climb;

(viii) en-route climb (cruise climb);

(ix) maximum angle of climb;

(x) altimeter setting procedures;

(xi) prolonged climb and use of cowl flaps or cooling gills;

(xii) instrument appreciation.

EXERCISE 3: STRAIGHT AND LEVEL FLIGHT

(a) Long briefing objectives:

(1) selection of power: throttle or pitch controls;

(2) engine synchronisation;

(3) fuel consumption aspects;

(4) use of trimming controls: elevator and rudder (aileron as applicable);

(5) operation of flaps:

(i) effect on pitch attitude;

(ii) effect on air speed.

(6) operation of landing gear:

(i) effect on pitch attitude;

(ii) effect on air speed.

(7) use of mixture controls;

(8) use of alternate air or carburettor heat controls;

(9) operation of cowl flaps or cooling gills;

(10) use of cabin ventilation and heating systems;

(11) operation and use of the other systems (as applicable to type);

(12) descending:

(i) pre-descent checks;

(ii) normal descent;

(iii) selection of throttle or pitch controls;

(iv) engine cooling considerations;

(v) emergency descent procedure.

(13) turning:

(i) medium turns;

(ii) climbing and descending turns;

(iii) steep turns (45 ° of bank or more).

(b) Air exercise:

(1) at normal cruising power:

(i) selection of cruise power;

(ii) manifold pressure or RPM;

(iii) engine synchronisation;

(iv) use of trimming controls;

(v) performance considerations: range or endurance.

(2) instrument appreciation;

(3) operation of flaps (in stages):

(i) air speed below v_{fe};

(ii) effect on pitch attitude;

(iii) effect on air speed.

(4) operation of landing gear:

(i) air speed below v_{lo} / v_{le};

(ii) effect on pitch attitude;

(iii) effect on air speed.

(5) use of mixture controls;

(6) use of alternate air or carburettor control;

(7) operation of cowl flaps or cooling gills;

(8) operation of cabin ventilation or heating systems;

(9) operation and use of other systems (as applicable to type);

(10) descending;

(i) pre-descent checks;

(ii) power selection: manifold pressure or RPM;

(iii) powered descent (cruise descent);

(iv) engine cooling considerations: use of cowl flaps or cooling gills;

(v) levelling off;

(vi) descending with flaps down;

(vii) descending with landing gear down;

(viii) altimeter setting procedure;

(ix) instrument appreciation;

(x) emergency descent:

(A) as applicable to type;

(B) limitations in turbulence v_{no}.

(11) turning:

(i) medium turns;

(ii) climbing and descending turns;

(iii) steep turns: 45 ° of ban;

(iv) instrument appreciation.

EXERCISE 4: SLOW FLIGHT

(a) Long briefing objectives:

(1) aeroplane handling characteristics during slow flight: flight at v_{s1} and v_{so} +5 knots;

(2) simulated go-around from slow flight:

(i) at V_{sse} with flaps down;

(ii) note pitch trim change.

(3) stalling:

(i) power selection;

(ii) symptoms approaching the stall;

(iii) full stall characteristics;

(iv) recovery from the full stall;

(v) recovery at the incipient stall;

(vi) stalling and recovery in the landing configuration;

(vii) recovery at the incipient stage in the landing configuration.

(4) instrument flight (basic):

(i) straight and level;

(ii) climbing;

(iii) turning;

(iv) descending.

(5) emergency drills (not including engine failure), as applicable to type;

(6) circuit approach and landing:

(i) downwind leg:

(A) air speed below v_{fe};

(B) use of flaps (as applicable);

(C) pre-landing checks;

(D) position to turn onto base leg.

(ii) base leg:

(A) selection of power (throttle or pitch), flaps and trimming controls;

(B) maintenance of correct air speed.

(iii) final approach:

(A) power adjustments (early reaction to undershooting);

(B) use of additional flaps (as required);

(C) confirmation of landing gear down;

(D) selection 'touch down' point;

(E) air speed reduction to V_{at};

(F) maintenance of approach path.

(iv) landing:

(A) greater sink rate;

(B) longer landing distance and run;

(C) crosswind approach and landing;

(D) crosswind considerations;

(E) short field approach and landing;

(F) short field procedure: considerations.

(b) Air exercise

(1) safety checks;

(2) setting up and maintaining (flaps up);

(i) v_{s1} + 5 knots;

(ii) note aeroplane handling characteristics.

(3) setting up and maintaining (flaps down):

(i) v_{so} + 5 knots;

(ii) note aeroplane handling characteristics.

(4) simulated go-around from a slow flight with flaps:

(i) down and air speed not below V_{sse}, for example air speed at V_{sse} or v_{mca} + 10 knots;

(ii) increase to full power and enter a climb;

(iii) note pitch change.

(5) resume normal flight.

(6) stalling;

(i) selection of RPM;

(ii) stall symptoms;

(iii) full stall characteristics;

(iv) recovery from the full stall: care in application of power;

(v) recovery at the incipient stage;

(vi) stalling and recovery in landing configuration;

(vii) stall recovery at the incipient stage in the landing configuration.

(7) instrument flight (basic):

(i) straight and level;

(ii) climbing;

(iii) turning;

(iv) descending.

(8) emergency drills (not including engine failure), as applicable to type;

(9) circuit, approach and landing:

(i) downwind leg:

(A) control of speed (below v_{fe});

(B) flaps as applicable;

(C) pre-landing checks;

(D) control of speed and height;

(E) base leg turn.

(ii) base leg:

(A) power selection;

(B) use of flap and trimming controls;

(C) maintenance of correct air speed.

(iii) final approach:

(A) use of additional flap (as required);

(B) confirmation of landing gear down;

(C) selection of touchdown point;

(D) air speed reduction to V_{at};

(E) maintaining correct approach path: use of power.

(iv) landing:

(A) control of sink rate during flare;

(B) crosswind considerations;

(C) longer landing roll;

(D) short or soft field approach and landing;

(E) considerations and precautions.

(10) Asymmetric power flight.

During this part, special emphasis is to be placed on the:

(i) circumstances in which actual feathering and un-feathering practice will be done, for example safe altitude; compliance with regulations about minimum altitude or height for feathering practice, weather conditions, distance from nearest available aerodrome;

(ii) procedure to use for instructor and student co-operation, for example the correct use of touch drills and the prevention of misunderstandings, especially during feathering and un-feathering practice and when zero thrust is being used for asymmetric circuits. This procedure is to include positive agreement as to which engine is being shut down or re-started or set at zero thrust and identifying each control and naming the engine it is going to affect;

(iii) consideration to be given to avoid over-working the operating engine, and the degraded performance when operating the aeroplane during asymmetric flight;

(iv) need to use the specific checklist for the aeroplane type.

EXERCISE 5: FLIGHT ON ASYMMETRIC POWER

(a) Long briefing objectives:

(1) introduction to asymmetric flight:

(2) feathering the propeller: method of operation;

(3) effects on aeroplane handling at cruising speed;

(4) introduction to effects upon aeroplane performance;

(5) note foot load to maintain a constant heading (no rudder trim);

(6) un-feathering the propeller;

(7) return to normal flight finding the zero thrust setting;

(8) comparison of foot load when feathered and with zero thrust set.

(9) effects and recognition of engine failure in level flight;

(10) forces and the effects of yaw;

(11) types of failure:

(i) sudden or gradual;

(ii) complete or partial.

(12) yaw, direction and further effects of yaw;

(13) flight instrument indications;

(14) identification of failed engine;

(15) the couples and residual out of balance forces: resultant flight attitude;

(16) use of rudder to counteract yaw;

(17) use of aileron: dangers of misuse;

(18) use of elevator to maintain level flight;

(19) use of power to maintain a safe air speed and altitude;

(20) supplementary recovery to straight and level flight: simultaneous increase of speed and reduction in power;

(21) identification of failed engine: idle leg = idle engine;

(22) use of engine instruments for identification:

(i) fuel pressure or flow;

(ii) RPM gauge response effect of CSU action at lower and higher air speed;

(iii) engine temperature gauges.

(23) confirmation of identification: close the throttle of identified failed engine;

(24) effects and recognition of engine failure in turns;

(25) identification and control;

(26) side forces and effects of yaw.

(27) During turning flight:

(i) effect of 'inside' engine failure: effect sudden and pronounced;

(ii) effect of 'outside' engine failure: effect less sudden and pronounced;

(iii) the possibility of confusion in identification (particularly at low power):

(A) correct use of rudder;

(B) possible need to return to lateral level flight to confirm correct identification.

(iv) visual and flight instrument indications;

(v) effect of varying speed and power;

(vi) speed and thrust relationship;

(vii) at normal cruising speed and cruising power: engine failure clearly recognised;

(viii) at low safe speed and climb power: engine failure most positively recognised;

(ix) high speed descent and low power: possible failure to notice asymmetry (engine failure).

(28) Minimum control speeds:

(i) ASI colour coding: red radial line.

Note: this exercise is concerned with the ultimate boundaries of controllability in various conditions that a student can reach in a steady asymmetric power state, approached by a gradual speed reduction. Sudden and complete failure should not be given at the Flight Manual v_{mca}. The purpose of the exercise is to continue the gradual introduction of a student to control an aeroplane in asymmetric power flight during extreme or critical situations. It is not a demonstration of v_{mca}.

(ii) Techniques for assessing critical speeds with wings level and recovery: dangers involved when minimum control speed and the stalling speed are very close: use of $V_{sse;}$

(iii) Establish a minimum control speed for each asymmetrically disposed engine to establish critical engine (if applicable);

(iv) Effects on minimum control speeds of:

(A) bank;

(B) zero thrust setting;

(C) take-off configuration:

(a) landing gear down and take-off flap set;

(b) landing gear up and take-off flap set.

Note: it is important to appreciate that the use of 5 ° of bank towards the operating engine produces a lower v_{mca} and also a better performance than that obtained with the wings held level. It is now normal for manufacturers to use 5 ° of bank in this manner when determining the v_{mca} for the specific type. Thus, the v_{mca} quoted in the aeroplane manual will have been obtained using the technique.

(29) Feathering and un-feathering:

(i) minimum heights for practising feathering or un-feathering drills;

(ii) engine handling: precautions (overheating, icing conditions, priming, warm-up, method of simulating engine failure: reference to aircraft engine manual and service instructions and bulletins).

(30) Engine failure procedure:

(i) once the maintenance of control has been achieved, the order in which the procedures are carried out will be determined by the phase of operation and the aircraft type.

(ii) flight phase:

(A) in cruising flight;

(B) critical phase such as immediately after take-off or during the approach to landing or during a go-around.

(31) Aircraft type:

Variations will inevitably occur in the order of certain drills and checks due to differences between aeroplane types and perhaps between models of the same type, and the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) is to be consulted to establish the exact order of these procedures.

For example, one flight manual or equivalent document (for example owner's manual or pilot's operating handbook) may call for the raising of flaps and landing gear before feathering, whilst another may recommend feathering as a first step. The reason for this latter procedure could be due to the fact that some engines cannot be feathered if the RPM drops below a certain figure.

Again, in some aeroplanes, the raising of the landing gear may create more drag during retraction due to the transient position of the landing gear doors and as a result of this retraction would best be left until feathering has been accomplished and propeller drag reduced.

Therefore, the order in which the drills and checks are shown in this syllabus under 'immediate actions' and 'subsequent actions' are to be used as a general guide only and the exact order of precedence is determined by reference to the flight manual or equivalent document (for example owner's manual or pilot's operating handbook) for the specific aeroplane type being used on the course.

(32) In-flight engine failure in cruise or other flight phase not including take-off or landing:

(i) immediate actions:

(A) recognition of asymmetric condition and control of the aircraft;

(B) identification and confirmation of failed engine:

(a) idle leg = idle engine;

(b) closing of throttle for confirmation.

(C) cause and fire check:

(a) typical reasons for failure;

(b) methods of rectification.

(D) feathering decision and procedure:

(a) reduction of other drag;

(b) need for speed but not haste;

(c) use of rudder trim.

(ii) subsequent actions;

(A) live engine:

(a) temperature, pressures and power;

(b) remaining services;

(c) electrical load: assess and reduce as necessary;

(d) effect on power source for air driven instruments;

(e) landing gear;

(f) flaps and other services.

(B) re-plan flight:

(a) ATC and weather;

(b) terrain clearance, SE cruise speed;

(c) decision to divert or continue.

(C) fuel management: best use of remaining fuel;

(D) dangers of re-starting damaged engine;

(E) action if unable to maintain altitude: effect of altitude on power available;

(F) effects on performance;

(G) effects on power available and power required;

(H) effects on various airframe configuration and propeller settings;

(I) use of flight manual or equivalent document (for example owner's manual or pilot's operating handbook):

(a) cruising;

(b) climbing: ASI colour coding (blue line);

(c) descending;

(d) turning.

(J) 'live' engine limitations and handling;

(K) take-off and approach: control and performance.

(33) Significant factors:

(i) significance of take-off safety speed:

(A) effect of landing gear, flap, feathering, take-off, trim setting, systems for operating landing gear and flaps;

(B) effect on mass, altitude and temperature (performance).

(ii) significance of best SE climb speed (V_{yse}):

(A) acceleration to best engine climb speed and establishing a positive climb;

(B) relationship of SE climb speed to normal climb speed;

(C) action if unable to climb.

(iii) significance of asymmetric committal height and speed: action if baulked below asymmetric committal height.

(34) Engine failure during take-off:

(i) below v_{mca} or unstick speed:

(A) accelerate or stop distance considerations;

(B) prior use of flight manual data if available.

(ii) above v_{mca} or unstick speed and below safety speed;

(iii) immediate re-landing or use of remaining power to achieve forced landing;

(iv) considerations:

(A) degree of engine failure;

(B) speed at the time;

(C) mass, altitude and temperature (performance);

(D) configuration;

(E) length of runway remaining;

(F) position of any obstacles ahead.

(35) Engine failure after take-off:

(i) simulated at a safe height and at or above take-off safety speed;

(ii) considerations:

(A) need to maintain control;

(B) use of bank towards operating engine;

(C) use of available power achieving best SE climb speed;

(D) mass, altitude, temperature (performance);

(E) effect of prevailing conditions and circumstances.

(36) Immediate actions: maintenance of control, including air speed and use of power:

(i) recognition of asymmetric condition;

(ii) identification and confirmation of failed engine;

(iii) feathering and removal of drag (procedure for type);

(iv) establishing best SE climb speed.

(37) Subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(i) cause and fire check;

(ii) live engine, handling considerations;

(iii) remaining services;

(iv) ATC liaison;

(v) fuel management.

Note: these procedures are applicable to aeroplane type and flight situation.

(38) Significance of asymmetric committal height:

(i) Asymmetric committal height is the minimum height needed to establish a positive climb whilst maintaining adequate speed for control and removal of drag during an approach to a landing.

Because of the significantly reduced performance of many CS/JAR/FAR 23 aeroplanes when operating on one engine, consideration is to be given to a minimum height from which it would be safely possible to attempt a go-around procedure, during an approach when the flight path will have to be changed from a descent to a climb with the aeroplane in a high drag configuration.

Due to the height loss which will occur during the time that the operating engine is brought up to full power, landing gear and flap retracted, and the aeroplane established in a climb at v_{yse} a minimum height (often referred to as 'Asymmetric committal height') is to be selected, below which the pilot should not attempt to take the aeroplane round again for another circuit. This height will be compatible with the aeroplane type, all up weight, altitude of the aerodrome being used, air temperature, wind, the height of obstructions along the climb out path, and pilot competence.

(ii) circuit approach and landing on asymmetric power:

(A) definition and use of asymmetric committal height;

(B) use of standard pattern and normal procedures;

(C) action if unable to maintain circuit height;

(D) speed and power settings required;

(E) decision to land or go-around at asymmetric committal height: factors to be considered.

(iii) undershooting importance of maintaining correct air speed (not below v_{yse}).

(39) Speed and heading control:

(i) height, speed and power relationship: need for minimum possible drag;

(ii) establishing positive climb at best SE rate of climb speed:

(A) effect of availability of systems, power for flap and landing gear;

(B) operation and rapid clean up.

Note 1: The air speed at which the decision is made to commit the aeroplane to a landing or to go-around should normally be the best SE rate of climb speed and in any case not less than the safety speed.

Note 2: On no account should instrument approach 'decision height' and its associated procedures be confused with the selection of minimum height for initiating a go-around in asymmetric power flight.

(40) Engine failure during an all engines approach or missed approach:

(i) use of asymmetric committal height and speed considerations;

(ii) speed and heading control;

(iii) decision to attempt a landing, go-around or force land as circumstances dictate.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(41) Instrument flying on asymmetric power:

(i) considerations relating to aircraft performance during:

(A) straight and level flight;

(B) climbing and descending;

(C) standard rate turns;

(D) level, climbing and descending turns including turns onto pre-selected headings.

(ii) availability of vacuum operated instruments;

(iii) availability of electrical power source.

(b) Air exercise

This section covers the operation of a SP ME aeroplane when one engine has failed and it is applicable to all such light piston aeroplanes. Checklists should be used as applicable.

(1) introduction to asymmetric flight:

(2) close the throttle of one engine;

(3) feather its propeller;

(4) effects on aeroplane handling at cruising speed;

(5) effects on aeroplane performance for example cruising speed and rate of climb;

(6) note foot load to maintain a constant heading;

(7) un-feather the propeller;

(8) return to normal flight finding the zero thrust throttle setting;

(9) comparison of foot load when feathered and with zero thrust set.

(10) effects and recognition of engine failure in level flight with the aeroplane straight and level at cruise speed:

(i) slowly close the throttle of one engine;

(ii) note yaw, roll and spiral descent.

(11) return to normal flight:

(i) close throttle of other engine;

(ii) note same effects in opposite direction.

(12) methods of control and identification of failed engine close one throttle and maintain heading and level flight by use of:

(i) rudder to control yaw;

(ii) aileron to hold wings level;

(iii) elevators to maintain level flight;

(iv) power (as required) to maintain air speed and altitude.

(13) alternative or supplementary method of control:

(i) simultaneously;

(ii) lower aeroplane nose to increase air speed;

(iii) reduce power;

(iv) loss of altitude: inevitable.

(14) identification of failed engine: idle foot = idle engine;

(15) use of instruments for identification:

(i) fuel pressure or fuel flow;

(ii) RPM gauge or CSU action may mask identification;

(iii) engine temperature gauges.

(16) confirmation of identification: close the throttle of the identified failed engine;

(17) effects and recognition of engine failure in turns and effects of 'inside' engine failure:

(i) more pronounced yaw;

(ii) more pronounced roll;

(iii) more pronounced pitch down.

(18) effects of 'outside' engine failure:

(i) less pronounced yaw;

(ii) less pronounced roll;

(iii) less pronounced pitch down.

(19) possibility of confusion in identification:

(i) use of correct rudder application;

(ii) return to lateral level flight if necessary.

(20) flight instrument indications;

(21) effect of varying speed and power;

(22) failure of one engine at cruise speed and power: engine failure clearly recognised;

(23) failure of one engine at low speed and high power (not below v_{sse}): engine failure most positively recognised;

(24) failure of one engine at higher speeds and low power: possible failure to recognise engine failure;

(25) minimum control speeds;

(26) establish the v_{yse}:

(i) select maximum permitted manifold pressure and RPM;

(ii) close the throttle on one engine;

(iii) raise the aeroplane nose and reduce the air speed;

(iv) note the air speed when maximum rudder deflection is being applied and when directional control can no longer be maintained;

(v) lower the aeroplane nose and reduce power until full directional control is regained;

(vi) the lowest air speed achieved before the loss of directional control will be the V_{mc} for the flight condition;

(vii) repeat the procedure closing the throttle of the other engine;

(viii) the higher of these two air speeds will identify the most critical engine to fail.

Note: warning - in the above situations the recovery is to be initiated immediately before directional control is lost with full rudder applied, or when a safe margin above the stall remains, for example when the stall warning device operates, for the particular aeroplane configuration and flight conditions. On no account should the aeroplane be allowed to decelerate to a lower air speed.

(27) establish the effect of using 5 ° of bank at v_{mc}:

(i) close the throttle of one engine;

(ii) increase to full power on the operating engine;

(iii) using 5 ° of bank towards the operating engine reduce speed to the V_{mc};

(iv) note lower V_{mc} when 5 ° of bank is used.

(28) 'in-flight' engine failure procedure;

(29) in cruise and other flight circumstances not including take-off and landing.

(30) Immediate actions: maintenance of control including air speed and use of power:

(i) identification and confirmation of failed engine;

(ii) failure cause and fire check;

(iii) feathering decision and implementation;

(iv) reduction of any other drag, for example flaps, cowl flaps etc.;

(v) retrim and maintain altitude.

(31) Subsequent actions:

(i) live engine:

(A) oil temperature, pressure, fuel flow and power;

(B) remaining services;

(C) electrical load: assess and reduce as necessary;

(D) effect on power source for air driven instruments;

(E) landing gear;

(F) flaps and other services.

(ii) re-plan flight:

(A) ATC and weather;

(B) terrain clearance;

(C) SE cruise speed;

(D) decision to divert or continue;

(iii) fuel management: best use of fuel;

(iv) dangers of re-starting damaged engine;

(v) action if unable to maintain altitude:

(A) adopt V_{yse};

(B) effect of altitude on power available.

(vi) effects on performance;

(vii) effects on power available and power required;

(viii) effects on various airframe configurations and propeller settings;

(ix) use of flight manual or equivalent document (for example owner's manual or pilot's operating handbook):

(A) cruising;

(B) climbing: ASI colour coding (blue line);

(C) descending;

(D) turning.

(x) 'live' engine limitations and handling;

(xi) take-off and approach: control and handling;

Note: to be done at a safe height away from the circuit;

(xii) take-off case with landing gear down and take-off flap set (if applicable);

(xiii) significance of take-off at or above safety speed (at safety speed. The ability to maintain control and to accelerate to SE climb speed with aeroplane clean and zero thrust set. Thereafter to achieve a positive climb);

(xiv) significance of flight below safety speed (below safety speed and above v_{mca}. A greater difficulty to maintain control, a possible loss of height whilst maintaining speed, cleaning up, accelerating to SE climb speed and establishing a positive climb);

(xv) significance of best SE climb speed (the ability to achieve the best rate of climb on one engine with minimum delay).

(32) Significance of asymmetric committal height:

(i) the ability to maintain or accelerate to the best SE rate of climb speed and to maintain heading whilst cleaning up with perhaps a slight height loss before climbing away;

(ii) below this height, the aeroplane is committed to continue the approach to a landing.

(33) Engine failure during take-off run and below safety speed briefing only;

(34) Engine failure after take-off;

Note: to be initiated at a safe height and at not less than take-off safety speed with due regard to the problems of a prolonged SE climb in the prevailing conditions.

(i) immediate actions:

(A) control of direction and use of bank;

(B) control of air speed and use of power;

(C) recognition of asymmetric condition;

(D) identification and confirmation of failed engine feathering and reduction of drag (procedure for type);

(E) re-trim;

(ii) subsequent actions: whilst carrying out an asymmetric power climb to the downwind position at SE best rate of climb speed:

(A) cause and fire check;

(B) live engine, handling considerations;

(C) drills and procedures applicable to aeroplane type and flight situation;

(D) ATC liaison;

(E) fuel management.

(35) Asymmetric circuit, approach and landing;

(i) downwind and base legs:

(A) use of standard pattern;

(B) normal procedures;

(C) landing gear and flap lowering considerations;

(D) position for base leg;

(E) live engine handling;

(F) air speed and power settings;

(G) maintenance of height.

(ii) final approach:

(A) asymmetric committal height drill;

(B) control of air speed and descent rate;

(C) flap considerations.

(iii) going round again on asymmetric power (missed approach):

(A) not below asymmetric committal height;

(B) speed and heading control;

(C) reduction of drag, landing gear retraction;

(D) maintaining V_{yse};

(E) establish positive rate of climb.

(36) Engine failure during all engines approach or missed approach:

Note: to be started at not less than asymmetric committal height and speed and not more than part flap set:

(i) speed and heading control;

(ii) reduction of drag flap;

(iii) decision to attempt landing or go-around;

(iv) control of descent rate if approach is continued;

(v) if go-around is initiated, maintain v_{yse}, flaps and landing gear retracted and establish positive rate of climb.

Note: at least one demonstration and practice of engine failure in this situation should be performed during the course.

(37) Instrument flying on asymmetric power;

(38) Flight instrument checks and services available:

(i) straight and level flight;

(ii) climbing and descending;

(iii) standard rate turns;

(iv) level, climbing and descending turns including turns onto pre-selected headings.

AMC1 FCL.940.CRI CRI — Revalidation and renewal

REFRESHER TRAINING

(a) Paragraph (c)(1) of FCL.940.CRI determine that an applicant for renewal of a CRI certificate shall complete refresher training as a CRI at an ATO. Paragraph (a)(2) also establishes that an applicant for revalidation of the CRI certificate that has not completed a minimum amount of instruction hours (established in paragraph (a)(1)) during the validity period of the certificate shall undertake refresher training at an ATO for the revalidation of the certificate. The amount of refresher training needed should be determined on a case by case basis by the ATO, taking into account the following factors:

(1) the experience of the applicant;

(2) whether the training is for revalidation or renewal;

(3) the amount of time lapsed since the last time the applicant has conducted training, in the case of revalidation, or since the certificate has lapsed, in the case of renewal. The amount of training needed to reach the desired level of competence should increase with the time lapsed.

(b) Once the ATO has determined the needs of the applicant, it should develop an individual training programme that should be based on the CRI training course and focus on the aspects where the applicant has shown the greatest needs.

AMC1 FCL.930.IRI IRI— Training course

GENERAL

(a) The aim of the IRI training course is to train aircraft licence holders to the level of competence defined in FCL.920, and adequate for an IRI.

(b) The IRI training course should give particular stress to the role of the individual in relation to the importance of human factors in the man-machine environment.

(c) Special attention should be paid to the applicant's levels of maturity and judgement including an understanding of adults, their behavioural attitudes and variable levels of education.

(d) With the exception of the section on 'teaching and learning', all the subject detail contained in the theoretical and flight training syllabus is complementary to the instrument rating pilot course syllabus which should already be known by the applicant. Therefore, the objective of the course is to:

   (1) refresh and bring up to date the technical knowledge of the student instructor;

   (2) train pilots in accordance with the requirements of the modular instrument flying training course;

   (3) enable the applicant to develop the necessary instructional techniques required for teaching of instrument flying, radio navigation and instrument procedures to the level required for the issue of an instrument rating;

   (4) ensure that the student instrument rating instructor's flying is of a sufficiently high standard.

(e) In part 3 some of the air exercises of the flight instruction syllabus of this AMC may be combined in the same flight.

(f) During the training course the applicants should be made aware of their own attitudes to the important aspects of flight safety. Improving safety awareness should be a fundamental objective throughout the training course. It will be of major importance for the training course to aim at giving applicants the knowledge, skills and attitudes relevant to an instructor's task. To achieve this, the course curriculum, in terms of objectives, should comprise at least the following areas.

(g) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(h) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

CONTENT

(i) The training course consists of three parts:

   (1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920.

   (2) Part 2: instrument technical theoretical knowledge instruction (technical training).

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The instrument theoretical knowledge instruction should comprise not less than 10 hours training to include the revision of instrument theoretical knowledge, the preparation of lesson plans and the development of classroom instructional skills to enable the IRI to instruct the instrument theoretical knowledge syllabus.

(b) All the subject detail contained in the instrument theoretical knowledge instruction syllabus and flight instruction syllabus is complementary to the instrument rating pilot course syllabus which should already be known by the applicant. Therefore, the objective of the course is to:

   (1) refresh and bring up to date the technical knowledge of the student instructor;

   (2) train pilots in accordance with the requirements of the modular instrument flying training course;

   (3) enable the applicant to develop the necessary instructional techniques required for teaching of instrument flying, radio navigation and instrument procedures to the level required for the issue of an instrument rating; and

   (4) ensure that the student instrument rating instructor's flying is of a sufficiently high standard.

(c) The theoretical subjects covered below should be used to develop the instructor's teaching skills. The items selected should relate to the student's background and should be applied to training for an IR.

GENERAL SUBJECTS

(d) Physiological and psychological factors:

   (1) the senses;

   (2) spatial disorientation;

   (3) sensory illusions;

   (4) stress.

(e) Flight instruments:

   (1) air speed indicator;

   (2) altimeter;

   (3) vertical speed indicator;

   (4) attitude indicator;

   (5) heading indicator;

(6) turn and slip indicator;

(7) magnetic compass;

(8) in relation to the above instruments the following items should be covered:

(i) principles of operation;

(ii) errors and in-flight serviceability checks;

(iii) system failures.

(f) Radio navigation aids:

(1) basic radio principles;

(2) use of VHF RTF channels;

(3) the Morse code;

(4) basic principles of radio aids;

(5) use of VOR;

(6) ground and aeroplane equipment;

(7) use of NDB/ADF;

(8) ground and aeroplane equipment;

(9) use of VHF/DF;

(10) radio detection and ranging (radar);

(11) ground equipment;

(12) primary radar;

(13) secondary surveillance radar;

(14) aeroplane equipment;

(15) transponders;

(16) precision approach system;

(17) other navigational systems (as applicable) in current operational use;

(18) ground and aeroplane equipment;

(19) use of DME;

(20) ground and aeroplane equipment;

(21) marker beacons;

(22) ground and aeroplane equipment;

(23) pre-flight serviceability checks;

(24) range, accuracy and limitations of equipment.

(g) Flight planning considerations;

(h) Aeronautical information publications:

(1) the training course should cover the items listed below, but the applicant's aptitude and previous aviation experience should be taken into account when determining the amount of instructional time allotted. Although a number of items contained under this heading are complementary to those contained in the PPL/CPL/IR syllabi, the instructor should ensure that they have been covered

during the applicant's training and due allowance should be made for the time needed to revise these items as necessary.

(2) AIP

(3) NOTAM class 1 and 2;

(4) AIC;

(5) information of an operational nature;

(6) the rules of the air and ATS;

(7) visual flight rules and instrument flight rules;

(8) flight plans and ATS messages;

(9) use of radar in ATS;

(10) radio failure;

(11) classification of airspace;

(12) airspace restrictions and hazards;

(13) holding and approach to land procedures;

(14) precision approaches and non precision approaches;

(15) radar approach procedures;

(16) missed approach procedures;

(17) visual manoeuvring after an instrument approach;

(18) conflict hazards in uncontrolled airspace;

(19) communications;

(20) types of services;

(21) extraction of AIP data relating to radio aids;

(22) charts available;

(23) en-route;

(24) departure and arrival;

(25) instrument approach and landing;

(26) amendments, corrections and revision service.

(i) flight planning general:

(1) the objectives of flight planning;

(2) factors affecting aeroplane and engine performance;

(3) selection of alternate(s);

(4) obtaining meteorological information;

(5) services available;

(6) meteorology briefing;

(7) telephone or electronic data processing;

(8) actual weather reports (TAFs, METARs and SIGMET messages);

(9) the route forecast;

(10) the operational significance of the meteorological information obtained (including icing, turbulence and visibility);

(11) altimeter considerations;

(12) definitions of:

(i) transition altitude;

(ii) transition level;

(iii) flight level;

(iv) QNH;

(v) regional QNH;

(vi) standard pressure setting;

(vii) QFE.

(13) altimeter setting procedures;

(14) pre-flight altimeter checks;

(15) take-off and climb;

(16) en-route;

(17) approach and landing;

(18) missed approach;

(19) terrain clearance;

(20) selection of a minimum safe en-route altitude;

(21) IFR;

(22) preparation of charts;

(23) choice of routes and flight levels;

(24) compilation of flight plan or log sheet;

(25) log sheet entries;

(26) navigation ground aids to be used;

(27) frequencies and identification;

(28) radials and bearings;

(29) tracks and fixes;

(30) safety altitude(s);

(31) fuel calculations;

(32) ATC frequencies (VHF);

(33) tower, approach, en-route, radar, FIS, ATIS, and weather reports;

(34) minimum sector altitudes at destination and alternate aerodromes;

(35) determination of minimum safe descent heights or altitudes (decision heights) at destination and alternate aerodromes.

(j) The privileges of the instrument rating:

(1) outside controlled airspace;

(2) within controlled airspace;

(3) period of validity and renewal procedures.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) An approved IRI course should comprise of at least 10 hours of flight instruction, of which a maximum of 8 hours may be conducted in an FSTD. A similar number of hours should be used for the instruction and practice of pre-flight and post-flight briefing for each exercise.

(b) The flight instruction should aim to ensure that the applicant is able to teach the air exercises safely and efficiently.

A. AEROPLANES

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INTRUMENT FLYING (Basic)
(for revision, as deemed necessary by the instructor)

(a) Long briefing objectives:
  (1) flight instruments;
  (2) physiological considerations;
  (3) instrument appreciation:
    (i) attitude instrument flight;
    (ii) pitch indications;
    (iii) bank indications;
    (iv) different instrument presentations;
    (v) introduction to the use of the attitude indicator;
    (vi) pitch attitude;
    (vii) bank attitude;
    (viii) maintenance of heading and balanced flight;
    (ix) instrument limitations (inclusive system failures).
  (4) attitude, power and performance:
    (i) attitude instrument flight;
    (ii) control instruments;
    (iii) performance instruments;
    (iv) effect of changing power and configuration;
    (v) cross-checking the instrument indications;
    (vi) instrument interpretation;
    (vii) direct and indirect indications (performance instruments);
    (viii) instrument lag;
    (ix) selective radial scan.
  (5) the basic flight manoeuvres (full panel):
    (i) straight and level flight at various air speeds and aeroplane configurations;
    (ii) climbing;
    (iii) descending;
    (iv) standard rate turns;
    (v) level, climbing and descending on to pre-selected headings.
(b) Air exercise:
  (1) instrument flying (basic);
    (i) physiological sensations;

(ii) instrument appreciation;

(iii) attitude instrument flight;

(iv) pitch attitude;

(v) bank attitude;

(vi) maintenance of heading and balanced flight;

(vii) attitude instrument flight;

(viii) effect of changing power and configuration;

(ix) cross-checking the instruments;

(x) selective radial scan;

(2) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and aeroplane configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

EXERCISE 2: INTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

(1) full panel;

(2) 30 ° level turns;

(3) unusual attitudes: recoveries;

(4) transference to instruments after take-off;

(5) limited panel;

(6) basic flight manoeuvres;

(7) unusual attitudes: recoveries.

(b) Air exercise:

(1) full panel;

(2) 30 ° level turns;

(3) unusual attitudes: recoveries;

(4) limited panel;

(5) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

(1) availability of VOR stations en-route;

(2) station frequencies and identification;

(3) signal reception range;

(4) effect of altitude;
(5) VOR radials;
(6) use of OBS;
(7) to or from indicator;
(8) orientation;
(9) selecting radials;
(10) intercepting a pre-selected radial;
(11) assessment of distance to interception;
(12) effects of wind;
(13) maintaining a radial;
(14) tracking to and from a VOR station;
(15) procedure turns;
(16) station passage;
(17) use of two stations for obtaining a fix;
(18) pre-selecting fixes along a track;
(19) assessment of ground speed and timing;
(20) holding procedures;
(21) various entries;
(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:
(1) station selection and identification;
(2) orientation;
(3) intercepting a pre-selected radial;
(4) R/T procedures and ATC liaison;
(5) maintaining a radial inbound;
(6) recognition of station passage;
(7) maintaining a radial outbound;
(8) procedure turn;
(9) use of two stations to obtain a fix along the track;
(10) assessment of ground speed and timing;
(11) holding procedures and entries;
(12) holding at a pre-selected fix;
(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF NDB

(a) Long briefing objectives:
(1) availability of an NDB facilities en-route;
(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;
(4) static interference;
(5) night effect;
(6) station interference;
(7) mountain effect;
(8) coastal refraction;
(9) orientation in relation to an NDB;
(10) homing;
(11) intercepting a pre-selected magnetic bearing and tracking inbound;
(12) station passage;
(13) tracking outbound;
(14) time and distance checks;
(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;
(16) holding procedures and various approved entries;
(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:
(1) selecting, tuning and identifying an NDB;
(2) ADF orientation;
(3) communication (R/T procedures and ATC liaison);
(4) homing;
(5) tracking inbound;
(6) station passage;
(7) tracking outbound;
(8) time and distance checks;
(9) intercepting a pre-selected magnetic bearing;
(10) determining the aeroplane's position from two NDBs or alternatively from one NDB and one other navaid;
(11) ADF holding procedures and various approved entries.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:
(1) availability of VHF/DF facilities en-route;
(2) location, frequencies, station call signs and hours of operation;
(3) signal and reception range;
(4) effect of altitude;
(5) communication (R/T procedures and ATC liaison);
(6) obtaining and using types of bearings, for example QTE, QDM and QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T Procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix.

(b) Air exercise:

(1) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS (SSR)

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMs;

(4) provision of service;

(5) communication (R/T, procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL PROCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the aeroplane radio;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:

(1) radio equipment serviceability checks;

(2) departure clearance;

(3) navaid selection;

(4) frequencies, radials, etc.;

(5) aerodrome departure checks, frequency changes, altitude and position reports;

(6) SID procedures.

EXERCISE 10: INSTRUMENT APPORACH: ILS APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURE

(a) Long briefing objectives:

(1) precision approach charts;

(2) approach to the initial approach fix and minimum sector altitude;

(3) navaid requirements, for example radar, ADF, etc.;

(4) communication (ATC liaison and R/T phraseology);

(5) holding procedure;

(6) the final approach track;

(7) forming a mental picture of the approach;

(8) completion of aerodrome approach checks;

(9) initial approach procedure;

(10) selection of the ILS frequency and identification;

(11) obstacle clearance altitude or height;

(12) operating minima;

(13) achieving the horizontal and vertical patterns;

(14) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(15) use of DME (as applicable);

(16) go-around and missed approach procedure;

(17) review of the published instructions;

(18) transition from instrument to visual flight (sensory illusions);

(19) visual manoeuvring after an instrument approach:

(i) circling approach;

(ii) visual approach to landing.

(b) Air exercise:

(1) initial approach to the ILS;

(2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of runway lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface and the length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localiser and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height;

(17) runway direction;

(18) overshoot and missed approach procedure;

(19) transition from instrument to visual flight;

(20) circling approach;

(21) visual approach to landing.

EXERCISE 11: INSTRUMENTS APPROACH: NDB APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning;

(6) holding procedure;

(7) the approach track;

(8) forming a mental picture of the approach;

(9) initial approach procedure;

(10) operating minima;

(11) completion of approach planning;

(12) achieving the horizontal and vertical patterns;

(13) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(14) use of DME (as applicable);

(15) go-around and missed approach procedure;

(16) review of the published instructions;

(17) transition from instrument to visual flight (sensory illusions);

(18) visual manoeuvring after an instrument approach;

(19) circling approach;

(20) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning including determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(2) circling approach;

(3) go-around and missed approach procedure;

(4) initial approach;

(5) frequency selection and identification;

(6) review of the published procedure and minimum safe sector altitude;

(7) ATC liaison and R/T phraseology;

(8) determination of decision height and altimeter setting;

(9) weather considerations, for example cloud base and visibility;

(10) availability of runway lighting;

(11) determination of inbound track;

(12) assessment of time from final approach fix to the missed approach point;

(13) ATC liaison;

(14) the outbound procedure (inclusive completion of pre-landing checks);

(15) the inbound procedure;

(16) re-check of identification code;

(17) altimeter setting re-checked;

(18) the final approach;

(19) note time and establish air speed and descent rate;

(20) maintaining the final approach track;

(21) anticipation of change in wind velocity and its effect on the drift;

(22) minimum descent altitude or height;

(23) runway direction;

(24) go-around and missed approach procedure;

(25) transition from instrument to visual flight (sensory illusions);

(26) visual approach.

EXERCISE 12: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF GNSS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

B. HELICOPTERS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INSTRUMENT FLYING (Basic)

(for revision as deemed necessary by the instructor)

(a) Long briefing objectives:

(1) flight instruments;

(2) physiological considerations;

(3) instrument appreciation:

(i) attitude instrument flight;

(ii) pitch indications;

(iii) bank indications;

(iv) different instrument presentations;

(v) introduction to the use of the attitude indicator;

(vi) pitch attitude;

(vii) bank attitude;

(viii) maintenance of heading and balanced flight;

(ix) instrument limitations (inc. system failures);

(4) attitude, power and performance:

(i) attitude instrument flight;

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan;

(5) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

(b) Air exercise:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) pitch attitude;

(5) bank attitude;

(6) maintenance of heading and balanced flight;

(7) attitude instrument flight;

(8) effect of changing power;

(9) cross-checking the instruments;

(10) selective radial scan;

(11) the basic flight manoeuvres (full panel):

   (i) straight and level flight at various air speeds and helicopter configurations;

   (ii) climbing;

   (iii) descending;

   (iv) standard rate turns;

   (v) level, climbing and descending on to pre-selected headings;

   (vi) manoeuvring at minimum and maximum IMC speed.

EXERCISE 2: INSTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

   (1) full panel;

   (2) 30° level turns;

   (3) unusual attitudes: recoveries;

   (4) transition to instruments after take-off;

   (5) limited panel;

   (6) basic flight manoeuvres;

   (7) unusual attitudes: recoveries.

(b) Air exercise:

   (1) full panel;

   (2) 30° level turns;

   (3) unusual attitudes: recoveries;

   (4) identification and recovery from low pitch steep bank and high pitch steep bank attitudes (at low and high power settings);

   (5) limited panel;

   (6) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

   (1) availability of VOR stations en-route;

   (2) station frequencies and identification;

(3) signal reception range;
(4) effect of altitude;
(5) VOR radials;
(6) use of OBS;
(7) to and from indicator;
(8) orientation;
(9) selecting radials;
(10) intercepting a pre-selected radial;
(11) assessment of distance to interception;
(12) effects of wind;
(13) maintaining a radial;
(14) tracking to and from a VOR station;
(15) procedure turns;
(16) station passage;
(17) use of two stations for obtaining a fix;
(18) pre-selecting fixes along a track;
(19) assessment of ground speed and timing;
(20) holding procedures;
(21) various entries;
(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:
(1) station selection and identification;
(2) orientation;
(3) intercepting a pre-selected radial;
(4) R/T procedures and ATC liaison;
(5) maintaining a radial inbound;
(6) recognition of station passage;
(7) maintaining a radial outbound;
(8) procedure turns;
(9) use of two stations to obtain a fix along the track;
(10) assessment of ground speed and timing;
(11) holding procedures and entries;
(12) holding at a pre-selected fix;
(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF NDB

(a) Long briefing objectives:
(1) availability of NDB facilities en-route;

(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;

(4) static interference;

(5) night effect;

(6) station interference;

(7) mountain effect;

(8) coastal refraction;

(9) orientation in relation to an NDB;

(10) homing;

(11) intercepting a pre-selected magnetic bearing and tracking inbound;

(12) station passage;

(13) tracking outbound;

(14) time and distance checks;

(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;

(16) holding procedures;

(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) selecting, tuning and identifying an NDB;

(2) ADF orientation;

(3) communication (R/T procedures and ATC liaison);

(4) homing;

(5) tracking inbound;

(6) station passage;

(7) tracking outbound;

(8) time and distance checks;

(9) intercepting a pre-selected magnetic bearing;

(10) determining the helicopter's position from two NDBs or alternatively from one NDB and one other navaid;

(11) ADF holding procedures.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:

(1) availability of VHF/DF facilities en-route;

(2) location, frequencies, station call signs and hours of operation;

(3) signal and reception range;

(4) effect of altitude;

(5) communication (R/T procedures and ATC liaison);

(6) obtaining and using types of bearings, for example QTE, QDM, QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix;

(b) Air exercise:

(4) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR SERVICES

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMS;

(4) provision of service;

(5) communication (R/T procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL POOCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the radio equipment;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:

(1) radio equipment serviceability checks;

(2) departure clearance;

(3) navaid selection;

(4) frequencies, radials, etc.;

(5) aerodrome departure checks, frequency changes, altitude and position reports;

(6) SID procedures.

EXERCISE 10: INSTRUMENT APPROACH: PRECISION APPROACH AID TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) precision approach charts;

(2) approach to the initial approach fix and minimum sector altitude;

(3) navaid requirements, for example radar, ADF, etc.;

(4) communication (ATC liaison and R/T phraseology);

(5) holding procedure;

(6) the final approach track;

(7) forming a mental picture of the approach;

(8) completion of aerodrome approach checks;

(9) initial approach procedure;

(10) selection of the ILS frequency and identification;

(11) obstacle clearance altitude or height;

(12) operating minima;

(13) achieving the horizontal and vertical patterns;

(14) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(15) use of DME (as applicable);

(16) go-around and missed approach procedure;

(17) review of the published instructions;

(18) transition from instrument to visual flight (sensory illusions);

(19) visual manoeuvring after an instrument approach;

(i) circling approach;

(ii) visual approach to landing.

(b) Air exercise:

(1) initial approach to the ILS;

(2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of landing site lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface and the length of the landing site;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localizer and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height.

(17) landing direction;

(18) go-around and missed approach procedure;

(19) transition from instrument to visual flight;

(20) circling approach;

(21) visual approach to landing.

EXERCISE 11: INSTRUMENT APPROACH: NON-PRECISION APPROACH TO SPECIFIED MINIMA AND MISSED APPROACH PROCEDURES

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning;

(6) holding procedure;

(7) the approach track;

(8) forming a mental picture of the approach;

(9) initial approach procedure;

(10) operating minima;

(11) completion of approach planning;

(12) achieving the horizontal and vertical patterns;

(13) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(14) use of DME (as applicable);

(15) go-around and missed approach procedure;

(16) review of the published instructions;

(17) transition from instrument to visual flight (sensory illusions);

(18) visual manoeuvring after an instrument approach;

(19) circling approach;

(20) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning, including determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing site;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach.

(2) circling approach;

(3) go-around and missed approach procedure;

(4) initial approach;

(5) frequency selection and identification;

(6) review of the published procedure and minimum safe sector altitude;

(7) ATC liaison and R/T phraseology;

(8) determination of decision height and altimeter setting;

(9) weather considerations, for example cloud base and visibility;

(10) availability of landing site lighting;

(11) determination of inbound track;

(12) assessment of time from final approach fix to the missed approach point;

(13) ATC liaison;

(14) the outbound procedure (incl. completion of pre-landing checks);

(15) the inbound procedure;

(16) re-check of identification code;

(17) altimeter setting re-checked;

(18) the final approach;

(19) note time and establish air speed and descent rate;

(20) maintaining the final approach track;

(21) anticipation of change in wind velocity and its effect on the drift;

(22) minimum descent altitude or height;

(23) landing site direction;

(24) go-around and missed approach procedure;

(25) transition from instrument to visual flight (sensory illusions);

(26) visual approach.

EXERCISE 12: USE OF GNSS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

C. AIRSHIPS

LONG BRIEFINGS AND AIR EXERCISES

EXERCISE 1: INSTRUMENT FLYING (Basic)

(for revision as deemed necessary by the instructor)

(a) Long briefing objectives:

(1) flight instruments;

(2) physiological considerations;

(3) instrument appreciation:

(i) attitude instrument flight;

(ii) pitch indications;

(iii) different instrument presentations;

(iv) introduction to the use of the attitude indicator;

(v) pitch attitude;

(vi) maintenance of heading and balanced flight;

(vii) instrument limitations (inclusive system failures).

(4) attitude, power and performance:

(i) attitude instrument flight;

(ii) control instruments;

(iii) performance instruments;

(iv) effect of changing power, trim and configuration;

(v) cross-checking the instrument indications;

(vi) instrument interpretation;

(vii) direct and indirect indications (performance instruments);

(viii) instrument lag;

(ix) selective radial scan.

(5) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and airship configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

(b) Air exercise:

(1) physiological sensations;

(2) instrument appreciation;

(3) attitude instrument flight;

(4) pitch attitude;

(5) bank attitude;

(6) maintenance of heading and balanced flight;

(7) attitude instrument flight;

(8) effect of changing power and configuration;

(9) cross-checking the instruments;

(10) selective radial scan;

(11) the basic flight manoeuvres (full panel):

(i) straight and level flight at various air speeds and airship configurations;

(ii) climbing;

(iii) descending;

(iv) standard rate turns;

(v) level, climbing and descending on to pre-selected headings.

EXERCISE 2: INSTRUMENT FLYING (Advanced)

(a) Long briefing objectives:

(1) full panel;

(2) unusual attitudes: recoveries;

(3) transference to instruments after take-off;

(4) limited panel;

(5) basic flight manoeuvres;

(6) unusual attitudes: recoveries.

(b) Air exercise:

(1) full panel;

(2) unusual attitudes: recoveries;

(3) limited panel;

(4) repeat of the above exercises.

EXERCISE 3: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VOR

(a) Long briefing objectives:

(1) availability of VOR stations en-route;

(2) station frequencies and identification;

(3) signal reception range;

(4) effect of altitude;

(5) VOR radials;

(6) use of OBS;

(7) to or from indicator;

(8) orientation;

(9) selecting radials;

(10) intercepting a pre-selected radial;

(11) assessment of distance to interception;

(12) effects of wind;

(13) maintaining a radial;

(14) tracking to and from a VOR station;

(15) procedure turns;

(16) station passage;

(17) use of two stations for obtaining a fix;

(18) pre-selecting fixes along a track;

(19) assessment of ground speed and timing;

(20) holding procedures;

(21) various entries;

(22) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) station selection and identification;

(2) orientation;

(3) intercepting a pre-selected radial;

(4) R/T procedures and ATC liaison;

(5) maintaining a radial inbound;

(6) recognition of station passage;

(7) maintaining a radial outbound;

(8) procedure turns;

(9) use of two stations to obtain a fix along the track;

(10) assessment of ground speed and timing;

(11) holding procedures and entries;

(12) holding at a pre-selected fix;

(13) holding at a VOR station.

EXERCISE 4: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF ADF

(Automatic DF equipment)

(a) Long briefing objectives:

(1) availability of NDB facilities en-route;

(2) location, frequencies, tuning (as applicable) and identification codes;

(3) signal reception range;

(4) static interference;

(5) night effect;

(6) station interference;

(7) mountain effect;

(8) coastal refraction;

(9) orientation in relation to an NDB;

(10) homing;

(11) intercepting a pre-selected magnetic bearing and tracking inbound;

(12) station passage;

(13) tracking outbound;

(14) time and distance checks;

(15) use of two NDBs to obtain a fix or alternatively use of one NDB and one other navaid;

(16) holding procedures and various approved entries;

(17) communication (R/T procedures and ATC liaison).

(b) Air exercise:

(1) selecting, tuning and identifying an NDB;

(2) ADF orientation;

(3) communication (R/T procedures and ATC liaison);

(4) homing;

(5) tracking inbound;

(6) station passage;

(7) tracking outbound;

(8) time and distance checks;

(9) intercepting a pre-selected magnetic bearing;

(10) determining the airship's position from two NDBs or alternatively from one NDB and one other navaid;

(11) ADF holding procedures and various approved entries.

EXERCISE 5: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF VHF/DF

(a) Long briefing objectives:

(1) availability of VHF/DF facilities en-route;

(2) location, frequencies, station call signs and hours of operation;

(3) signal and reception range;

(4) effect of altitude;

(5) communication (R/T procedures and ATC liaison);

(6) obtaining and using types of bearings, for example QTE, QDM, QDR;

(7) homing to a station;

(8) effect of wind;

(9) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(10) assessment of groundspeed and timing.

(b) Air exercise:

(1) establishing contact with a VHF/DF station;

(2) R/T procedures and ATC liaison;

(3) obtaining and using a QDR and QTE;

(4) homing to a station;

(5) effect of wind;

(6) use of two VHF/DF stations to obtain a fix (or alternatively one VHF/DF station and one other navaid);

(7) assessment of groundspeed and timing.

EXERCISE 6: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF DME

(a) Long briefing objectives:

(1) availability of DME facilities;

(2) location, frequencies and identification codes;

(3) signal reception range;

(4) slant range;

(5) use of DME to obtain distance, groundspeed and timing;

(6) use of DME to obtain a fix.

(b) Air exercise:

(1) station selection and identification;

(2) use of equipment functions;

(3) distance;

(4) groundspeed;

(5) timing;

(6) DME arc approach;

(7) DME holding.

EXERCISE 7: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF TRANSPONDERS

(a) Long briefing objectives:

(1) operation of transponders;

(2) code selection procedure;

(3) emergency codes;

(4) precautions when using airborne equipment.

(b) Air exercise:

(1) operation of transponders;

(2) types of transponders;

(3) code selection procedure;

(4) emergency codes;

(5) precautions when selecting the required code.

EXERCISE 8: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF EN-ROUTE RADAR SERVICES

(a) Long briefing objectives:

(1) availability of radar services;

(2) location, station frequencies, call signs and hours of operation;

(3) AIP and NOTAMS;

(4) provision of service;

(5) communication (R/T, procedures and ATC liaison);

(6) airspace radar advisory service;

(7) emergency service;

(8) aircraft separation standards.

(b) Air exercise:

(1) communication (R/T procedures and ATC liaison);

(2) establishing the service required and position reporting;

(3) method of reporting conflicting traffic;

(4) terrain clearance.

EXERCISE 9: PRE-FLIGHT AND AERODROME DEPARTURE AND ARRIVAL PROCEDURES

(a) Long briefing objectives:

(1) determining the serviceability of the airship radio;

(2) navigation equipment;

(3) obtaining the departure clearance;

(4) setting up radio navaids before take-off for example VOR frequencies, required radials, etc.;

(5) aerodrome departure procedures, frequency changes;

(6) altitude and position reporting as required;

(7) SID procedures;

(8) obstacle clearance considerations.

(b) Air exercise:

(1) radio equipment serviceability checks;

(2) departure clearance;

(3) navaid selection;

(4) frequencies, radials, etc.;

(5) aerodrome departure checks, frequency changes, altitude and position reports;

(6) SID procedures.

EXERCISE 10: INSTRUMENT APPROACHES: ILS APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACHES PROCEDURES

(a) Long briefing objectives:

(1) precision approach charts;

(2) approach to the initial approach fix and minimum sector altitude;

(3) navaid requirements, for example radar, ADF, etc.;

(4) communication (ATC liaison and R/T phraseology);

(5) review;

(6) holding procedure;

(7) the final approach track;

(8) forming a mental picture of the approach;

(9) completion of aerodrome approach checks;

(10) initial approach procedure;

(11) selection of the ILS frequency and identification;

(12) obstacle clearance altitude or height;

(13) operating minima;

(14) achieving the horizontal and vertical patterns;

(15) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(16) use of DME (as applicable);

(17) go-around and missed approach procedure;

(18) review of the published instructions;

(19) transition from instrument to visual flight (sensory illusions);

(20) visual manoeuvring after an instrument approach;

(i) circling approach;

(ii) visual approach to landing.

(b) Air exercise:

(1) initial approach to the ILS;

(2) completion of approach planning;

(3) holding procedure;

(4) frequency selection and identification of ILS;

(5) review of the published procedure and minimum sector altitude;

(6) communication (ATC liaison and R/T phraseology);

(7) determination of operating minima and altimeter setting;

(8) weather consideration, for example cloud base and visibility;

(9) availability of runway lighting;

(10) ILS entry methods;

(11) radar vectors;

(12) procedural method;

(13) assessment of approach time from the final approach fix to the aerodrome;

(14) determination of:

(i) the descent rate on final approach;

(ii) the wind velocity at the surface (and the length of the landing runway);

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach;

(15) circling approach;

(16) the approach:

(i) at the final approach fix;

(ii) use of DME (as applicable);

(iii) ATC liaison;

(iv) note time and establish air speed and descent rate;

(v) maintaining the localiser and glide path;

(vi) anticipation in change of wind velocity and its effect on drift;

(vii) decision height;

(viii) runway direction.

(17) missed approach procedure;

(18) transition from instrument to visual flight;

(19) circling approach;

(20) visual approach to landing.

EXERCISE 11: INSTRUMENT APPROACHES: NDB APPROACHES TO SPECIFIED MINIMA AND MISSED APPROACHES PROCEDURE

(a) Long briefing objectives:

(1) non-precision approach charts;

(2) initial approach to the initial approach fix and minimum sector altitude;

(3) ATC liaison;

(4) communication (ATC procedures and R/T phraseology);

(5) approach planning:

(i) holding procedure;

(ii) the approach track;

(iii) forming a mental picture of the approach;

(iv) initial approach procedure;

(v) operating minima;

(vi) completion of approach planning.

(6) achieving the horizontal and vertical patterns;

(7) assessment of distance, groundspeed time, and rate of descent from the final approach fix to the aerodrome;

(8) use of DME (as applicable);

(9) go-around and missed approach procedure;

(10) review of the published instructions;

(11) transition from instrument to visual flight (sensory illusions);

(12) visual manoeuvring after an instrument approach;

(13) circling approach;

(14) visual approach to landing.

(b) Air exercise:

(1) completion of approach planning including;

(2) determination of:

(i) descent rate from the final approach fix;

(ii) the wind velocity at the surface and length of the landing runway;

(iii) the obstruction heights to be borne in mind during visual manoeuvring after an instrument approach.

(3) circling approach;

(4) go-around and missed approach procedure;

(5) initial approach;

(6) frequency selection and identification;

(7) review of the published procedure and minimum safe sector altitude;

(8) ATC liaison and R/T phraseology;

(9) determination of decision height and altimeter setting;

(10) weather considerations, for example cloud base and visibility;

(11) availability of runway lighting;

(12) determination of inbound track;

(13) assessment of time from final approach fix to the missed approach point;

(14) ATC liaison;

(15) the outbound procedure (inclusive completion of pre-landing checks);

(16) the inbound procedure;

(17) re-check of identification code;

(18) altimeter setting re-checked;

(19) the final approach;

(20) note time and descent rate;

(21) maintaining the final approach track;

(22) anticipation of change in wind velocity and its effect on the drift;

(23) minimum descent altitude or height;

(24) runway direction;

(25) go-around and missed approach procedure;

(26) transition from instrument to visual flight (sensory illusions);

(27) visual approach.

EXERCISE 12: RADIO NAVIGATION (APPLIED PROCEDURES): USE OF GNNS (to be developed)

(a) Long briefing objectives: use of GNSS.

(b) Air exercise: use of GNSS.

AMC1 FCL.930.MCCI MCCI — Training course

AEROPLANES

GENERAL

(a) The objective of the technical training is to apply the core instructor competencies acquired during the teaching and learning training to MCC training.

(b) During the practical training the applicant should demonstrate the ability to instruct a pilot in MCC.

(c) To supervise applicants for MCCI certificates, the adequate experience should include at least three type rating or MCC courses.

(d) It is to be noted that airmanship is a vital ingredient of all flight operations. Therefore, in the following air exercises the relevant aspects of airmanship are to be stressed at the appropriate times during each flight.

(e) The student instructor should learn how to identify common errors and how to correct them properly, which should be emphasised at all times.

COURSE OBJECTIVE

(f) The course should be designed to give adequate training to the applicant in theoretical knowledge instruction and FSTD instruction to instruct those aspects of MCC required by an applicant for a type rating on a first MP aeroplane.

(g) Confirmation of competency of the applicant to be authorised as an MCCI(A) will be determined by the applicant conducting at least 3 hours MCC instruction to a satisfactory standard on the relevant FNPT or FFS under the supervision of a TRI(A), SFI(A) or MCCI(A) nominated by the ATO for this purpose.

(h) The course consists of three parts:

(1) Part 1: teaching and learning that should follow the content of AMC1 FCL.920;

(2) Part 2: technical theoretical knowledge instruction (technical training);

(3) Part 3: flight instruction.

Part 1

The content of the teaching and learning part of the FI training course, as established in AMC1 FCL.930.FI, should be used as guidance to develop the course syllabus.

Part 2

TECHNICAL THEORETICAL KNOWLEDGE INSTRUCTION SYLLABUS

(a) The FSTD training consists of the application of core instructor competencies to MCC training in a commercial air transport environment, including principles of threat and error management and CRM.

The content of the training programme should cover MCC course exercises in sufficient depth to meet the standard required for issue of the MCCI(A) certificate.

(b) The course should be related to the type of FSTD on which the applicant wishes to instruct. A training programme should give details of all theoretical knowledge instruction.

(c) Identification and application of human factors (as set in the ATPL syllabus 040) related to MCC aspects of the training.

Part 3

FLIGHT INSTRUCTION SYLLABUS

(a) The content of the instruction programme should cover training exercises as applicable to the MCC requirements of an applicant for a MP type rating.

(b) Training exercises:

The exercises should be accomplished as far as possible in a simulated commercial air transport environment. The instruction should cover the following areas:

(1) pre-flight preparation, including documentation, and computation of take-off performance data;

(2) pre-flight checks, including radio and navigation equipment checks and setting;

(3) before take-off checks, including powerplant checks, and take-off briefing by the PF;

(4) normal take-offs with different flap settings, tasks of PF and PNF, call-outs;

(5) rejected take-offs; crosswind take-offs; take-offs at maximum take-off mass; engine failure after v_1;

(6) normal and abnormal operation of aircraft systems, use of checklists;

(7) selected emergency procedures to include engine failure and fire, smoke control and removal, windshear during take-off and landing, emergency descent, incapacitation of a flight crew member;

(8) early recognition of and reaction on approaching stall in differing aircraft configurations;

(9) instrument flight procedures, including holding procedures; precision approaches using raw navigation data, flight director and automatic pilot, one engine simulated inoperative approaches, non-precision and circling approaches, approach briefing by the PF, setting of navigation equipment, call-out procedures during approaches; computation of approach and landing data;

(10) go-arounds; normal and with one engine simulated inoperative, transition from instrument to visual flight on reaching decision height or minimum descent height or altitude;

(11) landings, normal, crosswind and with one engine simulated inoperative, transition from instrument to visual flight on reaching decision height or minimum descent height or altitude.

SUBPART K — EXAMINERS

GM1 FCL.1000 Examiner certificates

SPECIAL CONDITIONS

When new aircraft are introduced, requirements such as to hold a licence and rating equivalent to the one for which the skill test is being conducted, or to have adequate flight experience, may not be possible to comply with. In this case, to allow for the first ratings for these aircraft to be issued to applicants, competent authorities need the possibility to issue a specific certificate that does not have to comply with the requirements established in this Subpart.

The competent authority should only give these certificates to holders of other examiner certificates. As far as possible, preference should be given to persons with experience in similar types or classes of aircraft, for example, in aircraft having the same kind and number of engines or rotors and of the same order of mass or technology.

The certificate should ideally be limited in validity to the time needed to qualify the first examiners for the new aircraft in accordance with this Subpart, but in any case it should not exceed the 3 years established in the rule.

GM1 FCL.1005(b) Limitation of privileges in case of vested interests

Examples of a situation where the examiner should consider if his/her objectivity is affected are when the applicant is a relative or a friend of the examiner, or when they are linked by economical interests or political affiliations, etc.

AMC1 FCL.1010 Prerequisites for examiners

When evaluating the applicant's background, the competent authority should evaluate the personality and character of the applicant, and his/her cooperation with the competent authority.

The competent authority may also take into account whether the applicant has been convicted of any relevant criminal or other offenses, taking into account national law and principles of non-discrimination.

AMC1 FCL.1015 Examiner standardisation

GENERAL

(a) The competent authority may provide the course itself or through an arrangement with an ATO. This arrangement should clearly state that the ATO is acting under the management system of the competent authority.

(b) The course should last:

(1) for the FE and FIE, at least 1 day, divided into theoretical and practical training;

(2) for other examiners, at least 3 days, divided into theoretical training (1 day) and practical training in an FFS conducting role played proficiency checks and skill tests (at least 2 days).

(c) The competent authority or the ATO should determine any further training required before presenting the candidate for the examiner assessment of competence.

CONTENT

(d) The training should comprise:

(1) Theoretical training covering at least:

(i) the contents of AMC2 FCL.1015 and the FEM;

(ii) Part-FCL and related AMCs and GM relevant to their duties;

(iii) operational requirements and related AMCs and GM relevant to their duties;

(iv) national requirements relevant to their examination duties;

(v) fundamentals of human performance and limitations relevant to flight examination;

(vi) fundamentals of evaluation relevant to applicant's performance;

(vii) management system of ATOs;

(viii) MCC, human performance and limitations, if applicable.

(2) Examiners should also be briefed on the protection requirements for personal data, liability, accident insurance and fees, as applicable in the member state concerned.

(3) All items above are the core knowledge requirements for an examiner and are recommended as the core course material. This core course may be studied before recommended examiner training is commenced. The core course may utilise any suitable training format.

(4) Practical training consisting of at least:

(i) knowledge and management of the test for which the certificate is to be sought. These are described in the relevant modules in the FEM;

(ii) knowledge of the administrative procedures pertaining to that test or check.

(5) For an initial examiner certificate, practical training should include the examination of the test profile sought, consisting of the conduct of at least two test or check profiles in the role of examiner (these

two tests or checks profiles can be performed in the same simulator session), including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. This training is conducted in the aircraft if approval for testing or checking in the aircraft is required. If examiner privileges in FSTD's are required, practical instruction in the use of FSTD(s) for testing or checking should also be completed.

(6) If examiner privileges are to include the conduct of proficiency checks for the revalidation or renewal of an instrument rating, practical instruction should include the conduct of at least four instrument check profiles in the role of examiner, including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. This training is conducted in the aircraft if approval for testing or checking in the aircraft is required. If examiner privileges in both FSTD and aircraft are required, at least one of the instrument check profiles should be conducted in an FSTD.

(7) For extension of an examiner certificate to further types (as required for TRE), further practical training on the new type may be required, consisting of the conduct of at least one test or check profile in the role of examiner on the new type, including briefing, conduct of the skill test and proficiency check, assessment of the applicant to whom the test or check is given, debriefing and recording or documentation under the supervision of an examiner of the appropriate category on the applicable type. A further examiner check on the new type may be required, which may be supervised by an inspector of the competent authority or a suitably authorised senior examiner.

AMC2 FCL.1015 Examiner standardisation

STANDARDISATION ARRANGEMENTS FOR EXAMINERS

LIMITATIONS

(a) An examiner should allow an applicant adequate time to prepare for a test or check, normally not more than 1 hour.

(b) An examiner should plan a test or check flight so that all required exercises can be performed while allowing sufficient time for each of the exercises and with due regard to the weather conditions, traffic situation, ATC requirements and local procedures.

PURPOSE OF A TEST OR CHECK

(c) Determine through practical demonstration during a test or check that an applicant has acquired or maintained the required level of knowledge and skill or proficiency.

(d) Improve training and flight instruction in ATOs by feedback of information from examiners about items or sections of tests or checks that are most frequently failed.

(e) Assist in maintaining and, where possible, improving air safety standards by having examiners display good airmanship and flight discipline during tests or checks.

CONDUCT OF TEST OR CHECK

(f) An examiner will ensure that an applicant completes a test or check in accordance with Part-FCL requirements and is assessed against the required test or check standards.

(g) Each item within a test or check section should be completed and assessed separately. The test or check schedule, as briefed, should not normally be altered by an examiner. A failed item is not always a failed section, for example type rating skill test where a failure of an item in a section does not fail the entire section, only the failed item is taken again.

(h) Marginal or questionable performance of a test or check item should not influence an examiner's assessment of any subsequent items.

(i) An examiner should verify the requirements and limitations of a test or check with an applicant during the pre-flight briefing.

(j) When a test or check is completed or discontinued, an examiner should debrief the applicant and give reasons for items or sections failed. In case of a failed or discontinued skill test and proficiency check, the examiner should provide appropriate advice to assist the applicant in re-tests or re-checks.

(k) Any comment on, or disagreement with, an examiner's test or check evaluation or assessment made during a debriefing will be recorded by the examiner on the test or check report, and will be signed by the examiner and countersigned by the applicant.

EXAMINER PREPARATION

(l) An examiner should supervise all aspects of the test or check flight preparation, including, where necessary, obtaining or assuring an ATC 'slot' time.

(m) An examiner will plan a test or check in accordance with Part-FCL requirements. Only the manoeuvres and procedures set out in the appropriate test or check form will be undertaken. The same examiner should not re-examine a failed applicant without the agreement of the applicant.

EXAMINER APPROACH

(n) An examiner should encourage a friendly and relaxed atmosphere to develop both before and during a test or check flight. A negative or hostile approach should not be used. During the test or check flight, the examiner should avoid negative comments or criticisms and all assessments should be reserved for the debriefing.

ASSESSMENT SYSTEM

(o) Although test or checks may specify flight test tolerances, an applicant should not be expected to achieve these at the expense of smoothness or stable flight. An examiner should make due allowance for unavoidable deviations due to turbulence, ATC instructions, etc. An examiner should terminate a test or check only when it is clear that the applicant has not been able to demonstrate the required level of knowledge, skill or proficiency and that a full re-test will be necessary or for safety reasons. An examiner will use one of the following terms for assessment:

   (1) a 'pass', provided that the applicant demonstrates the required level of knowledge, skill or proficiency and, where applicable, remains within the flight test tolerances for the licence or rating;

   (2) a 'fail' provided that any of the following apply:

      (i) the flight test tolerances have been exceeded after the examiner has made due allowance for turbulence or ATC instructions;

      (ii) the aim of the test or check is not completed;

      (iii) the aim of exercise is completed but at the expense of safe flight, violation of a rule or regulation, poor airmanship or rough handling;

      (iv) an acceptable level of knowledge is not demonstrated;

      (v) an acceptable level of flight management is not demonstrated;

      (vi) the intervention of the examiner or safety pilot is required in the interest of safety.

   (3) a 'partial pass' in accordance with the criteria shown in the relevant skill test appendix of Part-FCL.

METHOD AND CONTENTS OF THE TEST OR CHECK

(p) Before undertaking a test or check an examiner will verify that the aircraft or FSTD intended to be used is suitable and appropriately equipped for the test or check.

(q) A test or check flight will be conducted in accordance with the AFM and, if applicable, the AOM.

(r) A test or check flight will be conducted within the limitations contained in the operations manual of an ATO.

(s) Contents:

(1) a test or check is comprised of:

   (i) oral examination on the ground (where applicable);

   (ii) pre-flight briefing;

   (iii) in-flight exercises;

   (iv) post-flight debriefing.

(2) oral examination on the ground should include:

   (i) aircraft general knowledge and performance;

   (ii) planning and operational procedures;

   (iii) other relevant items or sections of the test or check.

(3) pre-flight briefing should include:

   (i) test or check sequence;

   (ii) power setting, speeds and approach minima, if applicable;

   (iii) safety considerations.

(4) in-flight exercises will include each relevant item or section of the test or check;

(5) post-flight debriefing should include:

   (i) assessment or evaluation of the applicant;

   (ii) documentation of the test or check with the applicant's FI present, if possible.

(t) A test or check is intended to simulate a practical flight. Thus, an examiner may set practical scenarios for an applicant while ensuring that the applicant is not confused and air safety is not compromised.

(u) When manoeuvres are to be flown by sole reference to instruments, the examiner should ensure that a suitable method of screening is used to simulate IMC.

(v) An examiner should maintain a flight log and assessment record during the test or check for reference during the post or flight debriefing.

(w) An examiner should be flexible to the possibility of changes arising to pre-flight briefings due to ATC instructions, or other circumstances affecting the test or check.

(x) Where changes arise to a planned test or check an examiner should be satisfied that the applicant understands and accepts the changes. Otherwise, the test or check flight should be terminated.

(y) Should an applicant choose not to continue a test or check for reasons considered inadequate by an examiner, the applicant will be assessed as having failed those items or sections not attempted. If the test or check is terminated for reasons considered adequate by the examiner, only these items or sections not completed will be tested during a subsequent test or check.

(z) An examiner may terminate a test or check at any stage, if it is considered that the applicant's competency requires a complete re-test or re-check.

GM1 FCL.1015 Examiner standardisation

(a) An examiner should plan per day not more than:

(1) three tests or checks relating to PPL, CPL, IR or class ratings;

(2) four tests or checks relating to LAPL, SPL or BPL;

(3) two tests or checks related to CPL, IR or ATPL;

(4) two assessments of competence related to instructor certificates;

(5) four tests or checks relating to SP type ratings.

(b) An examiner should plan at least 2 hours for a LAPL, SPL or BPL, 3 hours for a PPL, CPL, IR or class rating test or checks, and at least 4 hours for FI, CPL, IR, MPL, ATPL or MP type rating tests or checks, including pre-flight briefing and preparation, conduct of the test, check or assessment of competence, de-briefing, evaluation of the applicant and document-tation.

(c) When planning the duration of a test, check or assessment of competence, the following values may be used as guidance:

(1) 45 minutes for a LAPL(B) or BPL and SP class ratings VFR only;

(2) 90 minutes for LAPL(A) or (H), PPL and CPL, including navigation section;

(3) 60 minutes for IR, FI and SP type or class ratings;

(4) 120 minutes for CPL, MPL, ATPL and MP type ratings.

(d) For the LAPL(S) and SPL test or check flight the flight time must be sufficient to allow that all the items in each test or check section can be fully completed. If not all the items can be completed in one flight, additional flights have to be done.

AMC1 FCL.1020 Examiners assessment of competence

GENERAL

(a) The competent authority may nominate either one of its inspectors or a senior examiner to assess the competence of applicants for an examiner certificate.

DEFINITIONS

(b) Definitions:

(1) 'Inspector': the inspector of the competent authority conducting the examiner competence assessment;

(2) 'Examiner applicant': the person seeking certification as an examiner;

(3) 'Candidate': the person being tested or checked by the examiner applicant. This person may be a pilot for whom the test or check would be required, or the inspector of the competent authority who is conducting the examiner certification acceptance test.

CONDUCT OF THE ASSESSMENT

(c) An inspector of the competent authority or a senior examiner will observe all examiner applicants conducting a test on a 'candidate' in an aircraft for which examiner certificate is sought. Items from the related training course and test or check schedule will be selected by the inspector for examination of the 'candidate' by the examiner applicant. Having agreed with the inspector the content of the test, the examiner applicant will be expected to manage the entire test. This will include briefing, the conduct of the flight, assessment and debriefing of the 'candidate'. The inspector will discuss the assessment with the examiner applicant before the 'candidate' is debriefed and informed of the result.

BRIEFING THE 'CANDIDATE'

(d) The 'candidate' should be given time and facilities to prepare for the test flight. The briefing should cover the following:

(1) the objective of the flight;

(2) licensing checks, as necessary;

(3) freedom for the 'candidate' to ask questions;

(4) operating procedures to be followed (for example operators manual);

(5) weather assessment;

(6) operating capacity of 'candidate' and examiner;

(7) aims to be identified by 'candidate';

(8) simulated weather assumptions (for example icing and cloud base);

(9) use of screens (if applicable);

(10) contents of exercise to be performed;

(11) agreed speed and handling parameters (for example V-speeds, bank angle, approach minima);

(12) use of R/T;

(13) respective roles of 'candidate' and examiner (for example during

emergency);

(14) administrative procedures (for example submission of flight plan).

(e) The examiner applicant should maintain the necessary level of communication with the 'candidate'. The following check details should be followed by the examiner applicant:

(1) involvement of examiner in a MP operating environment;

(2) the need to give the 'candidate' precise instructions;

(3) responsibility for safe conduct of the flight;

(4) intervention by examiner, when necessary;

(5) use of screens;

(6) liaison with ATC and the need for concise, easily understood intentions;

(7) prompting the 'candidate' about required sequence of events (for example following a go-around);

(8) keeping brief, factual and unobtrusive notes.

ASSESSMENT

(f) The examiner applicant should refer to the flight test tolerances given in the relevant skill test. Attention should be paid to the following points:

(1) questions from the 'candidate';

(2) give results of the test and any sections failed;

(3) give reasons for failure.

DEBRIEFING

(g) The examiner applicant should demonstrate to the inspector the ability to conduct a fair, unbiased debriefing of the 'candidate' based on identifiable factual items. A balance between friendliness and firmness should be evident. The following points should be discussed with the 'candidate', at the applicant's discretion:

(1) advise the candidate on how to avoid or correct mistakes;

(2) mention any other points of criticism noted;

(3) give any advice considered helpful.

RECORDING OR DOCUMENTATION

(h) The examiner applicant should demonstrate to the inspector the ability to complete the relevant records correctly. These records may be:

(1) the relevant test or check form;

(2) licence entry;

(3) notification of failure form;

(4) relevant company forms where the examiner has privileges of conducting operator proficiency checks.

DEMONSTRATION OF THEORETICAL KNOWLEDGE

(i) The examiner applicant should demonstrate to the inspector a satisfactory knowledge of the regulatory requirements associated with the function of an examiner.

AMC1 FCL.1020; FCL.1025

QUALIFICATION OF SENIOR EXAMINERS

(a) A senior examiner specifically tasked by the competent authority to observe skill tests or proficiency checks for the revalidation of examiner certificates should:

  (1) hold a valid or current examiner certificate appropriate to the privileges being given;

  (2) have examiner experience level acceptable to the competent authority;

  (3) have conducted a number of skill tests or proficiency checks as a Part-FCL examiner.

(b) The competent authority may conduct a pre-assessment of the applicant or candidate carrying out a skill test and proficiency check under supervision of an inspector of the competent authority.

(c) Applicants should be required to attend a senior examiner briefing, course or seminar arranged by the competent authority. Content and duration will be determined by the competent authority and should include:

  (1) pre-course self-study;

  (2) legislation;

  (3) the role of the senior examiner;

  (4) an examiner assessment;

  (5) national administrative requirements.

(d) The validity of the authorisation should not exceed the validity of the examiners certificate, and in any case should not exceed 3 years. The authorisation may be revalidated in accordance with procedures established by the competent authority.

AMC1 FCL.1025 Validity, revalidation and renewal of examiner certificates

EXAMINER REFRESHER SEMINAR

The examiner refresher seminar should follow the content of the examiner standardisation course, included in AMC1 FCL.1015, and take into account specific contents adequate to the category of examiner affected.

AMC1 FCL.1030 (b)(3) Conduct of skill tests, proficiency checks and assessments of competence

OBLIGATIONS FOR EXAMINERS APPLICATION AND REPORT FORMS

Common application and report forms can be found:

(a) For skill tests or proficiency checks for issue, revalidation or renewal of LAPL, BPL, SPL, PPL, CPL and IR in AMC1 to Appendix 7;

(b) For training, skill tests or proficiency checks for ATPL, MPL or class and type ratings, in AMC1 to Appendix 9;

(c) For assessments of competence for instructors, in AMC5 FCL.935.

Appendices

AMC1 to Appendix 3 Training courses for the issue of a CPL and an ATPL

GENERAL

(a) When ensuring that the applicant complies with the prerequisites for the course, in accordance with ORA.ATO.145, the ATO should check that the applicant has enough knowledge of mathematics, physics and English to facilitate the understanding of the theoretical knowledge instruction content of the course.

(b) Whenever reference is made to a certain amount of hours of training, this means a full hour. Time not directly assigned to training (such as breaks, etc.) is not to be counted towards the total amount of time that is required.

A. ATP integrated course: aeroplanes

(a) The ATP integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for previous experience given to an applicant who already holds a PPL should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 750 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	40 hours
(2)	Aircraft general knowledge	80 hours
(3)	Flight performance and planning	90 hours
(4)	Human performance and limitations	50 hours
(5)	Meteorology	60 hours
(6)	Navigation	150 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flying instruction is divided into five phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at critically low air speeds, recognition of recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency procedures and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(viii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 5 hours of dual instruction and at least 40 hours as PIC.

The dual instruction and testing up to the VFR navigation progress test should comprise:

(i) repetition of exercises of phases 1 and 2;

(ii) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(iii) VFR navigation progress test conducted by an FI not connected with the applicant's training;

(iv) night flight time including take-offs and landings as PIC.

(4) phase 4:

Exercises up to the instrument rating skill test comprise:

(i) at least 55 hours instrument flight, which may contain up to 25 hours of instrument ground time in an FNPT I or up to 40 hours in an FNPT II or FFS which should be conducted by an FI or an authorised SFI;

(ii) 20 hours instrument time flown as SPIC;

(iii) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(iv) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedures;

(G) landings from instrument approaches, including circling.

(v) in-flight manoeuvres and specific flight characteristics;

(vi) operation of an ME aeroplane in the exercises of (iv), including operation of the aeroplane solely by reference to instruments with one engine simulated inoperative, and engine shut-down and restart (the latter training should be at a safe altitude unless carried out in an FSTD).

(5) phase 5:

(i) instruction and testing in MCC comprise the relevant training requirements;

(ii) if a type rating for MP aeroplanes is not required on completion of this part, the applicant will be provided with a certificate of course completion for MCC training.

B. ATP modular theoretical knowledge course: aeroplanes

(a) The aim of this course is to train pilots who have not received the theoretical knowledge instruction during an integrated course to the level of theoretical knowledge required for the ATPL.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

(c) The ATP modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

C. CPL/IR integrated course: aeroplanes

(a) The CPL/IR integrated course should last between 9 and 30 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for previous experience given to an applicant who already holds a PPL should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 500 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 500 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	50 hours
(3)	Flight performance and planning	60 hours
(4)	Human performance and limitations	15 hours
(5)	Meteorology	40 hours
(6)	Navigation	100 hours
(7)	Operational procedures	10 hours
(8)	Principles of flight	25 hours
(9)	Communications	30 hours

Other subdivisions of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flying instruction is divided into four phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane, including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at critically low air speeds, recognition of and recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency operations and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(viii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 5 hours of instruction and at least 40 hours as PIC.

The dual instruction and testing up to the VFR navigation progress test and the skill test should contain the following:

(i) repetition of exercises of phases 1 and 2;

(ii) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(iii) VFR navigation progress test conducted by an FI not connected with the applicant's training;

(iv) night flight time including take-offs and landings as PIC.

(4) phase 4:

Exercises up to the instrument rating skill test comprise:

(i) at least 55 hours instrument time, which may contain up to 25 hours of instrument ground time in an FNPT I or up to 40 hours in an FNPT II or FFS which should be conducted by an FI or an authorised SFI;

(ii) 20 hours instrument time flown as SPIC;

(iii) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(iv) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedures;

(G) landings from instrument approaches, including circling.

(v) in-flight manoeuvres and particular flight characteristics;

(vi) operation of either an SE or an ME aeroplane in the exercises of (iv), including in the case of an ME aeroplane operation of the aeroplane solely by reference to instruments with one engine simulated inoperative and engine shut-down and restart. The latter exercise is to be conducted at a safe altitude unless carried out in an FSTD.

D. CPL integrated course: aeroplanes

(a) The CPL integrated course should last between 9 and 24 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In the case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in a helicopter or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 350 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The flying instruction is divided into four phases:

(1) phase 1:

Exercises up to the first solo flight comprise a total of at least 10 hours dual flight instruction on an SE aeroplane, including:

(i) pre-flight operations, mass and balance determination, aeroplane inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and precautions;

(iii) control of the aeroplane by external visual references;

(iv) normal take-offs and landings;

(v) flight at relatively slow air speeds, recognition of and recovery from incipient and full stalls, spin avoidance;

(vi) unusual attitudes and simulated engine failure.

(2) phase 2:

Exercises up to the first solo cross-country flight comprise a total of at least 10 hours of dual flight instruction and at least 10 hours solo flight including:

(i) maximum performance (short field and obstacle clearance) take-offs and short-field landings;

(ii) flight by reference solely to instruments, including the completion of a 180 ° turn;

(iii) dual cross-country flying using external visual references, DR and radio navigation aids, diversion procedures;

(iv) aerodrome and traffic pattern operations at different aerodromes;

(v) crosswind take-offs and landings;

(vi) abnormal and emergency procedures and manoeuvres, including simulated aeroplane equipment malfunctions;

(vii) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(vii) knowledge of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS.

(3) phase 3:

Exercises up to the VFR navigation progress test comprise a total of at least 30 hours instruction and at least 58 hours as PIC, including:

(a) at least 10 hours instrument time, which may contain 5 hours of instrument ground time in an FNPT or an FFS and should be conducted by an FI or an authorised SFI;

(b) repetition of exercises of phases 1 and 2, which should include at least 5 hours in an aeroplane certificated for the carriage of at least four persons and have a variable pitch propeller and retractable landing gear;

(c) VFR flight at relatively critical high air speeds, recognition of and recovery from spiral dives;

(d) night flight time including take-offs and landings as PIC.

(4) phase 4:

The dual instruction and testing up to the CPL(A) skill test contain the following:

(i) up to 30 hours instruction which may be allocated to specialised aerial work training;

(ii) repetition of exercises in phase 3, as required;

(iii) in-flight manoeuvres and particular flight characteristics;

(iv) ME training.

If required, operation of an ME aeroplane including operation of the aeroplane with one engine simulated inoperative, and engine shutdown and restart (the latter exercise at a safe altitude unless carried out in an FSTD).

E. CPL modular course: aeroplanes

(a) The CPL modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

THEORETICAL KNOWLEDGE

(c) The 250 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The following flight time is suggested for the flying training:

(1)	visual flight training:	suggested flight time
(i)	Exercise 1: pre-flight operations: mass and balance determination, aeroplane inspection and servicing.	
(ii)	Exercise 2: take-off, traffic pattern, approach and landing, use of checklist, collision avoidance and checking procedures.	0:45 hours
(iii)	Exercise 3: traffic patterns: simulated engine failure during and after take-off.	0:45 hours
(iv)	Exercise 4: maximum performance (short field and obstacle clearance) take-offs and short-field landings.	1:00 hours
(v)	Exercise 5: crosswind take-offs, landings and go-arounds.	1:00 hours
(vi)	Exercise 6: flight at relatively critical high	0:45 hours

air speeds; recognition of and recovery from spiral dives.

(vii) Exercise 7:

flight at critically slow air speeds, spin avoidance, recognition of and recovery from incipient and full stalls.	0:45 hours

(viii) Exercise 8:

cross-country flying using DR and radio navigation aids; flight planning by the applicant; filing of ATC flight plan; evaluation of weather briefing documentation, NOTAM, etc.; R/T procedures and phraseology; positioning by radio navigation aids; operation to, from and transiting controlled aerodromes, compliance with ATS procedures for VFR flights, simulated radio communication failure, weather deterioration, diversion procedures; simulated engine failure during cruise flight; selection of an emergency landing strip.	10:00 hours

(2) instrument flight training:

(i) This module is identical to the 10 hours basic instrument flight module as set out in AMC2 to Appendix 6. This module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitudes.

(ii) All exercises may be performed in an FNPT I or II or an FFS. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(iii) A BITD may be used for the following exercises: (9), (10), (11), (12), (14) and (16).

(iv) The use of the BITD is subject to the following:

(A) the training is complemented by exercises on an aeroplane;

(B) the record of the parameters of the flight is available;

(C) an FI(A) or IRI(A) conducts the instruction.

(v) Exercise 9:

Basic instrument flying without external visual cues; horizontal flight; power changes for acceleration or deceleration, maintaining straight and level flight; turns in level flight with 15 ° and 25 ° bank, left and right; roll-out onto predetermined headings.	0:30 hours

(vi) Exercise 10:

Repetition of exercise 9; additionally climbing and descending, maintaining heading and speed, transition to horizontal flight; climbing and descending turns.	0:45 hours

(vii) Exercise 11:

Instrument pattern:	0:45 hours

(1) start exercise, decelerate to approach speed, flaps into approach configuration;

(2) initiate standard turn (left or right);

(3) roll out on opposite heading, maintain new heading for 1 minute;

(4) standard turn, gear down, descend 500 ft/min;

(5) roll out on initial heading, maintain descent (500 ft/min) and new heading for 1 minute;

(6) transition to horizontal flight, 1.000 ft below initial flight level;

(7) initiate go-around;

(8) climb at best rate of climb speed.

(viii) Exercise 12:

Repetition of exercise 9 and steep turns with 45° bank; recovery from unusual attitudes.	0:45 hours

(ix) Exercise 13:

Repetition of exercise 12	0:45 hours

(x) Exercise 14:

Radio navigation using VOR, NDB or, if available, VDF; interception of predetermined QDM and QDR.	0:45 hours

(xi) Exercise 15:

Repetition of exercise 9 and recovery from unusual attitudes.	0:45 hours

(xii) Exercise 16:

Repetition of exercise 9, turns and level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.	0:45 hours

(xiii) Exercise 17:

Recognition of, and recovery from, incipient and full stalls.	0:45 hours

(xiv) Exercise 18:

Repetition of exercises (14), (16) and (17).	3:30 hours

(3) ME training

If required, operation of an ME aeroplane in the exercises 1 through 18, including operation of the aeroplane with one engine simulated inoperative, and engine shutdown and restart. Before commencing training, the applicant should have complied with the type and class ratings requirements as appropriate to the aeroplane used for the test.

F. ATP/IR integrated course: helicopters

(a) The ATP/IR integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 750 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 750 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	40 hours
(2)	Aircraft general knowledge	80 hours
(3)	Flight performance and planning	90 hours
(4)	Human performance and limitations	50 hours
(5)	Meteorology	60 hours
(6)	Navigation	150 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

(d) The flight instruction is divided into four phases:

(1) phase 1:

Flight exercises up to the first solo flight comprise a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations, mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check, and basic instrument flying progress check. This phase comprises a total flight time of not less than 128 hours including 73 hours of dual flight instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as student PIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) advanced/touchdown auto-rotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of a 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes; compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Flight exercises up to IR skill test. This part comprises a total of 40 hours dual instrument flight time, including 10 hours of an ME IFR certificated helicopter.

The instruction and testing should contain the following:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(ii) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedure;

(G) landings from instrument approaches;

(H) in-flight manoeuvres and particular flight characteristics;

(I) instrument exercises with one engine simulated inoperative.

(4) phase 4:

Instruction in MCC should comprise the relevant training set out in FCL.735.H and AMC1 FCL,735.A, FCL.735.H and FCL.735.As.

If a type rating for MP helicopter is not required on completion of this part, the applicant should be provided with a certificate of course completion for MCC training.

G. ATP integrated course: helicopters

(a) The ATP integrated course should last between 12 and 36 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 650 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 650 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	70 hours
(3)	Flight performance and planning	65 hours
(4)	Human performance and limitations	40 hours
(5)	Meteorology	40 hours
(6)	Navigation	120 hours
(7)	Operational procedures	20 hours
(8)	Principles of flight	30 hours
(9)	Communications	25 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

(d) The flight instruction is divided into three phases:

(1) phase 1:

Flight exercises up to the first solo flight comprise a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations, mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress and basic instrument flying progress check conducted by an FI not connected with the applicant's training. This phase comprises a total flight time of not less than 128 hours, including 73 hours of dual instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as student PIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotations, simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including low level operations to and from unprepared sites;

(vii) 10 hours flight by sole reference to basic flight instruments, including completion of a 180 ° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Instruction in MCC comprises the relevant training set out in FCL.735.H and AMC1 FCL,735.A, FCL.735.H and FCL.735.As.

If a type rating for MP helicopter is not required on completion of this part, the applicant should be provided with a certificate of course completion for MCC training.

H. ATP modular theoretical knowledge course: helicopters

(a) The aim of this course is to train pilots who have not received the theoretical knowledge instruction during an integrated course to the level of theoretical knowledge required for the ATPL.

(b) An approved course should include formal classroom work and may include the use of such facilities as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

(c) The ATP modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

I. CPL/IR integrated course: helicopters

(a) The CPL/IR integrated course should last between 9 and 30 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 500 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 500 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	30 hours
(2)	Aircraft general knowledge	50 hours
(3)	Flight performance and planning	60 hours
(4)	Human performance and limitations	15 hours
(5)	Meteorology	40 hours
(6)	Navigation	100 hours
(7)	Operational procedures	10 hours
(8)	Principles of flight	25 hours
(9)	Communications	30 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flight instruction is divided into three phases:

(1) phase 1:

Flight exercises up to the first solo flight. This part comprises a total of at least 12 hours dual flight instruction on a helicopter including:

(i) pre-flight operations: mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotation, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check conducted by an FI not connected with the applicant's training, and basic instrument progress check. This part comprises a total flight time of not less than 128 hours, including 73 hours of dual instruction flight time and including at least 5 hours VFR conversion training on an ME helicopter, 15 hours of solo flight and 40 hours flown as SPIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotation and simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including selection of and low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of 180 degree turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids and diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

(3) phase 3:

Flight exercises up to IR skill test. This part comprises a total of 40 hours dual instrument flight time, including 10 hours of an ME IFR certificated helicopter.

The instruction and testing should contain the following:

(i) pre-flight procedures for IFR flights, including the use of the flight manual and appropriate ATS documents in the preparation of an IFR flight plan;

(ii) procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least:

(A) transition from visual to instrument flight on take-off;

(B) SIDs and arrivals;

(C) en-route IFR procedures;

(D) holding procedures;

(E) instrument approaches to specified minima;

(F) missed approach procedure;

(G) landings from instrument approaches;

(H) in-flight manoeuvres and particular flight characteristics;

(I) instrument exercises with one engine simulated inoperative.

J. CPL integrated course: helicopters

(a) The CPL integrated course should last between 9 and 24 months. This period may be extended where additional flying training or ground instruction is provided by the ATO.

CREDITING

(b) Credit for the hours flown should be entered into the applicant's training record. In case of a student pilot who does not hold a pilot licence and with the approval of the competent authority, an ATO may designate certain dual exercises to be flown in an aeroplane or a TMG up to a maximum of 20 hours.

THEORETICAL KNOWLEDGE

(c) The 350 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

The 350 hours of instruction should be divided in such a way that in each subject the minimum hours are:

(1)	Air law	25 hours
(2)	Aircraft general knowledge	30 hours
(3)	Flight performance and planning	25 hours
(4)	Human performance and limitations	10 hours
(5)	Meteorology	30 hours
(6)	Navigation	55 hours
(7)	Operational procedures	8 hours
(8)	Principles of flight	20 hours
(9)	Communications	10 hours

Other subdivision of hours may be agreed upon between the competent authority and the ATO.

FLYING TRAINING

(d) The flight instruction is divided into two phases:

(1) phase 1:

Flight exercises up to the first solo flight. This part comprises a total of not less than 12 hours dual flight instruction on a helicopter, including:

(i) pre-flight operations: mass and balance determination, helicopter inspection and servicing;

(ii) aerodrome and traffic pattern operations, collision avoidance and procedures;

(iii) control of the helicopter by external visual reference;

(iv) take-offs, landings, hovering, look-out turns and normal transitions from and to the hover;

(v) emergency procedures, basic auto-rotations, simulated engine failure, ground resonance recovery if relevant to type.

(2) phase 2:

Flight exercises until general handling and day VFR navigation progress check conducted by an FI not connected with the applicant's training, and basic instrument progress check. This part comprises a total flight time of not less than 123 hours, including 73 hours of dual instruction flight time, 15 hours of solo flight and 35 hours flown as SPIC. The instruction and testing contain the following:

(i) sideways and backwards flight, turns on the spot;

(ii) incipient vortex ring recovery;

(iii) touchdown or advanced auto-rotations and simulated engine-off landings, practice forced landings. Simulated equipment malfunctions and emergency procedures relating to malfunctions of engines, controls, electrical and hydraulic circuits;

(iv) steep turns;

(v) transitions, quick stops, out of wind manoeuvres, sloping ground landings and take-offs;

(vi) limited power and confined area operations, including selection of and low level operations to and from unprepared sites;

(vii) flight by sole reference to basic flight instruments, including completion of a 180° turn and recovery from unusual attitudes to simulate inadvertent entry into cloud;

(viii) cross-country flying by external visual reference, DR and radio navigation aids, diversion procedures;

(ix) aerodrome and traffic pattern operations at different aerodromes;

(x) operations to, from and transiting controlled aerodromes, compliance with ATS procedures, R/T procedures and phraseology;

(xi) application of meteorological briefing arrangements, evaluation of weather conditions for flight and use of AIS;

(xii) night flight, including take-offs and landings as PIC;

(xiii) general handling, day VFR navigation and basic instrument flying progress checks in accordance with Appendix 4 to Part-FCL, conducted by an FI not connected with the applicant's training.

K. CPL modular course: helicopters

(a) The CPL modular course should last 18 months. This period may be extended where additional training is provided by the ATO. The flight instruction and skill test need to be completed within the period of validity of the pass in the theoretical examinations.

(b) An approved course should include formal classroom work and may include the use of facilities such as interactive video, slide or tape presentation, learning carrels and computer-based training and other media distance learning (correspondence) courses as approved by the competent authority. Approved distance learning (correspondence) courses may also be offered as part of the course.

THEORETICAL KNOWLEDGE

(c) The 250 hours of instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

FLYING TRAINING

(d) The flying instruction comprises the following items. The flight time allocated to each exercise is at the discretion of the FI, provided that at least 5 hours flight time is allocated to cross-country flying.

VISUAL INSTRUCTION

(e) Within the total of dual flight instruction time, the applicant may have completed during the visual phase up to 5 hours in a helicopter FFS or FTD 2, 3 or FNPT II, III.

(1) pre-flight operations: mass and balance calculations, helicopter inspection and servicing;

(2) level flight speed changes, climbing, descending, turns, basic auto-rotations, use of checklist, collision avoidance and checking procedures;

(3) take-offs and landings, traffic pattern, approach, simulated engine failures in the traffic pattern. Sideways and backwards flight and spot turns in the hover;

(4) recovery from incipient vortex ring condition;

(5) advanced auto-rotations covering the speed range from low speed to maximum range and manoeuvre in auto-rotations (180 °, 360 ° and 'S' turns) and simulated engine-off landings;

(6) selection of emergency landing areas, auto-rotations following simulated emergencies to given areas and steep turns at 30 ° and 45 ° bank;

(7) manoeuvres at low level and quick-stops;

(8) landings, take-offs and transitions to and from the hover when heading out of wind;

(9) landings and take-offs from sloping or uneven ground;

(10) landings and take-offs with limited power;

(11) low level operations into and out of confined landing sites;

(12) cross-country flying using dead reckoning and radio navigation aids, flight planning by the applicant, filing of ATC flight plan, evaluation of weather briefing documentation, NOTAM, etc., R/T procedures and

phraseology, positioning by radio navigation aids; operation to, from and transiting controlled aerodromes, compliance with ATS procedures for VFR flights, simulated radio communication failure, weather deterioration, diversion procedures; location of an off airfield landing site and simulated approach.

BASIC INSTRUMENT INSTRUCTION

(f) A maximum of 5 hours of the following exercises may be performed in an FFS or FTD or FNPT. Flight training should be carried out in VMC using a suitable means of simulating IMC for the student.

(1) Exercise 1:

Instrument flying without external visual cues. Level flight performing speed changes, maintaining flight altitude (level, heading) turns in level flight at rate 1 and 30° bank, left and right; roll-out on predetermined headings;

(2) Exercise 2:

repetition of exercise 1; additionally climbing and descending, maintaining heading and speed, transition to horizontal flight; climbing and descending turns;

(3) Exercise 3:

repetition of exercise 1; and recovery from unusual attitudes;

(4) Exercise 4:

radio navigation;

(5) Exercise 5:

repetition of exercise 1; and turns using standby magnetic compass and standby artificial horizon (if fitted).

GM1 to Appendix 3; Appendix 6; FCL.735.H

OVERVIEW OF FSTD TRAINING CREDITS FOR DUAL INSTRUCTION IN HELICOPTER FLYING TRAINING COURSES

		ATPL(H)/IR integrated			FSTD credits
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual, including ME T/R training	75 hrs	15 hrs	40 hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	20 hrs FFS or FTD 2, 3 or FNPT II/III or 10 hrs in at least an FNPT I
Instrument rating training	40 hrs	-		40 hrs	
MCC	15 hrs	-	-	15 hrs	15 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
Total	140 hrs	55 hrs		195 hrs	65 hrs FFS or 60 hrs FTD 2, 3 or 55 hrs FNPT II/III or 10 hrs in at least an FNPT I
		ATPL(H)/VFR integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual including ME T/R training	75 hrs	15 hrs	40 hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
MCC / VFR	10 hrs	-	-	10 hrs	10 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
Total	95 hrs	55 hrs		150 hrs	40 hrs FFS or 35 hrs FTD 2, 3 or 30 hrs FNPT II/III or 5 hrs in at least an FNPT I
		CPL(H)/IR integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual including ME T/R training	75 hrs	15 hrs	40hrs	130 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III

Basic instrument	10 hrs	-	-	10 hrs	20 hrs FFS or FTD 2, 3 or FNPT II/III or 10 hrs in at least an FNPT I
Instrument rating training	40 hrs	-		40 hrs	
Total	125 hrs	55 hrs		180 hrs	50 hrs FFS C/D level or 45 hrs FTD 2, 3 or 40 hrs FNPT II/III or 10 hrs in at least an FNPT I

		CPL(H) Integrated			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual	75 hrs	15 hrs	35 hrs	125 hrs	30 hrs FFS C/D level or 25 hrs FTD 2, 3 or 20 hrs FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
Total	85 hrs	50 hrs		135 hrs	35 hrs FFS or 30 hrs FTD 2, 3 or 25 hrs FNPT II/III or 5 hrs in at least an FNPT I
		CPL(H) modular			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
Visual	20 hrs	-	-	20 hrs	5 hrs FFS or FTD 2, 3 or FNPT II/III
Basic instrument	10 hrs	-	-	10 hrs	5 hrs in at least an FNPT I
Total	30 hrs	-	-	30 hrs	10 hrs FFS or FTD 2,3 or FNPT II/III or 5 hrs in at least an FNPT I
		IR(H) modular			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
SE	50 hrs	-	-	50 hrs	35 hrs FFS or FTD 2, 3 or FNPT II/III or 20 hrs FNPT I (H) or (A)
ME	55 hrs	-	-	55 hrs	40 hrs FFS; FTD 2, 3 FNPT II/III or 20 hrs FNPT I (H) or (A)

		MCC(H)			
	Dual	Solo	SPIC	Total	FFS; FTD; FNPT
MCC / IR	20 hrs	-	-	20 hrs	20 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
MCC / VFR	15 hrs	-	-	15 hrs	15 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)
MCC / IR for MCC/VFR holders	5 hrs	-	-	5 hrs	5 hrs FFS or FTD 2, 3 (MCC) or FNPT II/III (MCC)

Note: In this matrix FSTD credits refer to helicopter FSTDs if not mentioned otherwise.

GM1 to Appendix 5 Integrated MPL training course

GENERAL

(a) In broad terms, the MPL holder is expected to be able to complete the airline operators' conversion course with a high probability of success and within the time frame normally allowed for this phase. The standard is equivalent to what is currently expected from graduates of the ATP(A) integrated course who have completed type rating training.

(b) The general approach is to use the existing ATP(A) integrated training course as a reference and to implement progressively the MPL integrated training course and specifically the transfer from actual flight to simulated flight.

(c) This transfer should be organised in a way that is similar to the approach used for ETOPS. Successive evolutions of the training syllabus introduce progressively a higher level of simulated flight and a reduction of actual flight. Change from one version to the next should only take place after enough experience has been gained and once its results, including those of airline operator conversion courses, have been analysed and taken into account.

MPL TRAINING SCHEME

(d) The following scheme should be applied:

MPL Training Scheme
Minimum 240 hours of training, including "Pilot Flying" (PF) and "Pilot Non Flying" (PNF)

Phases of training		Training items	Flight and simulated flight training media - Minimum level requirement -		Ground training media
Integrated TEM principles	**Phase 4 – advanced** Type rating training within an airline oriented environment	• CRM • Landing training • All weather • LOFT • Abnormal procedures • Normal procedures	Aeroplane: ME Multi-crew certified --- FSTD FS level D or C + ATC simulation	12 take-offs and landings as PF --- PF / PNF	• CBT • E-learning • Part task trainer • Class room
	Phase 3 – intermediate Application of multi-crew operations in a high performance ME turbine aeroplane	• CRM • LOFT • Abnormal procedures • Normal procedures • Multi-crew • Instrument flight	FSTD: *representing an ME turbine powered aeroplane to be operated with a co-pilot and qualified to an equivalent standard to level B + ATC simulation*	PF / PNF	
	Phase 2 – basic Introduction of multi-crew operations and instrument flight	• CRM • PF / PNF complement • IFR cross-country • Instrument flight	Aeroplane: SE or ME --- FSTD: FNPT II + MCC	PF / PNF	
	Phase 1 – core flying skills Specific basic SP training	• CRM • VFR Cross-country • Solo flight • Basic Instrument flight • Principles of flight • Cockpit procedures • Upset recovery • Night flight	Aeroplane: SE or ME --- FSTD: FNPT I / BITD	PF	

THEORETICAL KNOWLEDGE INSTRUCTION

(e) The 750 hours of theoretical knowledge instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions.

COMPETENCY UNITS, COMPETENCY ELEMENTS AND PERFORMANCE CRITERIA

(f) Apply human performance principles, including principles of threat and error management:

(1) cooperation;

(2) leadership and managerial skills;

(3) situation awareness;

(4) decision making.

These behaviour categories are intended to help in the effective utilisation of all available resources to achieve safe and efficient operations.

These behaviour categories may be adapted and extended to incorporate issues like communication and use of automation if it is considered to be relevant to the development of the curriculum.

(g) Perform Aircraft Ground and Pre-Flight Operations

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

		Duty	Observation and assessment Satisfactory (S) Unsatisfactory (U)
(2)	perform dispatch duties:		(S) or (U)
(i)	verifies technical condition of the a/c, including adequate use of MEL;	PF/PNF	
(ii)	checks technical bulletins and notices;	PF/PNF	
(iii)	determines operational environment and pertinent weather;	PF/PNF	
(iv)	determines impact of weather on aircraft performance;	PF/PNF	
(v)	applies flight planning and load procedures;	PF/PNF	
(vi)	determines fuel requirement;	PF/PNF	
(vii)	files an ATS flight plan (if required).	PF/PNF	
(3)	provide flight crew and cabin crew briefings;		(S) or (U)

	(i)	briefed flight crew in all relevant matters;	PF	
	(ii)	briefed cabin crew in all relevant matters.	PF	
(4)		perform pre-flight checks and cockpit preparation:		(S) or (U)
	(i)	ensures the airworthiness of the aircraft;	PF	
	(ii)	performs the cockpit preparation and briefings;	PF/PNF	
	(iii)	performs FMS initialisation, data insertion and confirmation;	PF/PNF	
	(iv)	optimises and checks take-off performance and take-off data calculation.	PF/PNF	
(5)		perform engine start:		(S) or (U)
	(i)	asks for, receives acknowledges and checks ATC clearance;	PNF	
	(ii)	performs engine start procedure;	PF/PNF	
	(iii)	uses standard communication procedures with ground crew and ATC.	PF/PNF	
(6)		perform taxi out:		(S) or (U)
	(i)	receives, checks and adheres to taxi clearance;	PNF	
	(ii)	taxis the aircraft, including use of exterior lighting;	PF	
	(iii)	complies to taxi clearance;	PF/PNF	
	(iv)	maintains look-out for conflicting traffic and obstacles;	PF/PNF	
	(v)	operates thrust, brakes and steering;	PF	
	(vi)	conducts relevant briefings;	PF	
	(vii)	uses standard communication procedures with crew and ATC;	PNF	
	(viii)	completes standard operating procedures and checklists;	PF/PNF	
	(ix)	updates and confirms FMS data;	PF/PNF	
	(x)	manages changes in performance and departure route;	PF/PNF	
	(xi)	completes de or anti-ice procedures.	PF/PNF	
(7)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	

	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(8)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF/PNF	

(h) Perform take-off

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors.

(2)		perform pre-take-off and pre-departure preparation:		(S) or (U)
	(i)	checks and acknowledges line up clearance;	PF/PNF	
	(ii)	checks correct runway selection ;	PF/PNF	
	(iii)	confirms validity of performance data;	PF/PNF	
	(iv)	checks approach sector and runway are clear;	PF/PNF	
	(v)	confirms all checklists and take-off preparations completed;	PF/PNF	
	(vi)	lines up the aircraft on centreline without losing distance;	PF	
	(vii)	checks weather on departure sector;	PF/PNF	
	(viii)	checks runway status and wind.	PF/PNF	
(3)		perform take-off roll:		(S) or (U)
	(i)	applies take-off thrust;	PF	
	(ii)	checks engine parameters;	PNF	
	(iii)	checks air speed indicators;	PF/PNF	
	(iv)	stays on runway centreline.	PF	
(4)		perform transition to instrument flight rules:		(S) or (U)
	(i)	applies v_1 procedures;	PF / PNF	
	(ii)	rotates at v_r to initial pitch attitude;	PF	
	(iii)	establishes initial wings level attitude;	PF	

(iv)	retracts landing gear;	PNF	
(v)	maintains climb out speed.	PF	
(5)	perform initial climb to flap retraction altitude:		(S) or (U)
(i)	sets climb power;	PF	
(ii)	adjusts attitude for acceleration;	PF	
(iii)	selects flaps according flap speed schedule;	PF/PNF	
(iv)	observes speed restrictions;	PF	
(v)	completes relevant checklists.	PF/PNF	
(6)	perform rejected take-off:		(S) or (U)
(i)	recognises the requirement to abort the take-off;	PF	
(ii)	applies the rejected take-off procedure;	PF	
(iii)	assesses the need to evacuate the aircraft.	PF/PNF	
(7)	perform navigation:		(S) or (U)
(i)	complies to departure clearance;	PF	
(ii)	complies with published departure procedures, for example speeds;	PF	
(iii)	monitors navigation accuracy;	PF/PNF	
(iv)	communicates and coordinates with ATC.	PNF	
(8)	manage abnormal and emergency situations:		(S) or (U)
(i)	identifies the abnormal condition;	PF/PNF	
(ii)	interprets the abnormal condition;	PF/PNF	
(iii)	performs the procedure for the abnormal condition.	PF/PNF	

(i) Perform climb

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)	perform SID or en-route navigation:		(S) or (U)
(i)	complies with departure clearance and procedures;	PF	
(ii)	demonstrates terrain awareness;	PF/PNF	
(iii)	monitors navigation accuracy;	PF/PNF	

	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC;	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	selects appropriate level of automation;	PF	
	(viii)	complies with altimeter setting procedures.	PF/PNF	
(3)		complete climb procedures and checklists:		(S) or (U)
	(i)	performs the after take-off items;	PF/PNF	
	(ii)	confirms and checks according checklists.	PF/PNF	
(4)		modify climb speeds, rate of climb and cruise altitude:		(S) or (U)
	(i)	recognises the need to change speed, rate of climb or cruise altitude;	PF	
	(ii)	selects and maintains the appropriate climb speed or rate of climb;	PF	
	(iii)	selects optimum cruise flight level.	PF/PNF	
(5)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PF/PNF	
(6)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(7)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF	

(j) Perform cruise

List of competency elements and performance criteria.

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		monitor navigation accuracy:		(S) or (U)
	(i)	demonstrates adequate area knowledge;	PF/PNF	
	(ii)	demonstrates adequate route knowledge;	PF/PNF	
	(iii)	navigates according to flight plan and clearance;	PF	
	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC;	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	uses all means of automation.	PF	
(3)		monitor flight progress:		(S) or (U)
	(i)	selects optimum speed;	PF	
	(ii)	selects optimum cruise flight level;	PF	
	(iii)	monitors and controls fuel status;	PF/PNF	
	(iv)	recognises the need for a possible diversion;	PF/PNF	
	(v)	creates a diversion contingency plan if required.	PF/PNF	
(4)		perform descent and approach planning:		(S) or (U)
	(i)	checks weather of destination and alternate airport;	PF/PNF	
	(ii)	checks runway in use and approach procedure;	PF/PNF	
	(iii)	sets the FMS accordingly;	PNF	
	(iv)	checks landing weight and landing distance required;	PNF	
	(v)	checks MEA, MGA and MSA;	PF/PNF	
	(vi)	identifies top of descent point.	PF	
(5)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	
	(ii)	operates systems as required.	PNF	
(6)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	

(7)		communicate with cabin crew, passengers and company:		(S) or (U)
	(i)	communicates relevant information with cabin crew;	PF	
	(ii)	communicates relevant information with company;	PF/PNF	
	(iii)	makes passenger announcements when appropriate.	PF	

(k) Perform descent

List of competency elements and performance criteria:

(1) Demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		initiate and manage descent:		(S) or (U)
	(i)	starts descent according to ATC clearance or optimum descent point;	PF	
	(ii)	selects optimum speed and descent rate;	PF	
	(iii)	adjusts speed to existing environmental conditions;	PF	
	(iv)	recognises the need to adjust the descent path;	PF	
	(v)	adjusts the flight path as required;	PF	
	(vi)	utilises all means of FMS descent information.	PF	
(3)		monitor and perform en route and descent navigation:		(S) or (U)
	(i)	complies with arrival clearance and procedures;	PF	
	(ii)	demonstrates terrain awareness;	PF/PNF	
	(iii)	monitors navigation accuracy;	PF/PNF	
	(iv)	adjusts flight to weather and traffic conditions;	PF	
	(v)	communicates and coordinates with ATC;	PNF	
	(vi)	observes minimum altitudes;	PF/PNF	
	(vii)	selects appropriate level or mode of automation;	PF	
	(viii)	complies with altimeter setting procedures.	PF/PNF	
(4)		re-planning and update of approach briefing:		(S) or (U)
	(i)	re-checks destination weather and runway in use;	PNF	
	(ii)	briefs or re-briefs about instrument approach and landing as required;	PF	
	(iii)	reprograms the FMS as required;	PNF	

(iv)	re-checks fuel status.	PF/PNF	
(5)	perform holding:		(S) or (U)
(i)	identifies holding requirement;	PF/PNF	
(ii)	programs FMS for holding pattern;	PNF	
(iii)	enters and monitors holding pattern;	PF	
(iv)	assesses fuel requirements and determines max holding time;	PF/PNF	
(v)	reviews the need for a diversion;	PF/PNF	
(vi)	initiates diversion.	PF	
(6)	perform systems operations and procedures:		(S) or (U)
(i)	monitors operation of all systems;	PF/PNF	
(ii)	operates systems as required.	PF/PNF	
(7)	manage abnormal and emergency situations:		
(i)	identifies the abnormal condition;	PF/PNF	
(ii)	interprets the abnormal condition;	PF/PNF	
(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(8)	communicate with cabin crew, passengers and company:		(S) or (U)
(i)	communicates relevant information with cabin crew;	PF	
(ii)	communicates relevant information with company;	PF/PNF	
(iii)	makes passenger announcements when appropriate;	PF	

(l) Perform approach

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)	perform approach in general:		(S) or (U)
(i)	executes approach according to procedures and situation;	PF	
(ii)	selects appropriate level or mode of automation;	PF	

	(iii)	selects optimum approach path;	PF	
	(iv)	operates controls smooth and coordinated;	PF	
	(v)	performs speed reduction and flap extension;	PF/PNF	
	(vi)	performs relevant checklists;	PF/PNF	
	(vii)	initiates final descent;	PF	
	(viii)	achieves stabilised approach criteria;	PF	
	(ix)	ensures adherence to minima;	PF/PNF	
	(x)	initiates go-around if required;	PF	
	(xi)	masters transition to visual segment.	PF	
(3)		perform precision approach:		(S) or (U)
	(i)	performs ILS approach;	PF	
	(ii)	performs MLS approach.	PF	
(4)		perform non-precision approach:		(S) or (U)
	(i)	performs VOR approach;	PF	
	(ii)	performs NDB approach;	PF	
	(iii)	performs SRE approach;	PF	
	(iv)	performs GNSS approach;	PF	
	(v)	performs ILS loc approach;	PF	
	(vi)	performs ILS back beam approach.	PF	
(5)		perform approach with visual reference to ground:		(S) or (U)
	(i)	performs standard visual approach;	PF	
	(ii)	performs circling approach.	PF	
(6)		monitor the flight progress:		(S) or (U)
	(i)	insures navigation accuracy;	PF/PNF	
	(ii)	communicates with ATC and crew members;	PNF	
	(iii)	monitors fuel status.	PF/PNF	
(7)		perform systems operations and procedures:		
	(i)	monitors operation of all systems;	PF	
	(ii)	operates systems as required.	PF	
(8)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	

(ii)	interprets the abnormal condition;	PF/PNF	
(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(9)	perform missed approach and go-around:		(S) or (U)
(i)	initiates go-around procedure;	PF	
(ii)	navigates according to missed approach procedure;	PF	
(iii)	completes the relevant checklists;	PF/PNF	
(iv)	initiates approach or diversion after the go-around;	PF	
(v)	communicates with ATC and crew members.	PNF	
(10)	communicate with cabin crew, passengers and company:		(S) or (U)
(i)	communicates relevant information with cabin crew;	PF	
(ii)	communicates relevant information with company;	PF/PNF	
(iii)	makes passenger announcements when appropriate;	PF	
(iv)	initiates go-around procedure.	PF	

(m) Perform landing

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)	land the aircraft;		(S) or (U)
(i)	maintains a stabilised approach path during visual segment;	PF	
(ii)	recognises and acts on changing conditions for windshift or wind shear segment;	PF	
(iii)	initiates flare;	PF	
(iv)	controls thrust;	PF	
(v)	achieves touchdown in touchdown zone on centreline;	PF	
(vi)	lowers nose wheel;	PF	
(vii)	maintains centreline;	PF	
(viii)	performs after-touchdown procedures;	PF	
(ix)	makes use of appropriate braking and reverse thrust;	PF	

	(x)	vacates runway with taxi speed.	PF	
(3)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF	
	(ii)	operates systems as required.	PF	
(4)		manage abnormal and emergency situations:		(S) or (U)
	(i)	identifies the abnormal condition;	PF/PNF	
	(ii)	interprets the abnormal condition;	PF/PNF	
	(iii)	performs the procedure for the abnormal condition.	PF/PNF	

(n) Perform after landing and post flight operations

List of competency elements and performance criteria:

(1) demonstrate attitudes and behaviours appropriate to the safe conduct of flight, including recognising and managing potential threats and errors;

(2)		perform taxiing and parking:		(S) or (U)
	(i)	receives, checks and adheres to taxi clearance;	PNF	
	(ii)	taxies the aircraft including use of exterior lighting;	PF	
	(iii)	controls taxi speed;	PF/PNF	
	(iv)	maintains centreline;	PF	
	(v)	maintains look-out for conflicting traffic and obstacles;	PF	
	(vi)	identifies parking position;	PF/PNF	
	(vii)	complies with marshalling or stand guidance;	PF/PNF	
	(viii)	applies parking and engine shut down procedures;	PF	
	(ix)	completes with relevant checklists.	PF/PNF	
(3)		perform aircraft post-flight operations:		(S) or (U)
	(i)	communicates to ground personnel and crew;	PF	
	(ii)	completes all required flight documentation;	PF/PNF	
	(iii)	ensures securing of the aircraft;	PF	
	(iv)	conducts the debriefings.	PF	
(4)		perform systems operations and procedures:		(S) or (U)
	(i)	monitors operation of all systems;	PF/PNF	

(ii)	operates systems as required.	PF/PNF	
(5)	manage abnormal and emergency situations:		(S) or (U)
(i)	identifies the abnormal condition;	PF/PNF	
(ii)	interprets the abnormal condition;	PF/PNF	
(iii)	performs the procedure for the abnormal condition.	PF/PNF	
(6)	communicate with cabin crew, passengers and company:		(S) or (U)
(i)	communicates relevant information with cabin crew;	PF	
(ii)	communicates relevant information with company;	PF/PNF	
(iii)	makes passenger announcements when appropriate.	PF	

PRINCIPLES OF THREAT AND ERROR MANAGEMENT

(o) One model that explains the principles of threat and error management is the TEM model.

(1) The components of the TEM model:

There are three basic components in the TEM model, from the perspective of flight crews: threats, errors and undesired aircraft states. The model proposes that threats and errors are part of everyday aviation operations that must be managed by flight crews, since both threats and errors carry the potential to generate undesired aircraft states. Flight crews must also manage undesired aircraft states, since they carry the potential for unsafe outcomes. Undesired state management is an essential component of the TEM model, as important as threat and error management. Undesired aircraft state management largely represents the last opportunity to avoid an unsafe outcome and thus maintain safety margins in flight operations.

(2) Threats:

(i) Threats are defined as events or errors that occur beyond the influence of the flight crew, increase operational complexity, and which must be managed to maintain the margins of safety. During typical flight operations, flight crews have to manage various contextual complexities. Such complexities would include, for example, dealing with adverse meteorological conditions, airports surrounded by high mountains, congested airspace, aircraft malfunctions, errors committed by other people outside of the cockpit, such as air traffic controllers, flight attendants or maintenance workers, and so forth. The TEM model considers these complexities as threats because they all have the potential to negatively affect flight operations by reducing margins of safety;

(ii) Some threats can be anticipated, since they are expected or known to the flight crew. For example, flight crews can anticipate the consequences of a thunderstorm by briefing their response in advance, or prepare for a congested airport by making sure they keep a watchful eye on other aircraft as they execute the approach;

(iii) Some threats can occur unexpectedly, such as an in-flight aircraft malfunction that happens suddenly and without warning. In this case, flight crews must apply skills and knowledge acquired through training and operational experience;

(iv) Lastly, some threats may not be directly obvious to, or observable by, flight crews immersed in the operational context, and may need to be uncovered by safety analysis. These are considered latent threats. Examples of latent threats include equipment design issues, optical illusions, or shortened turn-around schedules;

(v) Regardless of whether threats are expected, unexpected, or latent, one measure of the effectiveness of a flight crew's ability to manage threats is whether threats are detected with the necessary anticipation to enable the flight crew to respond to them through deployment of appropriate countermeasures;

(vi) Threat management is a building block to error management and undesired aircraft state management. Although the threat-error linkage is not necessarily straightforward, and although it may not be always possible to establish a linear relationship, or one-to-one mapping between threats, errors and undesired states, archival data demonstrates that mismanaged threats are normally linked to flight crew errors, which in turn are often linked to undesired aircraft states. Threat management provides the most proactive option to maintain margins of safety in flight operations, by voiding safety-compromising situations at their roots. As threat managers, flight crews are the last line of defence to keep threats from impacting flight operations;

(vii) Table 1 presents examples of threats, grouped under two basic categories derived from the TEM Model. Environmental threats occur due to the environment in which flight operations take place. Some environmental threats can be planned for and some will arise spontaneously, but they all have to be managed by flight crews in real time. Organisational threats, on the other hand, can be controlled (for example removed or, at least, minimised) at source by aviation organisations. Organisational threats are usually latent in nature. Flight crews still remain the last line of defence, but there are earlier opportunities for these threats to be mitigated by aviation organisations themselves.

Environmental threats	Organisational threats
(A) weather: thunderstorms, turbulence, icing, wind shear, cross or tailwind, very low or high temperatures; (B) ATC: traffic congestion, ACAS RA/TA, ATC command, ATC error, ATC language difficulty, ATC non-standard phraseology, ATC runway change, ATIS	(A) operational pressure: delays, late arrivals or equipment changes; (B) aircraft: aircraft malfunction, automation event or anomaly, MEL/CDL; (C) cabin: flight attendant error, cabin event distraction,

communication or units of measurement (QFE/meters); (C) airport: contaminated or short runway; contaminated taxiway, lack of, confusing, faded signage, markings, birds, aids unserviceable, complex surface navigation procedures or airport constructions; (D) terrain: high ground, slope, lack of references or 'black hole'; (E) other: similar call-signs.	interruption, cabin door security; (D) maintenance: maintenance event or error; (E) ground: ground-handling event, de-icing or ground crew error; (F) dispatch: dispatch paperwork event or error; (G) documentation: manual error or chart error; (H) other: crew scheduling event.

Table 1. Examples of threats (list is not exhaustive)

(3) Errors:

(i) Errors are defined actions or inactions by the flight crew that lead to deviations from organisational or flight crew intentions or expectations. Unmanaged or mismanaged errors frequently lead to undesired aircraft states. Errors in the operational context thus tend to reduce the margins of safety and increase the probability of adverse events;

(ii) Errors can be spontaneous (for example without direct linkage to specific, obvious threats), linked to threats, or part of an error chain. Examples of errors would include the inability to maintain stabilised approach parameters, executing a wrong automation mode, failing to give a required callout, or misinterpreting an ATC clearance;

(iii) Regardless of the type of error, an error's effect on safety depends on whether the flight crew detects and responds to the error before it leads to an undesired aircraft state and to a potential unsafe outcome. This is why one of the objectives of TEM is to understand error management (for example detection and response), rather than to solely focus on error causality (for example causation and commission). From the safety perspective, operational errors that are timely detected and promptly responded to (for example properly managed), errors that do not lead to undesired aircraft states, do not reduce margins of safety in flight operations, and thus become operationally inconsequential. In addition to its safety value, proper error management represents an example of successful human performance, presenting both learning and training value;

(iv) Capturing how errors are managed is then as important, if not more, as capturing the prevalence of different types of error. It is of interest to capture if and when errors are detected and by whom, the response(s) upon detecting errors, and the outcome of errors. Some errors are quickly detected and resolved, thus becoming operationally inconsequential, while others go undetected or are mismanaged. A mismanaged error is defined as an error that is linked to or induces an additional error or undesired aircraft state;

(v) Table 2 presents examples of errors, grouped under three basic categories derived from the TEM model. In the TEM concept, errors have to be 'observable' and therefore, the TEM model uses the 'primary interaction' as the point of reference for defining the error categories;

(vi) The TEM model classifies errors based upon the primary interaction of the pilot or flight crew at the moment the error is committed. Thus, in order to be classified as aircraft handling error, the pilot or flight crew must be interacting with the aircraft (for example through its controls, automation or systems). In order to be classified as procedural error, the pilot or flight crew must be interacting with a procedure (for example checklists; SOPs; etc.). In order to be classified as communication error, the pilot or flight crew must be interacting with people (ATC, ground crew, other crewmembers, etc.);

(vii) Aircraft handling errors, procedural errors and communication errors may be unintentional or involve intentional non-compliance. Similarly, proficiency considerations (for example skill or knowledge deficiencies, training system deficiencies) may underlie all three categories of error. In order to keep the approach simple and avoid confusion, the TEM model does not consider intentional non-compliance and proficiency as separate categories of error, but rather as sub-sets of the three major categories of error.

Aircraft handling errors	(A) manual handling, flight controls: vertical, lateral or speed deviations, incorrect flaps or speed brakes, thrust reverser or power settings; (B) automation: incorrect altitude, speed, heading, auto throttle settings, incorrect mode executed or incorrect entries; (C) systems, radio, instruments: incorrect packs, incorrect anti-icing, incorrect altimeter, incorrect fuel switches settings, incorrect speed bug or incorrect radio frequency dialled; (D) ground navigation: attempting to turn down wrong taxiway or runway, taxi too fast, failure to hold short or missed taxiway or runway.
Procedural errors	(A) SOPs: failure to cross-verify automation inputs; (B) checklists: wrong challenge and response; items missed, checklist performed late or at the wrong time; (C) callouts: omitted or incorrect callouts; (D) briefings: omitted briefings; items missed; (E) documentation: wrong weight and balance, fuel information, ATIS, or

	clearance information recorded, misinterpreted items on paperwork; incorrect logbook entries or incorrect application of MEL procedures.
Communication errors	(A) crew to external: missed calls, misinterpretations of instructions, incorrect read-back, wrong clearance, taxiway, gate or runway communicated; (B) pilot to pilot: within crew miscommunication or mis-interpretation.

Table 2. Examples of errors (list is not exhaustive)

(4) Undesired aircraft states:

(i) Undesired aircraft states are flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety. Undesired aircraft states that result from ineffective threat or error management may lead to compromising situations and reduce margins of safety in flight operations. Often considered at the cusp of becoming an incident or accident, undesired aircraft states must be managed by flight crews;

(ii) Examples of undesired aircraft states would include lining up for the incorrect runway during approach to landing, exceeding ATC speed restrictions during an approach, or landing long on a short runway requiring maximum braking. Events such as equipment malfunctions or ATC controller errors can also reduce margins of safety in flight operations, but these would be considered threats;

(iii) Undesired states can be managed effectively, restoring margins of safety, or flight crew response(s) can induce an additional error, incident, or accident;

(iv) Table 3 presents examples of undesired aircraft states, grouped under three basic categories derived from the TEM model;

Aircraft handling	(A) aircraft control (attitude); (B) vertical, lateral or speed deviations; (C) unnecessary weather penetration; (D) unauthorised airspace penetration; (E) operation outside aircraft limitations; (F) unstable approach; (G) continued landing after unstable approach;

	(H) long, floated, firm or off-centreline landing.
Ground navigation	(A) proceeding towards wrong taxiway or runway; (B) Wrong taxiway, ramp, gate or hold spot.
Incorrect aircraft configurations	(A) incorrect systems configuration; (B) incorrect flight controls configuration; (C) incorrect automation configuration; (D) incorrect engine configuration; (E) incorrect weight and balance configuration.

Table 3. Examples of undesired aircraft states (list is not exhaustive)

(v) An important learning and training point for flight crews is the timely switching from error management to undesired aircraft state management. An example would be as follows: a flight crew selects a wrong approach in the FMC. The flight crew subsequently identifies the error during a cross-check prior to the FAF. However, instead of using a basic mode (for example heading) or manually flying the desired track, both flight crew members become involved in attempting to reprogram the correct approach prior to reaching the FAF. As a result, the aircraft 'stitches' through the localiser, descends late, and goes into an unstable approach. This would be an example of the flight crew getting 'locked in' to error management, rather than switching to undesired aircraft state management. The use of the TEM model assists in educating flight crews that, when the aircraft is in an undesired state, the basic task of the flight crew is undesired aircraft state management instead of error management. It also illustrates how easy it is to get locked in to the error management phase;

(vi) Also from a learning and training perspective, it is important to establish a clear differentiation between undesired aircraft states and outcomes. Undesired aircraft states are transitional states between a normal operational state (for example a stabilised approach) and an outcome. Outcomes, on the other hand, are end states, most notably, reportable occurrences (for example incidents and accidents). An example would be as follows: a stabilised approach (normal operational state) turns into an unstabilised approach (undesired aircraft state) that results in a runway excursion (outcome);

(vii) The training and remedial implications of this differentiation are of significance. While at the undesired aircraft state stage, the flight crew has the possibility, through appropriate TEM, of recovering the situation, returning to a normal operational state, thus restoring margins of safety. Once the undesired aircraft state becomes an outcome, recovery of the situation, return to a normal operational state, and restoration of margins of safety is not possible.

(5) Countermeasures:

(i) Flight crews must, as part of the normal discharge of their operational duties, employ countermeasures to keep threats, errors and undesired aircraft states from reducing margins of safety in flight operations. Examples of countermeasures would include checklists, briefings, call-outs and SOPs, as well as personal strategies and tactics. Flight crews dedicate significant amounts of time and energies to the application of countermeasures to ensure margins of safety during flight operations. Empirical observations during training and checking suggest that as much as 70 % of flight crew activities may be countermeasures-related activities.

(ii) All countermeasures are necessarily flight crew actions. However, some countermeasures to threats, errors and undesired aircraft states that flight crews employ build upon 'hard' resources provided by the aviation system. These resources are already in place in the system before flight crews report for duty, and are therefore considered as systemic-based countermeasures. The following would be examples of 'hard' resources that flight crews employ as systemic-based countermeasures:

(A) ACAS;

(B) TAWS;

(C) SOPs;

(D) checklists;

(E) briefings;

(F) training;

(G) etc.

(iii) Other countermeasures are more directly related to the human contribution to the safety of flight operations. These are personal strategies and tactics, individual and team countermeasures that typically include canvassed skills, knowledge and attitudes developed by human performance training, most notably, by CRM training. There are basically three categories of individual and team countermeasures:

(A) planning countermeasures: essential for managing anticipated and unexpected threats;

(B) execution countermeasures: essential for error detection and error response;

(C) review countermeasures: essential for managing the changing conditions of a flight.

(iv) Enhanced TEM is the product of the combined use of systemic-based and individual and team countermeasures. Table 4 presents detailed examples of individual and team countermeasures. Further guidance on countermeasures can be found in the sample assessment guides for terminal training objectives (PANS-TRG, Chapter 3, Attachment B) as well as in the ICAO manual, Line Operations Safety Audit (LOSA) (Doc 9803).

Planning countermeasures		
SOP briefing	The required briefing was interactive and operationally thorough	(A) Concise, not rushed, and met SOP requirements; (B) Bottom lines were established
Plans stated	Operational plans and decisions were communicated and acknowledged	Shared understanding about plans: 'Everybody on the same page'
Workload assignment	Roles and responsibilities were defined for normal and non-normal situations	Workload assignments were communicated and acknowledged
Contingency management	Crew members developed effective strategies to manage threats to safety	(A) Threats and their consequences were anticipated; (B) Used all available resources to manage threats
Execution countermeasures		
Monitor and cross-check	Crew members actively monitored and cross-checked systems and other crew members	Aircraft position, settings, and crew actions were verified
Workload management	Operational tasks were prioritised and properly managed to handle primary flight duties	(A) Avoided task fixation; (B) Did not allow work overload
Automation management	Automation was properly managed to balance situational and workload requirements	(A) Automation setup was briefed to other members (B) Effective recovery techniques from automation anomalies

Review countermeasures		
Evaluation and modification of plans	Existing plans were reviewed and modified when necessary	Crew decisions and actions were openly analysed to make sure the existing plan was the best plan
Inquiry	Crew members asked questions to investigate and/or clarify current plans of action	Crew members not afraid to express a lack of knowledge: 'Nothing taken for granted' attitude
Assertiveness	Crew members stated critical information or solutions with appropriate persistence	Crew members spoke up without hesitation

Table 4. Examples of individual and team countermeasures

AMC1 to Appendix 6 Modular training course for the IR

ALL MODULAR FLYING TRAINING COURSES FOR THE IR, EXCEPT COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(a) The theoretical knowledge instruction may be given at an ATO conducting theoretical knowledge instruction only, in which case the HT of that organisation should supervise that part of the course.

(b) The 150 hours of theoretical knowledge instruction can include classroom work, interactive video, slide or tape presentation, learning carrels, computer-based training, and other media as approved by the competent authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course.

AMC2 to Appendix 6 Modular training course for the IR

SECTION A IR(A) - MODULAR FLYING TRAINING COURSE

Basic Instrument Flight Module Training Course

(a) This 10 hours module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitude recovery.

(b) All exercises may be performed in an FNPT I or II or an FFS, for a maximum of 5 hours. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(c) A BITD may be used for the exercises 1, 2, 3, 4, 6, and 8.

(d) The use of the BITD is subject to the following:

(1) the training should be complemented by exercises on an aeroplane;

(2) the record of the parameters of the flight must be available;

(3) an FI(A) or IRI(A) should conduct the instruction.

EXERCISES

(e) Exercise 1:

(1) basic instrument flying without external visual cues; — 0:30 hours

(2) horizontal flight;
power changes for
acceleration or deceleration;

(3) maintaining straight and level flight;

(4) turns in level flight with 15 ° and 25 ° bank, left and right;

(5) roll-out onto predetermined headings.

(f) Exercise 2:

(1) repetition of exercise 1; — 0:45 hours

(2) additionally climbing, descending, maintaining heading and speed, transition to horizontal flight;

(3) climbing and descending turns.

(g) Exercise 3:

Instrument pattern: — 0:45 hours

(1) start exercise, decelerate

to approach speed, flaps into approach configuration;

(2) initiate standard turn (left or right);

(3) roll out on opposite heading, maintain new heading for 1 minute;

(4) standard turn, gear down, descend 500 ft/min;

(4) roll out on initial heading, maintain descent (500 ft/min) and new heading for 1 minute;

(5) transition to horizontal flight, 1000 ft below initial flight level;

(6) initiate go-around;

(7) climb at best rate of climb speed.

(h) Exercise 4:

Repetition of exercise 1 and steep turns with 45° bank; recovery from unusual attitudes.	0:45 hours

(i) Exercise 5:

Repetition of exercise 4.	0:45 hours

(j) Exercise 6:

(1) radio navigation using VOR, NDB or, if available, VDF; (2) interception of predetermined QDM, QDR.	0:45 hours

(k) Exercise 7:

Repetition of exercise 1 and recovery from unusual attitudes.	0:45 hours

(l) Exercise 8:

(1) Repetition of exercise 1; 0:45 hours

(2) turns, level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.

(m) Exercise 9:

Recognition of, and recovery from, incipient and full stalls. 0:45 hours

(n) Exercise 10: Repetition of exercises 6, 8 and 9. 3:30 hours

Certificate of Completion of Basic instrument Flight Module

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

Pilot's last name(s):		First name(s):		
Type of licence:		Number:		State:
Flight training hours performed on SE aeroplane:		OR	Flight training hours performed on ME aeroplane:	
Flight training hours performed in an FSTD (maximum 5 hours):				
	Signature of applicant:			

The satisfactory completion of basic instrument flight module according to requirements is certified below:

TRAINING			
Basic instrument flight module training received during period:			
from:	to:	at:	ATO
Location and date:		Signature of head of training:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

AMC3 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(a) THEORETICAL KNOWLEDGE INSTRUCTION

(1) The theoretical knowledge instruction may be given at an approved training organisation conducting theoretical knowledge instruction only, in which case the Head of Training of that organisation should supervise that part of the course.

(2) The required theoretical knowledge instruction for the IR following the competency-based route may contain computer-based training, e-learning elements, interactive video, slide/tape presentation, learning carrels and other media as approved by the authority, in suitable proportions. Approved distance learning (correspondence) courses may also be offered as part of the course. The minimum amount of classroom teaching has to be provided as required by ORA.ATO.305.

(b) THEORETICAL KNOWLEDGE EXAMINATION

The applicant for the IR following the competency-based training route should pass an examination to demonstrate a level of theoretical knowledge appropriate to the privileges granted in the subjects further detailed in FCL.615(b). The number of questions per subject, the distribution of questions and the time allocated to each subject is detailed in AMC2 ARA.FCL.300(b).

AMC4 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

FLYING TRAINING

(a) The instrument flight instruction outside an ATO provided by an IRI(A) or an FI(A) holding the privilege to provide training for the IR in accordance with Appendix 6 Section Aa (6)(a)(i)(A) may consist of instrument flight time under instruction or instrument ground time or a combination thereof.

TRAINING AIRCRAFT

(b) The aeroplane used for the instrument flight training provided outside an ATO by an IRI(A) or FI(A) should be:

(1) fitted with primary flight controls that are instantly accessible by both the student and the instructor (for example dual flight controls or a centre control stick). Swing-over flight controls should not be used; and

(2) suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required.

(c) The FSTD used for the instrument flight instruction provided outside an ATO by an IRI(A) or FI(A) should be suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required

AMC5 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(6)(a)(i)(B); (6)(b)(i)(B)

PRIOR EXPERIENCE OF FLIGHT TIME UNDER IFR AS PIC

A rating giving privileges to fly under IFR and in IMC referred to in (6)(a)(i)(B) and (6)(b)(i)(B) may be any of the following:

(a) an EIR rating issued by a competent authority of a Member State; or

(b) a national instrument rating issued by a Member State prior to the application of Commission Regulation (EU) No 1178/2011; or

(c) an instrument rating issued in compliance with the requirements of Annex 1 to the Chicago Convention by a third country; or

(d) an authorisation issued by a Member State under Article 4(8) of Commission Regulation (EU) No 1178/2011.

The amount of credit given should not exceed the amount of hours completed as instrument flight time.

AMC6 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE

(6)(a)(ii); (6)(b)(ii)

PRIOR INSTRUMENT FLIGHT TIME UNDER INSTRUCTION

Prior instrument flight time under instruction on aeroplanes, as referred in (6)(a)(ii) and (6)(b)(ii), may be instrument flight time completed for the issue of:

(a) an EIR rating issued by a competent authority of a Member State; or

(b) a national instrument rating prior to the application of Commission Regulation (EU) No 1178/2011; or

(c) an instrument rating in compliance with the requirements of Annex 1 to the Chicago Convention by a third country; or

(d) an authorisation issued by a Member State under Article 4(8) of Commission Regulation (EU) No 1178/2011.

AMC7 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (6)(c); (6)(d)
PRE-ENTRY ASSESSMENT AND TRAINING RECORD
(a) PRE-ENTRY ASSESSMENT
The assessment to establish the amount of training to be credited and to identify the training needs should be based on the training syllabus established in Appendix 6 Aa.
(b) TRAINING RECORD
(1) Before initiating the assessment the applicant should provide to an ATO a training record containing the details of the previous flight instruction provided by the IRI(A) or the FI(A). This training record should at least specify the aircraft type and registration used for the training, the number of flights and the total amount of instrument time under instruction. It should also specify all the exercises completed during the training by using the syllabus contained in Appendix 6 Aa.
(2) The instructor having provided the training should keep the training records containing all the details of the flight training given for a period of at least 5 years after the completion of the training.

AMC8 to Appendix 6 Modular training courses for the IR

SECTION Aa IR(A) – COMPETENCY-BASED MODULAR FLYING TRAINING COURSE (8)
In order to be credited in full towards the multi-engine IR(A) training course requirements, the applicant should
(a) hold a multi-engine IR(A), issued in accordance with the requirements of Annex 1 to the Chicago Convention by a third country;
(b) have the minimum experience required in Appendix 6 Aa paragraph 8(c), of which at least 15 hours should be completed in a multi-engine aeroplane.

AMC9 to Appendix 6 Modular training courses for the IR

AIRSHIPS

Basic Instrument Flight Module Training Course

(a) This 10 hours module is focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitude recovery.

(b) All exercises may be performed in an FNPT I or II or an FFS, for a maximum of 5 hours. If instrument flight training is in VMC, a suitable means of simulating IMC for the student should be used.

(c) A BITD may be used for the exercises 1, 2, 3, 4, 6 and 8.

(d) The use of the BITD is subject to the following:

(1) the training should be complemented by exercises on an airship;

(2) the record of the parameters of the flight must be available;

(3) an FI(As) or IRI(As) should conduct the instruction.

EXERCISES

(e) Exercise 1:

(1) basic instrument flying without 0:30 hours

external visual cues;
(2) horizontal flight;
(3) maintaining straight and level flight;
(4) turns in level flight, left and right;
(5) rollout onto predetermined headings.

(f) Exercise 2:

(1) Repetition of exercise 1; additionally climbing and descending — 0:45 hours
(2) maintaining heading and speed;
(3) transition to horizontal flight;
(4) climbing and descending turns.

(g) Exercise 3:

Instrument pattern: — 0:45 hours

(1) start exercise, decelerate to approach speed, approach configuration;
(2) initiate standard turn (left or right);
(3) rollout on opposite heading, maintain new heading for 1 minute;
(4) standard turn, descend with given rate (for example 500 ft/min);
(5) rollout on initial heading, maintain descent (for example 500 ft/min) and new heading for 1 minute;
(6) transition to horizontal flight (for example 1000 ft below initial level);
(7) initiate go-around;
(8) climb at best rate of climb speed.

(h) Exercise 4:

(1) repetition of exercise 1; 0:45 hours

(2) recovery from unusual attitudes.

(i) Exercise 5

Repetition of exercise 4. 0:45 hours

(j) Exercise 6

(1) radio navigation using VOR, NDB or, if available, VDF; 0:45 hours

(2) interception of predetermined QDM, QDR.

(k) Exercise 7

(1) repetition of exercise 1; 0:45 hours

(2) recovery from unusual attitudes.

(l) Exercise 8

(1) repetition of exercise 1; 0:45 hours

(2) turns, level change and recovery from unusual attitudes with simulated failure of the artificial horizon or directional gyro.

(m) Exercise 9

Repetition of exercises (6) and (8). 4:15 hours

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

CERTIFICATE OF COMPLETION OF BASIC INSTRUMENT FLIGHT MODULE

Pilot’s last name(s):		First name(s):	
Type of licence:		Number:	State:

Flight training hours performed on airship:		
Flight training hours performed in an FSTD (maximum 5 hours):		
	Signature of applicant:	

The satisfactory completion of basic instrument flight module according to requirements is certified below:

TRAINING			
Basic instrument flight module training received during period:			
from:	to:	at:	ATO
Location and date:		Signature of head of training:	
Type and number of licence and state of issue:		Name(s) in capital letters of authorised instructor:	

GM1 to Appendix 7 IR skill test

To the skill test, an ME centreline thrust aeroplane is considered an SE aeroplane.

AMC1 to Appendix 7 IR skill test

LAPL, BPL, SPL, PPL, CPL, IR SKILL TEST AND PROFICIENCY CHECK APPLICATION AND REPORT FORM

APPLICATION AND REPORT FORM LAPL, BPL, SPL, PPL, CPL, IR SKILL TEST AND PROFICIENCY CHECK			
Applicant's last name(s):			
Applicant's first name(s):			**LAPL: A ☐ H ☐ B ☐ S ☐**
Signature of applicant:			**BPL: ☐ SPL: ☐**
Type of licence*:			**PPL: A ☐ H ☐ As ☐**
Licence number*:			**CPL: A ☐H ☐ As ☐**
State:			**IR: A ☐ H ☐ As ☐**
1	**Details of the flight**		
Group, class, type of aircraft:		**Registration:**	
Aerodrome or site:	**Take-off time:**	**Landing time:**	**Flight time:**
			Total flight time:
2	**Result of the test**		
Skill test details:			
Pass ☐	**Fail ☐**	**Partial pass ☐**	
3	**Remarks**		
Location and date:			
Examiner's certificate number *:		**Type and number of licence:**	
Signature of examiner:		**Name(s) in capital letters:**	

***if applicable**

AMC1 to Appendix 9 Training, skill test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

APPLICATION AND REPORT FORM

If applicable, this form is also the certificate of completion of the type rating course for ZFTT.

APPLICATION AND REPORT FORM ATPL, MPL, TYPE RATING, TRAINING, SKILL TEST AND PROFICIENCY CHECK AEROPLANES (A) AND HELICOPTERS (H)			
Applicant's last name(s):	**Aircraft:**	**SE-SP: A ☐ H ☐**	**ME-SP: A ☐ H ☐**
Applicant's first name(s):		**SE-MP: A ☐ H ☐**	**ME-MP: A ☐ H ☐**
Signature of applicant:	**Operations:**	**SP ☐**	**MP ☐**
Type of licence held:	**Checklist:**	**Training record: ☐**	**Type rating: ☐**
Licence number:		**Skill test: ☐**	**Class rating: ☐**
		IR: ☐	
State of licence issue:		**Proficiency check: ☐**	**ATPL: ☐ MPL: ☐**

1	**Theoretical training for the issue of a type or class rating performed during period**		
From:	**To:**	**At:**	
Mark obtained:	**% (Pass mark 75%):**	**Type and number of licence:**	
Signature of HT:		**Name(s) in capital letters:**	
2	**FSTD**		
FSTD (aircraft type):	**Three or more axes:Yes ☐ No ☐**	**Ready for service and used:**	
FSTD manufacturer:	**Motion or system:**	**Visual aid: Yes ☐ No ☐**	
FSTD operator:		**FSTD ID code:**	
Total training time at the controls:		**Instrument approaches at aerodromes to a decision altitude or height of:**	
Location, date and time:		**Type and number of licence:**	
Type rating instructor ☐ Class rating instructor ☐ .... instructor ☐			
Signature of instructor:		**Name(s) in capital letters:**	
3	**Flight training: in the aircraft ☐ in the FSTD (for ZFTT) ☐**		
Type of aircraft:	**Registration:**	**Flight time at the controls:**	
Take-offs:	**Landings:**	**Training aerodromes or sites (take-offs, approaches and landings):**	
Take-off time:		**Landing time:**	
Location and date:		**Type and number of licence held:**	
Type rating instructor ☐ Class rating instructor ☐			

Signature of instructor:			**Name(s) in capital letters:**
4	**Skill test ☐ Proficiency check ☐**		
Skill test and proficiency check details:			
Aerodrome or site:			**Total flight time:**
Take-off time:			**Landing time:**
Pass ☐		**Fail ☐**	**Reason(s) why, if failed:**
Location and date:			**SIM or aircraft registration:**
Examiner's certificate number (if applicable):			**Type and number of licence:**
Signature of examiner:			**Name(s) in capital letters:**

AMC2 to Appendix 9 Training, skill test and proficiency check for MPL, ATPL, type and class ratings, and proficiency check for IRs

TRAINING, SKILL TEST AND PROFICIENCY CHECK: SP AEROPLANES

Section 3.B of the training and skill test and proficiency check content for SP aeroplanes included in Appendix 9.B should include training on a circling approach, after an IFR approach.

PART-MED

Initial issue

15 December 2011

AMC and GM to Annex IV

(PART-MED)

SUBPART A-General requirements

Section 1 - General

AMC1 MED.A.015 Medical confidentiality

To ensure medical confidentiality, all medical reports and records should be securely held with accessibility restricted to personnel authorised by the medical assessor.

AMC1 MED.A.020 Decrease in medical fitness

If in any doubt about their fitness to fly, use of medication or treatment:

(a) holders of class 1 or class 2 medical certificates should seek the advice of an AeMC or AME;

(b) holders of LAPL medical certificates should seek the advice of an AeMC, AME, or of the GMP who issued the holder's medical certificate;

(c) suspension of exercise of privileges: holders of a medical certificate should seek the advice of an AeMC or AME when they have been suffering from any illness involving incapacity to function as a member of the flight crew for a period of at least 21 days.

AMC1 MED.A.025 Obligations of AeMC, AME, GMP and OHMP

(a) The report required in MED.A.025 (b)(4) should detail the results of the examination and the evaluation of the findings with regard to medical fitness.

(b) The report may be submitted in electronic format, but adequate identification of the examiner should be ensured.

(c) If the medical examination is carried out by two or more AMEs or GMPs, only one of them should be responsible for coordinating the results of the examination, evaluating the findings with regard to medical fitness, and signing the report.

Section 2 - Requirements for medical certificates

AMC1 MED.A.030 Medical certificates

(a) A class 1 medical certificate includes the privileges and validities of class 2 and LAPL medical certificates.

(b) A class 2 medical certificate includes the privileges and validities of a LAPL medical certificate.

AMC1 MED.A.035 Application for a medical certificate

When applicants do not present a current or previous medical certificate to the AeMC, AME or GMP prior to the relevant examinations, the AeMC, AME or GMP should not issue the medical certificate unless relevant information is received from the licensing authority.

AMC1 MED.A.045 Validity, revalidation and renewal of medical certificates

The validity period of a medical certificate (including any associated examination or special investigation) is determined by the age of the applicant at the date of the medical examination.

Subpart B - Specific requirements for class 1, class 2 and LAPL medical certificates

AMC for class 1, class 2 and LAPL medical certificates

Section 1 - General

AMC1 MED.B.001 Limitations to class 1, class 2 and LAPL medical certificates

(a) An AeMC or AME may refer the decision on fitness of the applicant to the licensing authority in borderline cases or where fitness is in doubt.

(b) In cases where a fit assessment can only be considered with a limitation, the AeMC, AME or the licensing authority should evaluate the medical condition of the applicant in consultation with flight operations and other experts, if necessary.

(c) Limitation codes:

	Code	Limitation
1	TML	restriction of the period of validity of the medical certificate
2	VDL	correction for defective distant vision
3	VML	correction for defective distant, intermediate and near vision
4	VNL	correction for defective near vision
5	CCL	correction by means of contact lenses only
6	VCL	valid by day only
7	HAL	valid only when hearing aids are worn
8	APL	valid only with approved prosthesis
9	OCL	valid only as co-pilot
10	OPL	valid only without passengers (PPL and LAPL only)
11	SSL	special restriction as specified
12	OAL	restricted to demonstrated aircraft type
13	AHL	valid only with approved hand controls
14	SIC	specific regular medical examination(s) - contact licensing authority
15	RXO	specialist ophthalmological examinations

(d) Entry of limitations

(1) Limitations 1 to 4 may be imposed by an AME or an AeMC.

(2) Limitations 5 to 15 should only be imposed:

(i) for class 1 medical certificates by the licensing authority;

(ii) for class 2 medical certificates by the AME or AeMC in consultation with the licensing authority;

(iii) for LAPL medical certificates by an AME or AeMC.

(e) Removal of limitations

(1) For class 1 medical certificates, all limitations should only be removed by the licensing authority.

(2) For class 2 medical certificates, limitations may be removed by the licensing authority or by an AeMC or AME in consultation with the licensing authority.

(3) For LAPL medical certificates, limitations may be removed by an AeMC or AME.

GM1 MED.B.001 Limitation codes

TML Time limitation

The period of validity of the medical certificate is limited to the duration as shown on the medical certificate. This period of validity commences on the date of the medical examination. Any period of validity remaining on the previous medical certificate is no longer valid. The pilot should present him/herself for re-examination when advised and should follow any medical recommendations.

VDL Wear corrective lenses and carry a spare set of spectacles

Correction for defective distant vision: whilst exercising the privileges of the licence, the pilot should wear spectacles or contact lenses that correct for defective distant vision as examined and approved by the AME. Contact lenses may not be worn until cleared to do so by the AME. If contact lenses are worn, a spare set of spectacles, approved by the AME, should be carried.

VML Wear multifocal spectacles and carry a spare set of spectacles

Correction for defective distant, intermediate and near vision: whilst exercising the privileges of the licence, the pilot should wear spectacles that correct for defective distant, intermediate and near vision as examined and approved by the AME. Contact lenses or full frame spectacles, when either correct for near vision only, may not be worn.

VNL Have available corrective spectacles and carry a spare set of spectacles

Correction for defective near vision: whilst exercising the privileges of the licence, the pilot should have readily available spectacles that correct for defective near vision as examined and approved by the AME. Contact lenses or full frame spectacles, when either correct for near vision only, may not be worn.

VCL Valid by day only

The limitation allows private pilots with varying degrees of colour deficiency to exercise the privileges of their licence by daytime only. Applicable to class 2 medical certificates only.

OML Valid only as or with qualified co-pilot

This applies to crew members who do not meet the medical requirements for single crew operations, but are fit for multi-crew operations. Applicable to class 1 medical certificates only.

OCL Valid only as co-pilot

This limitation is a further extension of the OML limitation and is applied when, for some well defined medical reason, the pilot is assessed as safe to operate in a co-pilot role but not in command. Applicable to class 1 medical certificates only.

OPL Valid only without passengers

This limitation may be considered when a pilot with a musculoskeletal problem, or some other medical condition, may involve an increased element of risk to flight safety which might be acceptable to the pilot but which is not acceptable for the carriage of passengers. Applicable to class 2 and LAPL medical certificates only.

OSL Valid only with safety pilot and in aircraft with dual controls

The safety pilot is qualified as PIC on the class/type of aircraft and rated for the flight conditions. He/she occupies a control seat, is aware of the type(s) of possible incapacity that the pilot whose medical certificate has been issued with this limitation may suffer and is prepared to take over the aircraft controls during flight. Applicable to class 2 and LAPL medical certificates only.

OAL Restricted to demonstrated aircraft type

This limitation may apply to a pilot who has a limb deficiency or some other anatomical problem which had been shown by a medical flight test or flight simulator testing to be acceptable but to require a restriction to a specific type of aircraft.

SIC Specific regular medical examination(s) contact licensing authority

This limitation requires the AME to contact the licensing authority before embarking upon renewal or recertification medical assessment. It is likely to concern a medical history of which the AME should be aware prior to undertaking the assessment.

RXO Specialist ophthalmological examinations

Specialist ophthalmological examinations are required for a significant reason. The limitation may be applied by an AME but should only be removed by the licensing authority.

Section 2 - Specific requirements for class 1 medical certificates

AMC1 MED.B.010 Cardiovascular system

(a) Examination

Exercise electrocardiography

An exercise ECG when required as part of a cardiovascular assessment should be symptom limited and completed to a minimum of Bruce Stage IV or equivalent.

(b) General

(1) Cardiovascular risk factor assessment

(i) Serum lipid estimation is case finding and significant abnormalities should require review, investigation and supervision by the AeMC or AME in consultation with the licensing authority.

(ii) An accumulation of risk factors (smoking, family history, lipid abnormalities, hypertension, etc.) should require cardiovascular evaluation by the AeMC or AME in consultation with the licensing authority.

(2) Cardiovascular assessment

(i) Reporting of resting and exercise electrocardiograms should be by the AME or an accredited specialist.

(ii) The extended cardiovascular assessment should be undertaken at an AeMC or may be delegated to a cardiologist.

(c) Peripheral arterial disease

If there is no significant functional impairment, a fit assessment may be considered by the licensing authority, provided:

(1) applicants without symptoms of coronary artery disease have reduced any vascular risk factors to an appropriate level;

(2) applicants should be on acceptable secondary prevention treatment;

(3) exercise electrocardiography is satisfactory. Further tests may be required which should show no evidence of myocardial ischaemia or significant coronary artery stenosis.

(d) Aortic aneurysm

(1) Applicants with an aneurysm of the infra-renal abdominal aorta may be assessed as fit with a multi-pilot limitation by the licensing authority. Follow-up by ultra-sound scans or other imaging techniques, as necessary, should be determined by the licensing authority.

(2) Applicants may be assessed as fit by the licensing authority after surgery for an infra-renal aortic aneurysm with a multi-pilot limitation at revalidation if the blood pressure and cardiovascular assessment are satisfactory. Regular cardiological review should be required.

(e) Cardiac valvular abnormalities

(1) Applicants with previously unrecognised cardiac murmurs should undergo evaluation by a cardiologist and assessment by the licensing authority. If considered significant, further investigation should include at least 2D Doppler echocardiography or equivalent imaging.

(2) Applicants with minor cardiac valvular abnormalities may be assessed as fit by the licensing authority. Applicants with significant abnormality of any of the heart valves should be assessed as unfit.

(3) Aortic valve disease

(i) Applicants with a bicuspid aortic valve may be assessed as fit if no other cardiac or aortic abnormality is demonstrated. Follow-up with echocardiography, as necessary, should be determined by the licensing authority.

(ii) Applicants with aortic stenosis require licensing authority review. Left ventricular function should be intact. A history of systemic embolism or significant dilatation of the thoracic aorta is disqualifying. Those with a mean pressure gradient of up to 20 mmHg may be assessed as fit. Those with mean pressure gradient above 20 mmHg but not greater than 40 mmHg may be assessed as fit with a multi-pilot limitation. A mean pressure gradient up to 50 mmHg may be acceptable. Follow-up with 2D Doppler echocardiography, as necessary, should be determined by the licensing authority. Alternative measurement techniques with equivalent ranges may be used.

(iii) Applicants with trivial aortic regurgitation may be assessed as fit. A greater degree of aortic regurgitation should require a multi-pilot limitation. There should be no demonstrable abnormality of the ascending aorta on 2D Doppler echocardiography. Follow-up, as necessary, should be determined by the licensing authority.

(4) Mitral valve disease

(i) Asymptomatic applicants with an isolated mid-systolic click due to mitral leaflet prolapse may be assessed as fit.

(ii) Applicants with rheumatic mitral stenosis should normally be assessed as unfit.

(iii) Applicants with uncomplicated minor regurgitation may be assessed as fit. Periodic cardiolological review should be determined by the licensing authority.

(iv) Applicants with uncomplicated moderate mitral regurgitation may be considered as fit with a multi-pilot limitation if the 2D Doppler echocardiogram demonstrates satisfactory left ventricular dimensions and satisfactory myocardial function is confirmed by exercise electrocardiography. Periodic cardiological review should be required, as determined by the licensing authority.

(v) Applicants with evidence of volume overloading of the left ventricle demonstrated by increased left ventricular end-diastolic diameter or evidence of systolic impairment should be assessed as unfit.

(f) Valvular surgery

Applicants with cardiac valve replacement/repair should be assessed as unfit. A fit assessment may be considered by the licensing authority.

(1) Aortic valvotomy should be disqualifying.

(2) Mitral leaflet repair for prolapse is compatible with a fit assessment, provided post-operative investigations reveal satisfactory left ventricular function without systolic or diastolic dilation and no more than minor mitral regurgitation.

(3) Asymptomatic applicants with a tissue valve or with a mechanical valve who, at least 6 months following surgery, are taking no cardioactive medication may be considered for a fit assessment with a multi-pilot limitation by the licensing authority. Investigations which demonstrate normal valvular and ventricular configuration and function should have been completed as demonstrated by:

(i) a satisfactory symptom limited exercise ECG. Myocardial perfusion imaging/stress echocardiography should be required if the exercise ECG is abnormal or any coronary artery disease has been demonstrated;

(ii) a 2D Doppler echocardiogram showing no significant selective chamber enlargement, a tissue valve with minimal structural alteration and a normal Doppler blood flow, and no structural or functional abnormality of the other heart valves. Left ventricular fractional shortening should be normal.

Follow-up with exercise ECG and 2D echocardiography, as necessary, should be determined by the licensing authority.

(4) Where anticoagulation is needed after valvular surgery, a fit assessment with a multi-pilot limitation may be considered after review by the licensing authority. The review should show that the anticoagulation is stable. Anticoagulation should be considered stable if, within the last 6 months, at least 5 INR values are documented, of which at least 4 are within the INR target range.

(g) Thromboembolic disorders

Arterial or venous thrombosis or pulmonary embolism are disqualifying whilst anticoagulation is being used as treatment. After 6 months of stable anticoagulation as prophylaxis, a fit assessment with multi-pilot limitation may be considered after review by the licensing authority. Anticoagulation should be considered stable if, within the last 6 months, at least 5 INR values are documented, of which at least 4 are within the INR target range. Pulmonary embolus should require full evaluation. Following cessation of anti-coagulant therapy, for any indication, applicants should require review by the licensing authority.

(h) Other cardiac disorders

(1) Applicants with a primary or secondary abnormality of the pericardium, myocardium or endocardium should be assessed as unfit. A fit assessment may be considered by the licensing authority following complete resolution and satisfactory cardiological evaluation which may include 2D Doppler echocardiography, exercise ECG and/or myocardial perfusion imaging/stress echocardiography and 24-hour ambulatory ECG. Coronary angiography may be indicated. Frequent review and a multi-pilot limitation may be required after fit assessment.

(2) Applicants with a congenital abnormality of the heart, including those who have undergone surgical correction, should be assessed as unfit. Applicants with minor abnormalities that are functionally unimportant may be assessed as fit by the licensing authority following cardiological assessment. No cardioactive medication is acceptable. Investigations may include 2D Doppler echocardiography, exercise ECG and 24-hour ambulatory ECG. Regular cardiological review should be required.

(i) Syncope

(1) Applicants with a history of recurrent vasovagal syncope should be assessed as unfit. A fit assessment may be considered by the licensing authority after a 6-month period without recurrence provided cardiological evaluation is satisfactory. Such evaluation should include:

(i) a satisfactory symptom limited 12 lead exercise ECG to Bruce Stage IV or equivalent. If the exercise ECG is abnormal, myocardial perfusion imaging/stress echocardiography should be required;

(ii) a 2D Doppler echocardiogram showing neither significant selective chamber enlargement nor structural or functional abnormality of the heart, valves or myocardium;

(iii) a 24-hour ambulatory ECG recording showing no conduction disturbance, complex or sustained rhythm disturbance or evidence of myocardial ischaemia.

(2) A tilt test carried out to a standard protocol showing no evidence of vasomotor instability may be required.

(3) Neurological review should be required.

(4) A multi-pilot limitation should be required until a period of 5 years has elapsed without recurrence. The licensing authority may determine a shorter or longer period of multi-pilot limitation according to the individual circumstances of the case.

(5) Applicants who experienced loss of consciousness without significant warning should be assessed as unfit.

(j) Blood pressure

(1) The diagnosis of hypertension should require cardiovascular review to include potential vascular risk factors.

(2) Anti-hypertensive treatment should be agreed by the licensing authority. Acceptable medication may include:

(i) non-loop diuretic agents;

(ii) ACE inhibitors;

(iii) angiotensin II/AT1 blocking agents (sartans);

(iv) slow channel calcium blocking agents;

(v) certain (generally hydrophilic) beta-blocking agents.

(3) Following initiation of medication for the control of blood pressure, applicants should be re-assessed to verify that the treatment is compatible with the safe exercise of the privileges of the licence held.

(k) Coronary artery disease

(1) Chest pain of uncertain cause should require full investigation.

(2) In suspected asymptomatic coronary artery disease, exercise electrocardiography should be required. Further tests may be required, which should show no evidence of myocardial ischaemia or significant coronary artery stenosis.

(3) Evidence of exercise-induced myocardial ischaemia should be disqualifying.

(4) After an ischaemic cardiac event, including revascularisation, applicants without symptoms should have reduced any vascular risk factors to an appropriate level. Medication, when used to control cardiac symptoms, is not acceptable. All applicants should be on acceptable secondary prevention treatment.

(i) A coronary angiogram obtained around the time of, or during, the ischaemic myocardial event and a complete, detailed clinical report of the ischaemic event and of any operative procedures should be available to the licensing authority:

(A) there should be no stenosis more than 50 % in any major untreated vessel, in any vein or artery graft or at the site of an angioplasty/stent, except in a vessel subtending a myocardial infarction. More than two stenoses between 30 % and 50 % within the vascular tree should not be acceptable;

(B) the whole coronary vascular tree should be assessed as satisfactory by a cardiologist, and particular attention should be paid to multiple stenoses and/or multiple revascularisations;

(C) an untreated stenosis greater than 30 % in the left main or proximal left anterior descending coronary artery should not be acceptable.

(ii) At least 6 months from the ischaemic myocardial event, including revascularisation, the following investigations should be completed (equivalent tests may be substituted):

(A) an exercise ECG showing neither evidence of myocardial ischaemia nor rhythm or conduction disturbance;

(B) an echocardiogram showing satisfactory left ventricular function with no important abnormality of wall motion (such as dyskinesia or akinesia) and a left ventricular ejection fraction of 50 % or more;

(C) in cases of angioplasty/stenting, a myocardial perfusion scan or stress echocardiogram, which should show no evidence of reversible myocardial ischaemia. If there is any doubt about myocardial perfusion in other cases (infarction or bypass grafting) a perfusion scan should also be required;

(D) further investigations, such as a 24-hour ECG, may be necessary to assess the risk of any significant rhythm disturbance.

(iii) Follow-up should be annually (or more frequently, if necessary) to ensure that there is no deterioration of the cardiovascular status. It should include a review by a cardiologist, exercise ECG and cardiovascular risk assessment. Additional investigations may be required by the licensing authority.

(A) After coronary artery vein bypass grafting, a myocardial perfusion scan or equivalent test should be performed if there is any indication, and in all cases within 5 years from the procedure.

(B) In all cases, coronary angiography should be considered at any time if symptoms, signs or non-invasive tests indicate myocardial ischaemia.

(iv) Successful completion of the 6-month or subsequent review will allow a fit assessment with a multi-pilot limitation.

(l) Rhythm and conduction disturbances

(1) Any significant rhythm or conduction disturbance should require evaluation by a cardiologist and appropriate follow-up in the case of a fit assessment. Such evaluation should include:

(i) exercise ECG to the Bruce protocol or equivalent. Bruce stage 4 should be achieved and no significant abnormality of rhythm or conduction, or evidence of myocardial ischaemia should be demonstrated. Withdrawal of cardioactive medication prior to the test should normally be required;

(ii) 24-hour ambulatory ECG which should demonstrate no significant rhythm or conduction disturbance;

(iii) 2D Doppler echocardiogram which should show no significant selective chamber enlargement or significant structural or functional abnormality, and a left ventricular ejection fraction of at least 50 %.

Further evaluation may include (equivalent tests may be substituted):

(iv) 24-hour ECG recording repeated as necessary;

(v) electrophysiological study;

(vi) myocardial perfusion imaging;

(vii) cardiac magnetic resonance imaging (MRI);

(viii) coronary angiogram.

(2) Applicants with frequent or complex forms of supra ventricular or ventricular ectopic complexes require full cardiological evaluation.

(3) Ablation

Applicants who have undergone ablation therapy should be assessed as unfit. A fit assessment may be considered by the licensing authority following successful catheter ablation and should require a multi-pilot limitation for at least one year, unless an electrophysiological study, undertaken at a minimum of 2 months after the ablation, demonstrates satisfactory results. For those whose long-term outcome cannot be assured by invasive or non-invasive testing, an additional period with a multi-pilot limitation and/or observation may be necessary.

(4) Supraventricular arrhythmias

Applicants with significant disturbance of supraventricular rhythm, including sinoatrial dysfunction, whether intermittent or established, should be assessed as unfit. A fit assessment may be considered by the licensing authority if cardiological evaluation is satisfactory.

(i) Atrial fibrillation/flutter

(A) For initial applicants, a fit assessment should be limited to those with a single episode of arrhythmia which is considered by the licensing authority to be unlikely to recur.

(B) For revalidation, applicants may be assessed as fit if cardiological evaluation is satisfactory.

(ii) Applicants with asymptomatic sinus pauses up to 2.5 seconds on resting electrocardiography may be assessed as fit if exercise electrocardiography, echocardiography and 24-hour ambulatory ECG are satisfactory.

(iii) Symptomatic sino-atrial disease should be disqualifying.

(5) Mobitz type 2 atrio-ventricular block

Applicants with Mobitz type 2 AV block should require full cardiological evaluation and may be assessed as fit in the absence of distal conducting tissue disease.

(6) Complete right bundle branch block

Applicants with complete right bundle branch block should require cardiological evaluation on first presentation and subsequently:

(i) for initial applicants under age 40, a fit assessment may be considered by the licensing authority. Initial applicants over age 40 should demonstrate a period of stability of 12 months;

(ii) for revalidation, a fit assessment may be considered if the applicant is under age 40. A multi-pilot limitation should be applied for 12 months for those over age 40.

(7) Complete left bundle branch block

A fit assessment may be considered by the licensing authority:

(i) Initial applicants should demonstrate a 3-year period of stability.

(ii) For revalidation, after a 3-year period with a multi-pilot limitation applied, a fit assessment without multi-pilot limitation may be considered.

(iii) Investigation of the coronary arteries is necessary for applicants over age 40.

(8) Ventricular pre-excitation

A fit assessment may be considered by the licensing authority:

(i) Asymptomatic initial applicants with pre-excitation may be assessed as fit if an electrophysiological study, including adequate drug-induced autonomic stimulation reveals no inducible re-entry tachycardia and the existence of multiple pathways is excluded.

(ii) Asymptomatic applicants with pre-excitation may be assessed as fit at revalidation with a multi-pilot limitation.

(9) Pacemaker

Applicants with a subendocardial pacemaker should be assessed as unfit. A fit assessment may be considered at revalidation by the licensing authority no sooner than 3 months after insertion and should require:

(i) no other disqualifying condition;

(ii) a bipolar lead system, programmed in bipolar mode without automatic mode change of the device;

(iii) that the applicant is not pacemaker dependent;

(iv) regular follow-up, including a pacemaker check; and

(v) a multi-pilot limitation.

(10) QT prolongation

Prolongation of the QT interval on the ECG associated with symptoms should be disqualifying. Asymptomatic applicants require cardiological evaluation for a fit assessment and a multi-pilot limitation may be required.

AMC1 MED.B.015 Respiratory system

(a) Examination

(1) Spirometry

Spirometric examination is required for initial examination. An FEV1/FVC ratio less than 70 % at initial examination should require evaluation by a specialist in respiratory disease.

(2) Chest radiography

Posterior/anterior chest radiography may be required at initial, revalidation or renewal examinations when indicated on clinical or epidemiological grounds.

(b) Chronic obstructive airways disease

Applicants with chronic obstructive airways disease should be assessed as unfit. Applicants with only minor impairment of their pulmonary function may be assessed as fit.

(c) Asthma

Applicants with asthma requiring medication or experiencing recurrent attacks of asthma may be assessed as fit if the asthma is considered stable with satisfactory pulmonary function tests and medication is compatible with flight safety. Systemic steroids are disqualifying.

(d) Inflammatory disease

For applicants with active inflammatory disease of the respiratory system a fit assessment may be considered when the condition has resolved without sequelae and no medication is required.

(e) Sarcoidosis

(1) Applicants with active sarcoidosis should be assessed as unfit. Investigation should be undertaken with respect to the possibility of systemic, particularly cardiac, involvement. A fit assessment may be considered if no medication is required, and the disease is investigated and shown to be limited to hilar lymphadenopathy and inactive.

(2) Applicants with cardiac sarcoid should be assessed as unfit.

(f) Pneumothorax

(1) Applicants with a spontaneous pneumothorax should be assessed as unfit. A fit assessment may be considered if respiratory evaluation is satisfactory:

(i) 1 year following full recovery from a single spontaneous pneumothorax;

(ii) at revalidation, 6 weeks following full recovery from a single spontaneous pneumothorax, with a multi-pilot limitation;

(iii) following surgical intervention in the case of a recurrent pneumothorax provided there is satisfactory recovery.

(2) A recurrent spontaneous pneumothorax that has not been surgically treated is disqualifying.

(3) A fit assessment following full recovery from a traumatic pneumothorax as a result of an accident or injury may be acceptable once full absorption of the pneumothorax is demonstrated.

(g) Thoracic surgery

(1) Applicants requiring major thoracic surgery should be assessed as unfit for a minimum of 3 months following operation or until such time as the effects of the operation are no longer likely to interfere with the safe exercise of the privileges of the applicable licence(s).

(2) A fit assessment following lesser chest surgery may be considered by the licensing authority after satisfactory recovery and full respiratory evaluation.

(h) Sleep apnoea syndrome/sleep disorder

Applicants with unsatisfactorily treated sleep apnoea syndrome should be assessed as unfit.

AMC1 MED.B.020 Digestive system

(a) Oesophageal varices

Applicants with oesophageal varices should be assessed as unfit.

(b) Pancreatitis

Applicants with pancreatitis should be assessed as unfit pending assessment. A fit assessment may be considered if the cause (e.g. gallstone, other obstruction, medication) is removed.

(c) Gallstones

(1) Applicants with a single asymptomatic large gallstone discovered incidentally may be assessed as fit if not likely to cause incapacitation in flight.

(2) An applicant with asymptomatic multiple gallstones may be assessed as fit with a multi-pilot limitation.

(d) Inflammatory bowel disease

Applicants with an established diagnosis or history of chronic inflammatory bowel disease should be assessed as fit if the inflammatory bowel disease is in established remission and stable and that systemic steroids are not required for its control.

(e) Peptic ulceration

Applicants with peptic ulceration should be assessed as unfit pending full recovery and demonstrated healing.

(f) Abdominal surgery

(1) Abdominal surgery is disqualifying for a minimum of 3 months. An earlier fit assessment may be considered if recovery is complete, the applicant is asymptomatic and there is only a minimal risk of secondary complication or recurrence.

(2) Applicants who have undergone a surgical operation on the digestive tract or its adnexa, involving a total or partial excision or a diversion of any of these organs, should be assessed as unfit for a minimum period of 3 months or until such time as the effects of the operation are no longer likely to interfere with the safe exercise of the privileges of the applicable licence(s).

AMC1 MED.B.025 Metabolic and endocrine systems

(a) Metabolic, nutritional or endocrine dysfunction

Applicants with metabolic, nutritional or endocrine dysfunction may be assessed as fit if the condition is asymptomatic, clinically compensated and stable with or without replacement therapy, and regularly reviewed by an appropriate specialist.

(b) Obesity

Applicants with a Body Mass Index ≥ 35 may be assessed as fit only if the excess weight is not likely to interfere with the safe exercise of the applicable licence(s) and a satisfactory cardiovascular risk review has been undertaken.

(c) Addison's disease

Addison's disease is disqualifying. A fit assessment may be considered, provided that cortisone is carried and available for use whilst exercising the privileges of the licence(s). Applicants may be assessed as fit with a multi-pilot limitation.

(d) Gout

Applicants with acute gout should be assessed as unfit. A fit assessment may be considered once asymptomatic, after cessation of treatment or the condition is stabilised on anti-hyperuricaemic therapy.

(e) Thyroid dysfunction

Applicants with hyperthyroidism or hypothyroidism should be assessed as unfit. A fit assessment may be considered when a stable euthyroid state is attained.

(f) Abnormal glucose metabolism

Glycosuria and abnormal blood glucose levels require investigation. A fit assessment may be considered if normal glucose tolerance is demonstrated (low renal threshold) or impaired glucose tolerance without diabetic pathology is fully controlled by diet and regularly reviewed.

(g) Diabetes mellitus

Subject to good control of blood sugar with no hypoglycaemic episodes:

(1) applicants with diabetes mellitus not requiring medication may be assessed as fit;

(2) the use of antidiabetic medications that are not likely to cause hypoglycaemia may be acceptable for a fit assessment with a multi-pilot limitation.

AMC1 MED.B.030 Haematology

(a) Abnormal haemoglobin

Applicants with abnormal haemoglobin should be investigated.

(b) Anaemia

(1) Applicants with anaemia demonstrated by a reduced haemoglobin level or haematocrit less than 32 % should be assessed as unfit and require investigation. A fit assessment may be considered in cases where the primary cause has been treated (e.g. iron or B12 deficiency) and the haemoglobin or haematocrit has stabilised at a satisfactory level.

(2) Anaemia which is unamenable to treatment is disqualifying.

(c) Polycythaemia

Applicants with polycythaemia should be assessed as unfit and require investigation. A fit assessment with a multi-pilot limitation may be considered if the condition is stable and no associated pathology is demonstrated.

(d) Haemoglobinopathy

(1) Applicants with a haemoglobinopathy should be assessed as unfit. A fit assessment may be considered where minor thalassaemia or other haemoglobinopathy is diagnosed without a history of crises and where full functional capability is demonstrated. The haemoglobin level should be satisfactory.

(2) Applicants with sickle cell disease should be assessed as unfit.

(e) Coagulation disorders

Applicants with a coagulation disorder should be assessed as unfit. A fit assessment may be considered if there is no history of significant bleeding episodes.

(f) Haemorrhagic disorders

Applicants with a haemorrhagic disorder require investigation. A fit assessment with a multi-pilot limitation may be considered if there is no history of significant bleeding.

(g) Thrombo-embolic disorders

(1) Applicants with a thrombotic disorder require investigation. A fit assessment with a multi-pilot limitation may be considered if there is no history of significant clotting episodes.

(2) An arterial embolus is disqualifying.

(h) Disorders of the lymphatic system

Applicants with significant localised and generalised enlargement of the lymphatic glands and diseases of the blood should be assessed as unfit and require investigation. A fit assessment may be considered in cases of an acute infectious process which is fully recovered or Hodgkin's lymphoma or other lymphoid malignancy which has been treated and is in full remission.

(i) Leukaemia

(1) Applicants with acute leukaemia should be assessed as unfit. Once in established remission, applicants may be assessed as fit.

(2) Applicants with chronic leukaemia should be assessed as unfit. After a period of demonstrated stability a fit assessment may be considered.

(3) Applicants with a history of leukaemia should have no history of central nervous system involvement and no continuing side-effects from treatment of flight safety importance. Haemoglobin and platelet levels should be satisfactory. Regular follow-up is required.

(j) Splenomegaly

Applicants with splenomegaly should be assessed as unfit and require investigation. A fit assessment may be considered when the enlargement is minimal, stable and no associated pathology is demonstrated, or if the enlargement is minimal and associated with another acceptable condition.

AMC1 MED.B.035 Genitourinary system

(a) Abnormal urinalysis

Investigation is required if there is any abnormal finding on urinalysis.

(b) Renal disease

(1) Applicants presenting with any signs of renal disease should be assessed as unfit. A fit assessment may be considered if blood pressure is satisfactory and renal function is acceptable.

(2) The requirement for dialysis is disqualifying.

(c) Urinary calculi

(1) Applicants with an asymptomatic calculus or a history of renal colic require investigation.

(2) Applicants presenting with one or more urinary calculi should be assessed as unfit and require investigation.

(3) A fit assessment with a multi-pilot limitation may be considered whilst awaiting assessment or treatment.

(4) A fit assessment without multi-pilot limitation may be considered after successful treatment for a calculus.

(5) With residual calculi, a fit assessment with a multi-pilot limitation may be considered.

(d) Renal/urological surgery

(1) Applicants who have undergone a major surgical operation on the urinary tract or the urinary apparatus involving a total or partial excision or a diversion of any of its organs should be assessed as unfit for a minimum period of 3 months or until such time as the effects of the operation are no longer likely to cause incapacity in flight. After other urological surgery, a fit assessment may be considered if the applicant is completely asymptomatic and there is minimal risk of secondary complication or recurrence.

(2) An applicant with compensated nephrectomy without hypertension or uraemia may be considered for a fit assessment.

(3) Applicants who have undergone renal transplantation may be considered for a fit assessment if it is fully compensated and tolerated with only minimal immuno-suppressive therapy after at least 12 months. Applicants may be assessed as fit with a multi-pilot limitation.

(4) Applicants who have undergone total cystectomy may be considered for a fit assessment if there is satisfactory urinary function, no infection and no recurrence of primary pathology. Applicants may be assessed as fit with a multi-pilot limitation.

AMC1 MED.B.040 Infectious disease

(a) Infectious disease General

In cases of infectious disease, consideration should be given to a history of, or clinical signs indicating, underlying impairment of the immune system.

(b) Tuberculosis

Applicants with active tuberculosis should be assessed as unfit. A fit assessment may be considered following completion of therapy.

(c) Syphilis

Acute syphilis is disqualifying. A fit assessment may be considered in the case of those fully treated and recovered from the primary and secondary stages.

(d) HIV infection

(1) HIV positivity is disqualifying. A fit assessment with a multi-pilot limitation may be considered for individuals with stable, non-progressive disease. Frequent review is required.

(2) The occurrence of AIDS or AIDS-related complex is disqualifying.

(e) Infectious hepatitis

Infectious hepatitis is disqualifying. A fit assessment may be considered after full recovery.

AMC1 MED.B.045 Obstetrics and gynaecology

(a) Gynaecological surgery

An applicant who has undergone a major gynaecological operation should be assessed as unfit for a period of 3 months or until such time as the effects of the operation are not likely to interfere with the safe exercise of the privileges of the licence(s) if the holder is completely asymptomatic and there is only a minimal risk of secondary complication or recurrence.

(b) Severe menstrual disturbances

An applicant with a history of severe menstrual disturbances unamenable to treatment should be assessed as unfit.

(c) Pregnancy

(1) A pregnant licence holder may be assessed as fit with a multi-pilot limitation during the first 26 weeks of gestation, following review of the obstetric evaluation by the AeMC or AME who should inform the licensing authority.

(2) The AeMC or AME should provide written advice to the applicant and the supervising physician regarding potentially significant complications of pregnancy.

AMC1 MED.B.050 Musculoskeletal system

(a) An applicant with any significant sequela from disease, injury or congenital abnormality affecting the bones, joints, muscles or tendons with or without surgery requires full evaluation prior to a fit assessment.

(b) In cases of limb deficiency, a fit assessment may be considered following a satisfactory medical flight test or simulator testing.

(c) An applicant with inflammatory, infiltrative, traumatic or degenerative disease of the musculoskeletal system may be assessed as fit provided the condition is in remission and the applicant is taking no disqualifying medication and has satisfactorily completed a medical flight or simulator flight test. A limitation to specified aircraft type(s) may be required.

(d) Abnormal physique, including obesity, or muscular weakness may require medical flight or flight simulator testing. Particular attention should be paid to emergency procedures and evacuation. A limitation to specified aircraft type(s) may be required.

AMC1 MED.B.055 Psychiatry

(a) Psychotic disorder

A history, or the occurrence, of a functional psychotic disorder is disqualifying unless a cause can be unequivocally identified as one which is transient, has ceased and will not recur.

(b) Organic mental disorder

An organic mental disorder is disqualifying. Once the cause has been treated, an applicant may be assessed as fit following satisfactory psychiatric review.

(c) Psychotropic substances

Use or abuse of psychotropic substances likely to affect flight safety is disqualifying.

(d) Schizophrenia, schizotypal or delusional disorder

Applicants with an established schizophrenia, schizotypal or delusional disorder should only be considered for a fit assessment if the licensing authority concludes that the original diagnosis was inappropriate or inaccurate or, in the case of a single episode of delirium, provided that the applicant has suffered no permanent impairment.

(e) Mood disorder

An established mood disorder is disqualifying. After full recovery and after full consideration of an individual case a fit assessment may be considered, depending on the characteristics and gravity of the mood disorder. If a stable maintenance psychotropic medication is confirmed, a fit assessment should require a multi-pilot limitation.

(f) Neurotic, stress-related or somatoform disorder

Where there is suspicion or established evidence that an applicant has a neurotic, stress-related or somatoform disorder, the applicant should be referred for psychiatric opinion and advice.

(g) Personality or behavioural disorder

Where there is suspicion or established evidence that an applicant has a personality or behavioural disorder, the applicant should be referred for psychiatric opinion and advice.

(h) Disorders due to alcohol or other substance use

(1) Mental or behavioural disorders due to alcohol or other substance use, with or without dependency, are disqualifying.

(2) A fit assessment may be considered after a period of two years documented sobriety or freedom from substance use. At revalidation or renewal a fit assessment may be considered earlier with a multi-pilot limitation. Depending on the individual case, treatment and review may include:

(i) in-patient treatment of some weeks followed by:

(A) review by a psychiatric specialist; and

(B) ongoing review including blood testing and peer reports, which may be required indefinitely.

(i) Deliberate self-harm

A single self-destructive action or repeated acts of deliberate self-harm are disqualifying. A fit assessment may be considered after full consideration of an individual case and may require psychiatric or psychological review. Neuropsychological assessment may also be required.

AMC1 MED.B.060 Psychology

(a) Where there is suspicion or established evidence that an applicant has a psychological disorder, the applicant should be referred for psychological opinion and advice.

(b) Established evidence should be verifiable information from an identifiable source which evokes doubts concerning the mental fitness or personality of a particular individual. Sources for this information can be accidents or incidents, problems in training or proficiency checks, delinquency or knowledge relevant to the safe exercise of the privileges of the applicable licence.

(c) The psychological evaluation may include a collection of biographical data, the administration of aptitude as well as personality tests and psychological interview.

(d) The psychologist should submit a written report to the AME, AeMC or licensing authority as appropriate, detailing his/her opinion and recommendation.

AMC1 MED.B.065 Neurology

(a) Epilepsy

(1) A diagnosis of epilepsy is disqualifying, unless there is unequivocal evidence of a syndrome of benign childhood epilepsy associated with a very low risk of recurrence, and unless the applicant has been free of recurrence and off treatment for more than 10 years. One or more convulsive episodes after the age of 5 are disqualifying. In the case of an acute symptomatic seizure, which is considered to have a very low risk of recurrence, a fit assessment may be considered after neurological review.

(2) An applicant may be assessed as fit by the licensing authority with a multi-pilot limitation if:

(i) there is a history of a single afebrile epileptiform seizure;

(ii) there has been no recurrence after at least 10 years off treatment;

(iii) there is no evidence of continuing predisposition to epilepsy.

(b) Conditions with a high propensity for cerebral dysfunction

An applicant with a condition with a high propensity for cerebral dysfunction should be assessed as unfit. A fit assessment may be considered after full evaluation.

(c) Clinical EEG abnormalities

(1) Electroencephalography is required when indicated by the applicant’s history or on clinical grounds.

(2) Epileptiform paroxysmal EEG abnormalities and focal slow waves should be disqualifying.

(d) Neurological disease

Any stationary or progressive disease of the nervous system which has caused or is likely to cause a significant disability is disqualifying. However, in case of minor functional losses associated with stationary disease, a fit assessment may be considered after full evaluation.

(e) Episode of disturbance of consciousness

In the case of a single episode of disturbance of consciousness, which can be satisfactorily explained, a fit assessment may be considered, but a recurrence should be disqualifying.

(f) Head injury

An applicant with a head injury which was severe enough to cause loss of consciousness or is associated with penetrating brain injury should be reviewed by a consultant neurologist. A fit assessment may be considered if there has been a full recovery and the risk of epilepsy is sufficiently low.

(g) Spinal or peripheral nerve injury, myopathies

An applicant with a history or diagnosis of spinal or peripheral nerve injury or myopathy should be assessed as unfit. A fit assessment may be considered if neurological review and musculoskeletal assessments are satisfactory.

AMC1 MED.B.070 Visual system

(a) Eye examination

(1) At each aero-medical revalidation examination, an assessment of the visual fitness should be undertaken and the eyes should be examined with regard to possible pathology.

(2) All abnormal and doubtful cases should be referred to an ophthalmologist. Conditions which indicate ophthalmological examination include, but are not limited to, a substantial decrease in the uncorrected visual acuity, any decrease in best corrected visual acuity and/or the occurrence of eye disease, eye injury, or eye surgery.

(3) Where specialist ophthalmological examinations are required for any significant reason, this should be imposed as a limitation on the medical certificate.

(b) Comprehensive eye examination

A comprehensive eye examination by an eye specialist is required at the initial examination. All abnormal and doubtful cases should be referred to an ophthalmologist. The examination should include:

(1) history;

(2) visual acuities - near, intermediate and distant vision (uncorrected and with best optical correction if needed);

(3) examination of the external eye, anatomy, media (slit lamp) and fundoscopy;

(4) ocular motility;

(5) binocular vision;

(6) colour vision;

(7) visual fields;

(8) tonometry on clinical indication; and

(9) refraction hyperopic initial applicants with a hyperopia of more than +2 dioptres and under the age of 25 should undergo objective refraction in cycloplegia.

(c) Routine eye examination

A routine eye examination may be performed by an AME and should include:

(1) history;

(2) visual acuities - near, intermediate and distant vision (uncorrected and with best optical correction if needed);

(3) examination of the external eye, anatomy, media and fundoscopy;

(4) further examination on clinical indication.

(d) Refractive error

(1) At initial examination an applicant may be assessed as fit with:

(i) hypermetropia not exceeding +5.0 dioptres;

(ii) myopia not exceeding –6.0 dioptres;

(iii) astigmatism not exceeding 2.0 dioptres;

(iv) anisometropia not exceeding 2.0 dioptres

provided that optimal correction has been considered and no significant pathology is demonstrated.

(2) Initial applicants who do not meet the requirements in (1)(ii), (iii) and (iv) above should be referred to the licensing authority. A fit assessment may be considered following review by an ophthalmologist.

(3) At revalidation an applicant may be assessed as fit with:

(i) hypermetropia not exceeding +5.0 dioptres;

(ii) myopia exceeding –6.0 dioptres;

(iii) astigmatism exceeding 2.0 dioptres;

(iv) anisometropia exceeding 2.0 dioptres

provided that optimal correction has been considered and no significant pathology is demonstrated.

(4) If anisometropia exceeds 3.0 dioptres, contact lenses should be worn.

(5) If the refractive error is +3.0 to +5.0 or –3.0 to –6.0 dioptres, there is astigmatism or anisometropia of more than 2 dioptres but less than 3 dioptres, a review should be undertaken 5 yearly by an eye specialist.

(6) If the refractive error is greater than –6.0 dioptres, there is more than 3.0 dioptres of astigmatism or anisometropia exceeds 3.0 dioptres, a review should be undertaken 2 yearly by an eye specialist.

(7) In cases (5) and (6) above, the applicant should supply the eye specialist's report to the AME. The report should be forwarded to the licensing authority as part of the medical examination report. All abnormal and doubtful cases should be referred to an ophthalmologist.

(e) Uncorrected visual acuity

No limits apply to uncorrected visual acuity.

(f) Substandard vision

(1) Applicants with reduced central vision in one eye may be assessed as fit if the binocular visual field is normal and the underlying pathology is acceptable according to ophthalmological assessment. A satisfactory medical flight test and a multi-pilot limitation are required.

(2) An applicant with acquired substandard vision in one eye may be assessed as fit with a multi-pilot limitation if:

(i) the better eye achieves distant visual acuity of 6/6 (1.0), corrected or uncorrected;

(ii) the better eye achieves intermediate visual acuity of N14 and N5 for near;

(iii) in the case of acute loss of vision in one eye, a period of adaptation time has passed from the known point of visual loss, during which the applicant should be assessed as unfit;

(iv) there is no significant ocular pathology; and

(v) a medical flight test is satisfactory.

(3) An applicant with a visual field defect may be assessed as fit if the binocular visual field is normal and the underlying pathology is acceptable to the licensing authority.

(g) Keratoconus

Applicants with keratoconus may be assessed as fit if the visual requirements are met with the use of corrective lenses and periodic review is undertaken by an ophthalmologist.

(h) Heterophoria

Applicants with heterophoria (imbalance of the ocular muscles) exceeding:

(1) at 6 metres:

2.0 prism dioptres in hyperphoria,

10.0 prism dioptres in esophoria,

8.0 prism dioptres in exophoria

and

(2) at 33 centimetres:

1.0 prism dioptre in hyperphoria,

8.0 prism dioptres in esophoria,

12.0 prism dioptres in exophoria

should be assessed as unfit. The applicant should be reviewed by an ophthalmologist and if the fusional reserves are sufficient to prevent asthenopia and diplopia a fit assessment may be considered.

(i) Eye surgery

The assessment after eye surgery should include an ophthalmological examination.

(1) After refractive surgery, a fit assessment may be considered, provided that:

(i) pre-operative refraction was not greater than +5 dioptres;

(ii) post-operative stability of refraction has been achieved (less than 0.75 dioptres variation diurnally);

(iii) examination of the eye shows no post-operative complications;

(iv) glare sensitivity is within normal standards;

(v) mesopic contrast sensitivity is not impaired;

(vi) review is undertaken by an eye specialist.

(2) Cataract surgery entails unfitness. A fit assessment may be considered after 3 months.

(3) Retinal surgery entails unfitness. A fit assessment may be considered 6 months after successful surgery. A fit assessment may be acceptable earlier after retinal laser therapy. Follow-up may be required.

(4) Glaucoma surgery entails unfitness. A fit assessment may be considered 6 months after successful surgery. Follow-up may be required.

(5) For (2), (3) and (4) above, a fit assessment may be considered earlier if recovery is complete.

(j) Correcting lenses

Correcting lenses should permit the licence holder to meet the visual requirements at all distances.

AMC1 MED B.075 Colour vision

(a) At revalidation, colour vision should be tested on clinical indication.

(b) The Ishihara test (24 plate version) is considered passed if the first 15 plates, presented in a random order, are identified without error.

(c) Those failing the Ishihara test should be examined either by:

(1) anomaloscopy (Nagel or equivalent). This test is considered passed if the colour match is trichromatic and the matching range is 4 scale units or less; or by

(2) lantern testing with a Spectrolux, Beynes or Holmes-Wright lantern. This test is considered passed if the applicant passes without error a test with accepted lanterns.

AMC1 MED.B.080 Otorhino-laryngology

(a) Hearing

(1) The applicant should understand correctly conversational speech when tested with each ear at a distance of 2 metres from and with the applicant’s back turned towards the AME.

(2) The pure tone audiogram should cover the 500 Hz, 1 000 Hz, 2 000 Hz and 3 000 Hz frequency thresholds.

(3) An applicant with hypoacusis should be referred to the licensing authority. A fit assessment may be considered if a speech discrimination test or functional flight deck hearing test demonstrates satisfactory hearing ability. A vestibular function test may be appropriate.

(4) If the hearing requirements can only be met with the use of hearing aids, the hearing aids should provide optimal hearing function, be well tolerated and suitable for aviation purposes.

(b) Comprehensive otorhinolaryngological examination

A comprehensive otorhino-laryngological examination should include:

(1) history;

(2) clinical examination including otoscopy, rhinoscopy, and examination of the mouth and throat;

(3) tympanometry or equivalent;

(4) clinical assessment of the vestibular system.

(c) Ear conditions

(1) An applicant with an active pathological process, acute or chronic, of the internal or middle ear should be assessed as unfit. A fit assessment may be considered once the condition has stabilised or there has been a full recovery.

(2) An applicant with an unhealed perforation or dysfunction of the tympanic membranes should be assessed as unfit. An applicant with a single dry perforation of non-infectious origin and which does not interfere with the normal function of the ear may be considered for a fit assessment.

(d) Vestibular disturbance

An applicant with disturbance of vestibular function should be assessed as unfit. A fit assessment may be considered after full recovery. The presence of spontaneous or positional nystagmus requires complete vestibular evaluation by an ENT specialist. Significant abnormal caloric or rotational vestibular responses are disqualifying. Abnormal vestibular responses should be assessed in their clinical context.

(e) Sinus dysfunction

An applicant with any dysfunction of the sinuses should be assessed as unfit until there has been full recovery.

(f) Oral/upper respiratory tract infections

A significant, acute or chronic infection of the oral cavity or upper respiratory tract is disqualifying. A fit assessment may be considered after full recovery.

(g) Speech disorder

A significant disorder of speech or voice is disqualifying.

AMC1 MED.B.085 Dermatology

(a) Referral to the licensing authority should be made if doubt exists about the fitness of an applicant with eczema (exogenous and endogenous), severe psoriasis, bacterial infections, drug induced, or bullous eruptions or urticaria.

(b) Systemic effects of radiant or pharmacological treatment for a dermatological condition should be considered before a fit assessment can be considered.

(c) In cases where a dermatological condition is associated with a systemic illness, full consideration should be given to the underlying illness before a fit assessment may be considered.

AMC1 MED.B.090 Oncology

(a) Applicants who underwent treatment for malignant disease may be assessed as fit by the licensing authority if:

(1) there is no evidence of residual malignant disease after treatment;

(2) time appropriate to the type of tumour has elapsed since the end of treatment;

(3) the risk of inflight incapacitation from a recurrence or metastasis is sufficiently low;

(4) there is no evidence of short or long-term sequelae from treatment. Special attention should be paid to applicants who have received anthracycline chemotherapy;

(5) satisfactory oncology follow-up reports are provided to the licensing authority.

(b) A multi-pilot limitation should be applied as appropriate.

(c) Applicants with pre-malignant conditions of the skin may be assessed as fit if treated or excised as necessary and there is regular follow-up.

Section 3 - Specific requirements for class 2 medical certificates

AMC2 MED.B.010 Cardiovascular system

(a) Examination

Exercise electrocardiography

An exercise ECG when required as part of a cardiovascular assessment should be symptom-limited and completed to a minimum of Bruce Stage IV or equivalent.

(b) General

(1) Cardiovascular risk factor assessment

An accumulation of risk factors (smoking, family history, lipid abnormalities, hypertension, etc.) requires cardiovascular evaluation.

(2) Cardiovascular assessment

Reporting of resting and exercise electrocardiograms should be by the AME or an accredited specialist.

(c) Peripheral arterial disease

A fit assessment may be considered for an applicant with peripheral arterial disease, or after surgery for peripheral arterial disease, provided there is no significant functional impairment, any vascular risk factors have been reduced to an appropriate level, the applicant is receiving acceptable secondary prevention treatment, and there is no evidence of myocardial ischaemia.

(d) Aortic aneurysm

(1) Applicants with an aneurysm of the thoracic or abdominal aorta may be assessed as fit, subject to satisfactory cardiological evaluation and regular follow-up.

(2) Applicants may be assessed as fit after surgery for a thoracic or abdominal aortic aneurysm subject to satisfactory cardiological evaluation to exclude the presence of coronary artery disease.

(e) Cardiac valvular abnormalities

(1) Applicants with previously unrecognised cardiac murmurs require further cardiological evaluation.

(2) Applicants with minor cardiac valvular abnormalities may be assessed as fit.

(f) Valvular surgery

(1) Applicants who have undergone cardiac valve replacement or repair may be assessed as fit if post-operative cardiac function and investigations are satisfactory and no anticoagulants are needed.

(2) Where anticoagulation is needed after valvular surgery, a fit assessment with an OSL or OPL limitation may be considered after cardiological review. The review should show that the anticoagulation is stable. Anticoagulation should be considered stable if, within the last 6 months, at least 5 INR values are documented, of which at least 4 are within the INR target range.

(g) Thromboembolic disorders

Arterial or venous thrombosis or pulmonary embolism are disqualifying whilst anticoagulation is being used as treatment. After 6 months of stable anticoagulation as prophylaxis, a fit assessment with an OSL or OPL limitation may be considered after review in consultation with the licensing authority. Anticoagulation should be considered stable if, within the last 6 months, at least 5 INR values are documented, of which at least 4 are within the INR target range. Pulmonary embolus should require full evaluation.

(h) Other cardiac disorders

(1) Applicants with a primary or secondary abnormality of the pericardium, myocardium or endocardium may be assessed as unfit pending satisfactory cardiological evaluation.

(2) Applicants with a congenital abnormality of the heart, including those who have undergone surgical correction, may be assessed as fit subject to satisfactory cardiological assessment. Cardiological follow-up may be necessary and should be determined in consultation with the licensing authority.

(i) Syncope

Applicants with a history of recurrent vasovagal syncope may be assessed as fit after a 6-month period without recurrence, provided that cardiological evaluation is satisfactory. Neurological review may be indicated.

(j) Blood pressure

(1) When the blood pressure at examination consistently exceeds 160 mmHg systolic and/or 95 mmHg diastolic, with or without treatment, the applicant should be assessed as unfit.

(2) The diagnosis of hypertension requires review of other potential vascular risk factors.

(3) Applicants with symptomatic hypotension should be assessed as unfit.

(4) Anti-hypertensive treatment should be compatible with flight safety.

(5) Following initiation of medication for the control of blood pressure, applicants should be re-assessed to verify that the treatment is compatible with the safe exercise of the privileges of the licence held.

(k) Coronary artery disease

(1) Chest pain of uncertain cause requires full investigation.

(2) In suspected asymptomatic coronary artery disease cardiological evaluation should show no evidence of myocardial ischaemia or significant coronary artery stenosis.

(3) After an ischaemic cardiac event, or revascularisation, applicants without symptoms should have reduced any vascular risk factors to an appropriate level. Medication, when used to control angina pectoris, is not acceptable. All applicants should be on acceptable secondary prevention treatment.

(i) A coronary angiogram obtained around the time of, or during, the ischaemic myocardial event and a complete, detailed clinical report of the ischaemic event and of any operative procedures should be available to the AME.

(A) There should be no stenosis more than 50 % in any major untreated vessel, in any vein or artery graft or at the site of an angioplasty/stent, except in a vessel subtending a myocardial infarction. More than two stenoses between 30 % and 50 % within the vascular tree should not be acceptable.

(B) The whole coronary vascular tree should be assessed as satisfactory and particular attention should be paid to multiple stenoses and/or multiple revascularisations.

(C) An untreated stenosis greater than 30 % in the left main or proximal left anterior descending coronary artery should not be acceptable.

(ii) At least 6 months from the ischaemic myocardial event, including revascularisation, the following investigations should be completed (equivalent tests may be substituted):

(A) an exercise ECG showing neither evidence of myocardial ischaemia nor rhythm disturbance;

(B) an echocardiogram showing satisfactory left ventricular function with no important abnormality of wall motion and a satisfactory left ventricular ejection fraction of 50 % or more;

(C) in cases of angioplasty/stenting, a myocardial perfusion scan or stress echocardiogram which should show no evidence of reversible myocardial ischaemia. If there is doubt about revascularisation in myocardial infarction or bypass grafting, a perfusion scan should also be required;

(D) further investigations, such as a 24-hour ECG, may be necessary to assess the risk of any significant rhythm disturbance.

(iii) Periodic follow-up should include cardiological review.

(A) After coronary artery bypass grafting, a myocardial perfusion scan (or satisfactory equivalent test) should be performed if there is any indication, and in all cases within five years from the procedure for a fit assessment without a safety pilot limitation.

(B) In all cases, coronary angiography should be considered at any time if symptoms, signs or non-invasive tests indicate myocardial ischaemia.

(iv) Successful completion of the six month or subsequent review will allow a fit assessment. Applicants may be assessed as fit with a safety pilot limitation having successfully completed only an exercise ECG.

(4) Angina pectoris is disqualifying, whether or not it is abolished by medication.

(l) Rhythm and conduction disturbances

Any significant rhythm or conduction disturbance should require cardiological evaluation and an appropriate follow-up before a fit assessment may be considered. An OSL or OPL limitation should be considered as appropriate.

(1) Ablation

A fit assessment may be considered following successful catheter ablation subject to satisfactory cardiological review undertaken at a minimum of 2 months after the ablation.

(2) Supraventricular arrhythmias

(i) Applicants with significant disturbance of supraventricular rhythm, including sinoatrial dysfunction, whether intermittent or established, may be assessed as fit if cardiological evaluation is satisfactory.

(ii) Applicants with atrial fibrillation/flutter may be assessed as fit if cardiological evaluation is satisfactory.

(iii) Applicants with asymptomatic sinus pauses up to 2.5 seconds on resting electrocardiography may be assessed as fit if cardiological evaluation is satisfactory.

(3) Heart block

(i) Applicants with first degree and Mobitz type 1 AV block may be assessed as fit.

(ii) Applicants with Mobitz type 2 AV block may be assessed as fit in the absence of distal conducting tissue disease.

(4) Complete right bundle branch block

Applicants with complete right bundle branch block may be assessed as fit subject to satisfactory cardiological evaluation.

(5) Complete left bundle branch block

Applicants with complete left bundle branch block may be assessed as fit subject to satisfactory cardiological assessment.

(6) Ventricular pre-excitation

Asymptomatic applicants with ventricular pre-excitation may be assessed as fit subject to satisfactory cardiological evaluation.

(7) Pacemaker

Applicants with a subendocardial pacemaker may be assessed as fit no sooner than 3 months after insertion provided:

(i) there is no other disqualifying condition;

(ii) a bipolar lead system is used, programmed in bipolar mode without automatic mode change of the device;

(iii) the applicant is not pacemaker dependent; and

(iv) the applicant has a regular follow-up, including a pacemaker check.

AMC2 MED.B.015 Respiratory system

(a) Chest radiography

Posterior/anterior chest radiography may be required if indicated on clinical grounds.

(b) Chronic obstructive airways disease

Applicants with only minor impairment of pulmonary function may be assessed as fit.

(c) Asthma

Applicants with asthma may be assessed as fit if the asthma is considered stable with satisfactory pulmonary function tests and medication is compatible with flight safety. Systemic steroids should be disqualifying.

(d) Inflammatory disease

Applicants with active inflammatory disease of the respiratory system should be assessed as unfit pending resolution of the condition.

(e) Sarcoidosis

(1) Applicants with active sarcoidosis should be assessed as unfit. Investigation should be undertaken with respect to the possibility of systemic involvement. A fit assessment may be considered once the disease is inactive.

(2) Applicants with cardiac sarcoid should be assessed as unfit.

(f) Pneumothorax

(1) Applicants with spontaneous pneumothorax should be assessed as unfit. A fit assessment may be considered if respiratory evaluation is satisfactory six weeks following full recovery from a single spontaneous pneumothorax or following recovery from surgical intervention in the case of treatment for a recurrent pneumothorax.

(2) A fit assessment following full recovery from a traumatic pneumothorax as a result of an accident or injury may be acceptable once full absorption of the pneumothorax is demonstrated.

(g) Thoracic surgery

Applicants requiring major thoracic surgery should be assessed as unfit until such time as the effects of the operation are no longer likely to interfere with the safe exercise of the privileges of the applicable licence(s).

(h) Sleep apnoea syndrome

Applicants with unsatisfactorily treated sleep apnoea syndrome should be assessed as unfit.

AMC2 MED.B.020 Digestive system

(a) Oesophageal varices

Applicants with oesophageal varices should be assessed as unfit.

(b) Pancreatitis

Applicants with pancreatitis should be assessed as unfit pending satisfactory recovery.

(c) Gallstones

(1) Applicants with a single asymptomatic large gallstone or asymptomatic multiple gallstones may be assessed as fit.

(2) Applicants with symptomatic single or multiple gallstones should be assessed as unfit. A fit assessment may be considered following gallstone removal.

(d) Inflammatory bowel disease

Applicants with an established diagnosis or history of chronic inflammatory bowel disease may be assessed as fit provided that the disease is stable and not likely to interfere with the safe exercise of the privileges of the applicable licence(s).

(e) Peptic ulceration

Applicants with peptic ulceration should be assessed as unfit pending full recovery.

(f) Abdominal surgery

(1) Abdominal surgery is disqualifying. A fit assessment may be considered if recovery is complete, the applicant is asymptomatic and there is only a minimal risk of secondary complication or recurrence.

(2) Applicants who have undergone a surgical operation on the digestive tract or its adnexa, involving a total or partial excision or a diversion of any of these organs, should be assessed as unfit until such time as the effects of the operation are no longer likely to interfere with the safe exercise of the privileges of the applicable licence(s).

AMC2 MED.B.025 Metabolic and endocrine systems

(a) Metabolic, nutritional or endocrine dysfunction

Metabolic, nutritional or endocrine dysfunction is disqualifying. A fit assessment may be considered if the condition is asymptomatic, clinically compensated and stable.

(b) Obesity

Obese applicants may be assessed as fit only if the excess weight is not likely to interfere with the safe exercise of the applicable licence(s).

(c) Addison's disease

Applicants with Addison's disease may be assessed as fit provided that cortisone is carried and available for use whilst exercising the privileges of the licence.

(d) Gout

Applicants with acute gout should be assessed as unfit until asymptomatic.

(e) Thyroid dysfunction

Applicants with thyroid disease may be assessed as fit once a stable euthyroid state is attained.

(f) Abnormal glucose metabolism

Glycosuria and abnormal blood glucose levels require investigation. A fit assessment may be considered if normal glucose tolerance is demonstrated (low renal threshold) or impaired glucose tolerance is fully controlled by diet and regularly reviewed.

(g) Diabetes mellitus

Applicants with diabetes mellitus may be assessed as fit. The use of antidiabetic medications that are not likely to cause hypoglycaemia may be acceptable.

AMC2 MED.B.030 Haematology

(a) Abnormal haemoglobin

Haemoglobin should be tested when clinically indicated.

(b) Anaemia

Applicants with anaemia demonstrated by a reduced haemoglobin level or low haematocrit may be assessed as fit once the primary cause has been treated and the haemoglobin or haematocrit has stabilised at a satisfactory level.

(c) Polycythaemia

Applicants with polycythaemia may be assessed as fit if the condition is stable and no associated pathology is demonstrated.

(d) Haemoglobinopathy

Applicants with a haemoglobinopathy may be assessed as fit if minor thalassaemia or other haemoglobinopathy is diagnosed without a history of crises and where full functional capability is demonstrated.

(e) Coagulation and haemorrhagic disorders

Applicants with a coagulation or haemorrhagic disorder may be assessed as fit if there is no likelihood of significant bleeding.

(f) Thrombo-embolic disorders

Applicants with a thrombotic disorder may be assessed as fit if there is no likelihood of significant clotting episodes.

(g) Disorders of the lymphatic system

Applicants with significant enlargement of the lymphatic glands or haematological disease may be assessed as fit if the condition is unlikely to interfere with the safe exercise of the privileges of the applicable licence(s). Applicants may be assessed as fit in cases of acute infectious process which is fully recovered or Hodgkin's lymphoma or other lymphoid malignancy which has been treated and is in full remission.

(h) Leukaemia

(1) Applicants with acute leukaemia may be assessed as fit once in established remission.

(2) Applicants with chronic leukaemia may be assessed as fit after a period of demonstrated stability.

(3) In cases (1) and (2) above there should be no history of central nervous system involvement and no continuing side effects from treatment of flight safety importance. Haemoglobin and platelet levels should be satisfactory. Regular follow-up is required.

(i) Splenomegaly

Applicants with splenomegaly may be assessed as fit if the enlargement is minimal, stable and no associated pathology is demonstrated, or if the enlargement is minimal and associated with another acceptable condition.

AMC2 MED.B.035 Genitourinary system

(a) Renal disease

Applicants presenting with renal disease may be assessed as fit if blood pressure is satisfactory and renal function is acceptable. The requirement for dialysis is disqualifying.

(b) Urinary calculi

(1) Applicants presenting with one or more urinary calculi should be assessed as unfit.

(2) Applicants with an asymptomatic calculus or a history of renal colic require investigation.

(3) While awaiting assessment or treatment, a fit assessment with a safety pilot limitation may be considered.

(4) After successful treatment the applicant may be assessed as fit.

(5) Applicants with parenchymal residual calculi may be assessed as fit.

(c) Renal/urological surgery

(1) Applicants who have undergone a major surgical operation on the urinary tract or the urinary apparatus involving a total or partial excision or a diversion of any of its organs should be assessed as unfit until such time as the effects of the operation are no longer likely to cause incapacity in flight. After other urological surgery, a fit assessment may be considered if the applicant is completely asymptomatic, there is minimal risk of secondary complication or recurrence presenting with renal disease, if blood pressure is satisfactory and renal function is acceptable. The requirement for dialysis is disqualifying.

(2) An applicant with compensated nephrectomy without hypertension or uraemia may be assessed as fit.

(3) Applicants who have undergone renal transplantation may be considered for a fit assessment if it is fully compensated and with only minimal immuno-suppressive therapy.

(4) Applicants who have undergone total cystectomy may be considered for a fit assessment if there is satisfactory urinary function, no infection and no recurrence of primary pathology.

AMC2 MED.B.040 Infectious diseases

(a) Tuberculosis

Applicants with active tuberculosis should be assessed as unfit until completion of therapy.

(b) HIV infection

A fit assessment may be considered for HIV positive individuals with stable, non-progressive disease if full investigation provides no evidence of HIV-associated diseases that might give rise to incapacitating symptoms.

AMC2 MED.B.045 Obstetrics and gynaecology

(a) Gynaecological surgery

An applicant who has undergone a major gynaecological operation should be assessed as unfit until such time as the effects of the operation are not likely to interfere with the safe exercise of the privileges of the licence(s).

(b) Pregnancy

(1) A pregnant licence holder may be assessed as fit during the first 26 weeks of gestation following satisfactory obstetric evaluation.

(2) Licence privileges may be resumed upon satisfactory confirmation of full recovery following confinement or termination of pregnancy.

AMC2 MED.B.050 Musculoskeletal system

(a) An applicant with any significant sequela from disease, injury or congenital abnormality affecting the bones, joints, muscles or tendons with or without surgery should require full evaluation prior to fit assessment.

(b) In cases of limb deficiency, a fit assessment may be considered following a satisfactory medical flight test.

(c) An applicant with inflammatory, infiltrative, traumatic or degenerative disease of the musculoskeletal system may be assessed as fit, provided the condition is in remission and the applicant is taking no disqualifying medication and has satisfactorily completed a medical flight test. A limitation to specified aircraft type(s) may be required.

(d) Abnormal physique or muscular weakness may require a satisfactory medical flight test. A limitation to specified aircraft type(s) may be required.

AMC2 MED.B.055 Psychiatry

(a) Psychotic disorder

A history, or the occurrence, of a functional psychotic disorder is disqualifying unless in certain rare cases a cause can be unequivocally identified as one which is transient, has ceased and will not recur.

(b) Psychotropic substances

Use or abuse of psychotropic substances likely to affect flight safety is disqualifying. If a stable maintenance psychotropic medication is confirmed, a fit assessment with an OSL limitation may be considered.

(c) Schizophrenia, schizotypal or delusional disorder

An applicant with a history of schizophrenia, schizotypal or delusional disorder may only be considered fit if the original diagnosis was inappropriate or inaccurate as confirmed by psychiatric evaluation or, in the case of a single episode of delirium, provided that the applicant has suffered no permanent impairment.

(d) Disorders due to alcohol or other substance use

(1) Mental or behavioural disorders due to alcohol or other substance use, with or without dependency, are disqualifying.

(2) A fit assessment may be considered in consultation with the licensing authority after a period of two years documented sobriety or freedom from substance use. A fit assessment may be considered earlier with an OSL or OPL limitation. Depending on the individual case, treatment and review may include:

(i) in-patient treatment of some weeks followed by:

(A) review by a psychiatric specialist; and

(B) ongoing review, including blood testing and peer reports, which may be required indefinitely.

AMC2 MED.B.060 Psychology

Applicants with a psychological disorder may need to be referred for psychological or neuropsychiatric opinion and advice.

AMC2 MED.B.065 Neurology

(a) Epilepsy

An applicant may be assessed as fit if:

(1) there is a history of a single afebrile epileptiform seizure, considered to have a very low risk of recurrence;

(2) there has been no recurrence after at least 10 years off treatment;

(3) there is no evidence of continuing predisposition to epilepsy.

(b) Conditions with a high propensity for cerebral dysfunction

An applicant with a condition with a high propensity for cerebral dysfunction should be assessed as unfit. A fit assessment may be considered after full evaluation.

(c) Neurological disease

Any stationary or progressive disease of the nervous system which has caused or is likely to cause a significant disability is disqualifying. In case of minor functional loss associated with stationary disease, a fit assessment may be considered after full evaluation.

(d) Head injury

An applicant with a head injury which was severe enough to cause loss of consciousness or is associated with penetrating brain injury may be assessed as fit if there has been a full recovery and the risk of epilepsy is sufficiently low.

AMC2 MED.B.070 Visual system

(a) Eye examination

(1) At each aero-medical revalidation examination an assessment of the visual fitness of the licence holder should be undertaken and the eyes should be examined with regard to possible pathology. Conditions which indicate further ophthalmological examination include, but are not limited to, a substantial decrease in the uncorrected visual acuity, any decrease in best corrected visual acuity and/or the occurrence of eye disease, eye injury, or eye surgery.

(2) At the initial assessment, the examination should include:

(i) history;

(ii) visual acuities - near, intermediate and distant vision (uncorrected and with best optical correction if needed);

(iii) examination of the external eye, anatomy, media and fundoscopy;

(iv) ocular motility;

(v) binocular vision;

(vi) colour vision and visual fields;

(vii) further examination on clinical indication.

(3) At the initial assessment the applicant should submit a copy of the recent spectacle prescription if visual correction is required to meet the visual requirements.

(b) Routine eye examination

A routine eye examination should include:

(1) history;

(2) visual acuities - near, intermediate and distant vision (uncorrected and with best optical correction if needed);

(3) examination of the external eye, anatomy, media and fundoscopy;

(4) further examination on clinical indication.

(c) Visual acuity

In an applicant with amblyopia, the visual acuity of the amblyopic eye should be 6/18 (0,3) or better. The applicant may be assessed as fit, provided the visual acuity in the other eye is 6/6 (1,0) or better, with or without correction, and no significant pathology can be demonstrated.

(d) Substandard vision

(1) Reduced stereopsis, abnormal convergence not interfering with near vision and ocular misalignment where the fusional reserves are sufficient to prevent asthenopia and diplopia may be acceptable.

(2) An applicant with substandard vision in one eye may be assessed as fit subject to a satisfactory flight test if the better eye:

(i) achieves distant visual acuity of 6/6 (1,0), corrected or uncorrected;

(ii) achieves intermediate visual acuity of N14 and N5 for near;

(iii) has no significant pathology.

(3) An applicant with a visual field defect may be considered as fit if the binocular visual field is normal and the underlying pathology is acceptable.

(e) Eye surgery

(1) The assessment after eye surgery should include an ophthalmological examination.

(2) After refractive surgery a fit assessment may be considered provided that there is stability of refraction, there are no postoperative complications and no increase in glare sensitivity.

(3) After cataract, retinal or glaucoma surgery a fit assessment may be considered once recovery is complete.

(f) Correcting lenses

Correcting lenses should permit the licence holder to meet the visual requirements at all distances.

AMC2 MED B.075 Colour vision

(a) The Ishihara test (24 plate version) is considered passed if the first 15 plates, presented in a random order, are identified without error.

(b) Those failing the Ishihara test should be examined either by:

(1) anomaloscopy (Nagel or equivalent). This test is considered passed if the colour match is trichromatic and the matching range is 4 scale units or less; or by

(2) lantern testing with a Spectrolux, Beynes or Holmes-Wright lantern. This test is considered passed if the applicant passes without error a test with accepted lanterns.

(c) Colour vision should be tested on clinical indication at revalidation or renewal examinations.

AMC2 MED.B.080 Otorhino-laryngology

(a) Hearing

(1) The applicant should understand correctly conversational speech when tested with each ear at a distance of 2 metres from and with the applicant's back turned towards the AME.

(2) An applicant with hypoacusis may be assessed as fit if a speech discrimination test or functional cockpit hearing test demonstrates satisfactory hearing ability. An applicant for an instrument rating with hypoacusis should be assessed in consultation with the licensing authority.

(3) If the hearing requirements can be met only with the use of hearing aids, the hearing aids should provide optimal hearing function, be well tolerated and suitable for aviation purposes.

(b) Examination

An ear, nose and throat (ENT) examination should form part of all initial, revalidation and renewal examinations.

(c) Ear conditions

(1) An applicant with an active pathological process, acute or chronic, of the internal or middle ear should be assessed as unfit until the condition has stabilised or there has been a full recovery.

(2) An applicant with an unhealed perforation or dysfunction of the tympanic membranes should be assessed as unfit. An applicant with a single dry perforation of non-infectious origin which does not interfere with the normal function of the ear may be considered for a fit assessment.

(d) Vestibular disturbance

An applicant with disturbance of vestibular function should be assessed as unfit pending full recovery.

(e) Sinus dysfunction

An applicant with any dysfunction of the sinuses should be assessed as unfit pending full recovery.

(f) Oral/upper respiratory tract infections

A significant acute or chronic infection of the oral cavity or upper respiratory tract is disqualifying until full recovery.

(g) Speech disorder

A significant disorder of speech or voice should be disqualifying.

(h) Air passage restrictions

An applicant with significant restriction of the nasal air passage on either side, or significant malformation of the oral cavity or upper respiratory tract may be assessed as fit if ENT evaluation is satisfactory.

(i) Eustachian tube function

An applicant with significant dysfunction of the Eustachian tubes may be assessed as fit in consultation with the licensing authority.

AMC2 MED.B.085 Dermatology

In cases where a dermatological condition is associated with a systemic illness, full consideration should be given to the underlying illness before a fit assessment can be considered.

AMC MED.B.090 Oncology

(a) Applicants may be considered for a fit assessment after treatment for malignant disease if:

(1) there is no evidence of residual malignant disease after treatment;

(2) time appropriate to the type of tumour has elapsed since the end of treatment;

(3) the risk of in-flight incapacitation from a recurrence or metastasis is sufficiently low;

(4) there is no evidence of short or long-term sequelae from treatment that may adversely affect flight safety;

(5) special attention is paid to applicants who have received anthracyline chemotherapy;

(6) arrangements for an oncological follow-up have been made for an appropriate period of time.

(b) Applicants with pre-malignant conditions of the skin may be assessed as fit if treated or excised as necessary and there is a regular follow-up.

Section 4 - Specific requirements for LAPL medical certificates

AMC1 MED.B.095 Medical examination and/or assessment of applicants for LAPL medical certificates

When a specialist evaluation is required under this section, the aero-medical assessment of the applicant should be performed by an AeMC, an AME or, in the case of AMC 5(d), by the licensing authority.

AMC2 MED.B.095 Cardiovascular system

(a) Examination

Pulse and blood pressure should be recorded at each examination.

(b) General

(1) Cardiovascular risk factor assessment

An accumulation of risk factors (smoking, family history, lipid abnormalities, hypertension, etc.) requires cardiovascular evaluation.

(2) Aortic aneurysm

Applicants with an aortic aneurysm may be assessed as fit subject to satisfactory cardiological evaluation and a regular follow-up.

(3) Cardiac valvular abnormalities

Applicants with a cardiac murmur may be assessed as fit if the murmur is assessed as being of no pathological significance.

(4) Valvular surgery

After cardiac valve replacement or repair a fit assessment may be considered if post-operative cardiac function and investigations are satisfactory. Anticoagulation, if needed, should be stable.

(5) Other cardiac disorders:

(i) Applicants with other cardiac disorders may be assessed as fit subject to satisfactory cardiological assessment.

(ii) Applicants with symptomatic hypertrophic cardiomyopathy should be assessed as unfit.

(c) Blood pressure

(1) When the blood pressure consistently exceeds 160 mmHg systolic and/or 95 mmHg diastolic, with or without treatment, the applicant should be assessed as unfit.

(2) The initiation of medication for the control of blood pressure should require a period of temporary suspension of the medical certificate to establish the absence of significant side effects.

(d) Coronary artery disease

(1) Applicants with suspected myocardial ischaemia should be investigated before a fit assessment can be considered.

(2) Applicants with angina pectoris requiring medication for cardiac symptoms should be assessed as unfit.

(3) After an ischaemic cardiac event, including myocardial infarction or revascularisation, applicants without symptoms should have reduced any vascular risk factors to an appropriate level. Medication, when used to control cardiac symptoms, is not acceptable. All applicants should be on acceptable secondary prevention treatment.

(4) In cases under (1), (2) and (3) above, applicants who have had a satisfactory cardiological evaluation to include an exercise test or equivalent that is negative for ischaemia may be assessed as fit.

(e) Rhythm and conduction disturbances

(1) Applicants with a significant disturbance of cardiac rhythm or conduction should be assessed as unfit unless a cardiological evaluation concludes that the disturbance is not likely to interfere with the safe exercise of the privileges of the LAPL.

(2) Pre-excitation

Applicants with ventricular pre-excitation may be assessed as fit subject to satisfactory cardiological evaluation. Applicants with ventricular pre-excitation associated with a significant arrhythmia should be assessed as unfit.

(3) Pacemaker

A fit assessment may be considered subject to satisfactory cardiological evaluation.

AMC3 MED.B.095 Respiratory system

(a) Asthma and chronic obstructive airways disease

Applicants with asthma or minor impairment of pulmonary function may be assessed as fit if the condition is considered stable with satisfactory pulmonary function and medication is compatible with flight safety. Systemic steroids may be disqualifying depending on dosage needed and corresponding side effects.

(b) Sarcoidosis

(1) Applicants with active sarcoidosis should be assessed as unfit. Investigation should be undertaken with respect to the possibility of systemic involvement. A fit assessment may be considered once the disease is inactive.

(2) Applicants with cardiac sarcoidosis should be assessed as unfit.

(c) Pneumothorax

(1) Applicants with spontaneous pneumothorax may be assessed as fit subject to satisfactory respiratory evaluation following full recovery from a single spontaneous pneumothorax or following recovery from surgical treatment for a recurrent pneumothorax.

(2) Applicants with traumatic pneumothorax may be assessed as fit following full recovery.

(d) Thoracic surgery

Applicants who have undergone major thoracic surgery may be assessed as fit following full recovery.

(e) Sleep apnoea syndrome/sleep disorder

Applicants with unsatisfactorily treated sleep apnoea syndrome should be assessed as unfit.

AMC4 MED.B.095 Digestive system

(a) Gallstones

Applicants with symptomatic gallstones should be assessed as unfit. A fit assessment may be considered following gallstone removal.

(b) Inflammatory bowel disease

Applicants with an established diagnosis or history of chronic inflammatory bowel disease may be assessed as fit provided that the disease is stable and not likely to interfere with the safe exercise of the privileges of the licence.

(c) Abdominal surgery

Applicants who have undergone a surgical operation on the digestive tract or its adnexae may be assessed as fit provided recovery is complete, they are asymptomatic and there is only a minimal risk of secondary complication or recurrence.

(d) Pancreatitis

Applicants with pancreatitis may be assessed as fit after satisfactory recovery.

AMC5 MED.B.095 Metabolic and endocrine systems

(a) Metabolic, nutritional or endocrine dysfunction

Applicants with metabolic, nutritional or endocrine dysfunction may be assessed as fit subject to demonstrated stability of the condition and satisfactory aero-medical evaluation.

(b) Obesity

Obese applicants may be assessed as fit if the excess weight is not likely to interfere with the safe exercise of the licence.

(c) Thyroid dysfunction

Applicants with thyroid disease may be assessed as fit once a stable euthyroid state is attained.

(d) Diabetes mellitus

(1) The use of antidiabetic medications that are not likely to cause hypoglycaemia should be acceptable for a fit assessment.

(2) Applicants with diabetes mellitus Type 1 should be assessed as unfit.

(3) Applicants with diabetes mellitus Type 2 treated with insulin may be assessed as fit with limitations for revalidation if blood sugar control has been achieved and the process under (e) and (f) below is followed. An OSL limitation is required. A TML limitation for 12 months may be

needed to ensure compliance with the follow-up requirements below. Licence privileges should be restricted to aeroplanes and sailplanes only.

(e) Aero-medical assessment by, or under the guidance of, the licensing authority:

(1) A diabetology review at yearly intervals, including:

(i) symptom review;

(ii) review of data logging of blood sugar;

(iii) cardiovascular status. Exercise ECG at age 40, at 5-yearly intervals thereafter and on clinical indication, including an accumulation of risk factors;

(iv) nephropathy/ nephropathy status.

(2) Ophthalmological review at yearly intervals, including:

(i) visual fields Humphrey-perimeter;

(ii) retinas full dilatation slit lamp and documentation;

(ii) cataract clinical screening.

The development of retinopathy requires a full ophthalmological review.

(3) Blood testing at 6-monthly intervals:

(i) HbA1c; target is 7,5–8,5 %;

(ii) renal profile;

(iii) liver profile;

(iv) lipid profile.

(4) Applicants should be assessed as temporarily unfit after:

(i) changes of medication/insulin leading to a change to the testing regime until stable blood sugar control can be demonstrated;

(ii) a single unexplained episode of severe hypoglycaemia until stable blood sugar control can be demonstrated.

(5) Applicants should be assessed as unfit in the following cases:

(i) loss of hypoglycaemia awareness;

(ii) development of retinopathy with any visual field loss;

(iii) significant nephropathy;

(iv) any other complication of the disease where flight safety may be jeopardised.

(f) Pilot responsibility

Blood sugar testing is carried out during non-operational and operational periods. A whole blood glucose measuring device with memory should be carried and used. Equipment for continuous glucose monitoring (CGMS) should not be used. Pilots should prove to the AME or AeMC or licensing authority that testing has been performed as indicated below and with which results.

(1) Testing during non-operational periods: normally 3–4 times/day or as recommended by the treating physician, and on any awareness of hypoglycaemia.

(2) Testing frequency during operational periods:

(i) 120 minutes before departure;

(ii) <30 minutes before departure;

(iii) 60 minutes during flight;

(iv) 30 minutes before landing.

(3) Actions following glucose testing:

(i) 120 minutes before departure: if the test result is >15 mmol/l, piloting should not be commenced.

(ii) 10–15g of carbohydrate should be ingested and a re-test performed within 30 minutes if:

(A) any test result is <4,5 mmol/l;

(B) the pre-landing test measurement is missed or a subsequent go-around/diversion is performed.

GM1 MED.B.095 Diabetes mellitus Type 2 treated with insulin

(a) Pilots and their treating physician should be aware that if the HbA1c target level was set to normal (non-diabetic) levels, this will significantly increase the chance of hypoglycaemia. For safety reasons the target level of HbA1c is therefore set to 7,5–8,5 % even though there is evidence that lower HbA1c levels are correlated with fewer diabetic complications.

(b) The safety pilot should be briefed pre-flight on the potential condition of the pilot. The results of blood sugar testing before and during flight should be shared with the safety pilot for the acceptability of the values obtained.

AMC6 MED.B.095 Haematology

Applicants with a haematological condition, such as:

(a) abnormal haemoglobin including, but not limited to, anaemia, polycythaemia or haemoglobinopathy;

(b) coagulation, haemorrhagic or thrombotic disorder;

(c) significant lymphatic enlargement;

(d) acute or chronic leukaemia;

(e) enlargement of the spleen

may be assessed as fit subject to satisfactory aero-medical evaluation.

AMC7 MED.B.095 Genitourinary system

(a) Applicants with a genitourinary disorder, such as:

(1) renal disease; or

(2) one or more urinary calculi, or a history of renal colic

may be assessed as fit subject to satisfactory renal/urological evaluation.

(b) Applicants who have undergone a major surgical operation in the urinary apparatus may be assessed as fit following full recovery.

AMC8 MED.B.095 Infectious disease

HIV infection: applicants who are HIV positive may be assessed as fit if investigation provides no evidence of clinical disease.

AMC9 MED.B.095 Obstetrics and gynaecology

(a) Pregnancy

Holders of a LAPL medical certificate should only exercise the privileges of their licences until the 26th week of gestation under routine antenatal care.

(b) Applicants who have undergone a major gynaecological operation may be assessed as fit after full recovery.

AMC10 MED.B.095 Musculoskeletal system

Applicants should have satisfactory functional use of the musculoskeletal system to enable the safe exercise of the privileges of the licence.

AMC11 MED.B.095 Psychiatry

(a) Applicants with a mental or behavioural disorder due to alcohol or other substance use should be assessed as unfit pending recovery and freedom from substance use and subject to satisfactory psychiatric evaluation after treatment.

(b) Applicants with an established history or clinical diagnosis of schizophrenia, schizotypal or delusional disorder should be assessed as unfit.

(c) Psychotropic substances

Use or abuse of psychotropic substances likely to affect flight safety should be disqualifying. If a stable maintenance psychotropic medication is confirmed, a fit assessment with an appropriate limitation may be considered.

(d) Applicants with a psychiatric condition, such as:

(1) mood disorder;

(2) neurotic disorder;

(3) personality disorder;

(4) mental or behavioural disorder

should undergo satisfactory psychiatric evaluation before a fit assessment may be considered.

(e) Applicants with a history of significant or repeated acts of deliberate self-harm should undergo satisfactory psychiatric and/or psychological evaluation before a fit assessment can be considered.

AMC12 MED.B.095 Psychology

Applicants with a psychological disorder may need to be referred for psychological opinion and advice.

AMC13 MED.B.095 Neurology

(a) Epilepsy and seizures

(1) Applicants with an established diagnosis of and under treatment for epilepsy should be assessed as unfit. A re-assessment after all treatment has been stopped for at least 5 years should include a neurological evaluation.

(2) Applicants may be assessed as fit if:

(i) there is a history of a single afebrile epileptiform seizure considered to have a very low risk of recurrence; and

(ii) there has been no recurrence after at least 5 years off treatment; or

(iii) a cause has been identified and treated and there is no evidence of continuing predisposition to epilepsy.

(b) Neurological disease

(1) Applicants with any stationary or progressive disease of the nervous system which has caused or is likely to cause a significant disability should be assessed as unfit. The AME or AeMC should assess these applicants taking into account the privileges of

the licence held and the risk involved. An OPL limitation may be appropriate if a fit assessment is made.

(2) In case of minor functional loss associated with stationary disease, a fit assessment may be considered after full evaluation.

(c) Head injury

Applicants with a head injury which was severe enough to cause loss of consciousness or is associated with penetrating brain injury may be assessed as fit if there has been a full recovery and the risk of epilepsy is sufficiently low.

(d) Spinal or peripheral nerve injury

Applicants with a history or diagnosis of spinal or peripheral nerve injury may be assessed as fit if neurological review and musculoskeletal assessments are satisfactory.

AMC14 MED.B.095 Visual system

(a) Applicants should not possess any abnormality of the function of the eyes or their adnexa or any active pathological condition, congenital or acquired, acute or chronic, or any sequelae of eye surgery or trauma, which is likely to interfere with the safe exercise of the privileges of the applicable licence(s).

(b) Eye examination

The examination should include visual acuities (near, intermediate and distant vision) and visual field.

(c) Visual acuity

(1) Visual acuity with or without corrective lenses should be 6/9 (0,7) binocularly and 6/12 (0,5) in each eye.

(2) Applicants who do not meet the required visual acuity should be assessed by an AME or AeMC, taking into account the privileges of the licence held and the risk involved.

(3) Applicants should be able to read an N5 chart (or equivalent) at 30–50cms and an N14 chart (or equivalent) at 100cms, with correction if prescribed.

(c) Substandard vision

Applicants with substandard vision in one eye may be assessed as fit if the better eye:

(1) achieves distant visual acuity of 6/6 (1,0), corrected or uncorrected;

(2) achieves distant visual acuity less than 6/6 (1,0) but not less than 6/9 (0,7), after ophthalmological evaluation.

(d) Visual field defects

Applicants with a visual field defect may be assessed as fit if the binocular visual field or monocular visual field is normal.

(e) Eye surgery

(1) After refractive surgery, a fit assessment may be considered, provided that there is stability of refraction, there are no post-operative complications and no significant increase in glare sensitivity.

(2) After cataract, retinal or glaucoma surgery a fit assessment may be considered once recovery is complete.

(f) Correcting lenses

Correcting lenses should permit the licence holder to meet the visual requirements at all distances.

AMC15 MED.B.095 Colour vision

Applicants for a night rating should correctly identify 9 of the first 15 plates of the 24-plate edition of Ishihara pseudoisochromatic plates or should be colour safe.

AMC16 MED.B.095 Otorhino-laryngology

(a) Hearing

(1) Applicants should understand correctly conversational speech when tested at a distance of 2 metres from and with the applicant's back turned towards the examiner.

(2) Applicants with hypoacusis should demonstrate satisfactory functional hearing ability.

(b) Ear conditions

Applicants for a LAPL medical certificate with:

(1) an active pathological process, acute or chronic, of the internal or middle ear;

(2) unhealed perforation or dysfunction of the tympanic membrane(s);

(3) disturbance of vestibular function;

(4) significant restriction of the nasal passages;

(5) sinus dysfunction;

(6) significant malformation or significant, acute or chronic infection of the oral cavity or upper respiratory tract; or

(7) significant disorder of speech or voice

should undergo further medical examination and assessment to establish that the condition does not interfere with the safe exercise of the privileges of the licence.

Subpart C - Requirements for medical fitness of cabin crew

Section 1 - General requirements

AMC1 MED.C.005 Aero-medical assessments

(a) When conducting aero-medical examination and/or assessments of cabin crew, their medical fitness should be assessed with particular regard to their physical and mental ability to:

(1) undergo the training required for cabin crew to acquire and maintain competence, e.g. actual fire-fighting, slide descending, using Protective Breathing Equipment (PBE) in a simulated smoke-filled environment, providing first aid;

(2) manipulate the aircraft systems and emergency equipment to be used by cabin crew, e.g. cabin management systems, doors/exits, escape devices, fire extinguishers, taking also into account the type of aircraft operated e.g. narrow-bodied or wide-bodied, single/multi-deck, single/multi-crew operation;

(3) continuously sustain the aircraft environment whilst performing duties, e.g. altitude, pressure, re-circulated air, noise; and the type of operations such as short/medium/long/ultralong haul; and

(4) perform the required duties and responsibilities efficiently during normal and abnormal operations, and in emergency situations and psychologically demanding circumstances e.g. assistance to crew members and passengers in case of decompression; stress management, decision-making, crowd control and effective crew coordination, management of disruptive passengers and of security threats. When relevant, operating as single cabin crew should also be taken into account when assessing the medical fitness of cabin crew.

Section 2 - Requirements for aero-medical assessment of cabin crew

AMC1 MED.C.025 Content of aero-medical assessments

Aero-medical examinations and/or assessments of cabin crew members should be conducted according to the specific medical requirements in AMC2 to AMC18 MED.C.025.

AMC2 MED.C.025 Cardiovascular system

(a) Examination

(1) A standard 12-lead resting electrocardiogram (ECG) and report should be completed on clinical indication, at the first examination after the age of 40 and then at least every five years after the age of 50. If cardiovascular risk factors such as smoking, abnormal cholesterol levels or obesity are present, the intervals of resting ECGs should be reduced to two years.

(2) Extended cardiovascular assessment should be required when clinically indicated.

(b) Cardiovascular system - general

(1) Cabin crew members with any of the following conditions:

(i) aneurysm of the thoracic or supra-renal abdominal aorta, before surgery;

(ii) significant functional abnormality of any of the heart valves; or

(iii) heart or heart/lung transplantation should be assessed as unfit.

(2) Cabin crew members with an established diagnosis of one of the following conditions:

(i) peripheral arterial disease before or after surgery;

(ii) aneurysm of the abdominal aorta, before or after surgery;

(iii) minor cardiac valvular abnormalities;

(iv) after cardiac valve surgery;

(v) abnormality of the pericardium, myocardium or endocardium;

(vi) congenital abnormality of the heart, before or after corrective surgery;

(vii) a cardiovascular condition requiring systemic anticoagulant therapy;

(viii) recurrent vasovagal syncope;

(ix) arterial or venous thrombosis; or

(x) pulmonary embolism

should be evaluated by a cardiologist before a fit assessment can be considered.

(c) Blood pressure

Blood pressure should be recorded at each examination.

(1) The blood pressure should be within normal limits.

(2) The initiation of medication for the control of blood pressure should require a period of temporary suspension of fitness to establish the absence of any significant side effects.

(d) Coronary artery disease

(1) Cabin crew members with:

(i) cardiac ischaemia;

(ii) symptomatic coronary artery disease; or

(iii) symptoms of coronary artery disease controlled by medication

should be assessed as unfit.

(2) Cabin crew members who are asymptomatic after myocardial infarction or surgery for coronary artery disease should have fully recovered before a fit assessment can be considered.

(e) Rhythm/conduction disturbances

(1) Cabin crew members with any significant disturbance of cardiac conduction or rhythm should undergo cardiological evaluation before a fit assessment can be considered.

(2) Cabin crew members with a history of:

(i) ablation therapy; or

(ii) pacemaker implantation

should undergo satisfactory cardiovascular evaluation before a fit assessment can be made.

(3) Cabin crew members with:

(i) symptomatic sinoatrial disease;

(ii) complete atrioventricular block;

(iii) symptomatic QT prolongation;

(iv) an automatic implantable defibrillating system; or

(v) a ventricular anti-tachycardia pacemaker

should be assessed as unfit.

AMC3 MED.C.025 Respiratory system

(a) Cabin crew members with significant impairment of pulmonary function should be assessed as unfit. A fit assessment may be considered once pulmonary function has recovered and is satisfactory.

(b) Cabin crew members should be required to undergo pulmonary function tests on clinical indication.

(c) Cabin crew members with a history or established diagnosis of:

(1) asthma;

(2) active inflammatory disease of the respiratory system;

(3) active sarcoidosis;

(3) pneumothorax;

(4) sleep apnoea syndrome/sleep disorder; or

(5) major thoracic surgery

should undergo respiratory evaluation with a satisfactory result before a fit assessment can be considered.

(d) Cabin crew members who have undergone a pneumonectomy should be assessed as unfit.

AMC4 MED.C.025 Digestive system

(a) Cabin crew members with any sequelae of disease or surgical intervention in any part of the digestive tract or its adnexa likely to cause incapacitation in flight, in particular any obstruction due to stricture or compression, should be assessed as unfit.

(b) Cabin crew members should be free from herniae that might give rise to incapacitating symptoms.

(c) Cabin crew members with disorders of the gastro-intestinal system, including:

(1) recurrent dyspeptic disorder requiring medication;

(2) pancreatitis;

(3) symptomatic gallstones;

(4) an established diagnosis or history of chronic inflammatory bowel disease; or

(5) after surgical operation on the digestive tract or its adnexa, including surgery involving total or partial excision or a diversion of any of these organs

may be assessed as fit subject to satisfactory evaluation after successful treatment and full recovery after surgery.

AMC5 MED.C.025 Metabolic and endocrine systems

(a) Cabin crew members should not possess any functional or structural metabolic, nutritional or endocrine disorder which is likely to interfere with the safe exercise of their duties and responsibilities.

(b) Cabin crew members with metabolic, nutritional or endocrine dysfunction may be assessed as fit, subject to demonstrated stability of the condition and satisfactory aero-medical evaluation.

(c) Diabetes mellitus

(1) Cabin crew members with diabetes mellitus requiring insulin may be assessed as fit if it can be demonstrated that adequate blood sugar control has been achieved and hypoglycaemia awareness is established and maintained. Limitations should be imposed as appropriate. A requirement to undergo specific regular medical examinations (SIC) and a restriction to operate only in multi-cabin crew operations should be placed as a minimum.

(2) Cabin crew members with diabetes mellitus not requiring insulin may be assessed as fit if it can be demonstrated that adequate blood sugar control has been achieved and hypoglycaemia awareness, if applicable considering the medication, is achieved.

AMC6 MED.C.025 Haematology

Cabin crew members with a haematological condition, such as:

(a) abnormal haemoglobin including, but not limited to, anaemia, polycythaemia or haemoglobinopathy;

(b) coagulation, haemorrhagic or thrombotic disorder;

(c) significant lymphatic enlargement;

(d) acute or chronic leukaemia; or

(e) enlargement of the spleen

may be assessed as fit subject to satisfactory aero-medical evaluation.

AMC7 MED.C.025 Genitourinary system

(a) Urine analysis should form part of every aero-medical examination and/or assessment. The urine should not contain any abnormal element(s) considered to be of pathological significance.

(b) Cabin crew members with any sequela of disease or surgical procedures on the kidneys or the urinary tract, in particular any obstruction due to stricture or compression likely to cause incapacitation should be assessed as unfit.

(c) Cabin crew members with a genitourinary disorder, such as:

(1) renal disease; or

(2) a history of renal colic due to one or more urinary calculi

may be assessed as fit subject to satisfactory renal/urological evaluation.

(d) Cabin crew members who have undergone a major surgical operation in the urinary apparatus involving a total or partial excision or a diversion of its organs should be assessed as unfit and be re-assessed after full recovery before a fit assessment can be made.

AMC8 MED.C.025 Infectious disease

Cabin crew members who are HIV positive may be assessed as fit if investigation provides no evidence of clinical disease and subject to satisfactory aero-medical evaluation.

AMC9 MED.C.025 Obstetrics and gynaecology

(a) Cabin crew members who have undergone a major gynaecological operation should be assessed as unfit until full recovery.

(b) Pregnancy

(1) A pregnant cabin crew member may be assessed as fit only during the first 16 weeks of gestation following review of the obstetric evaluation by the AME or OHMP.

(2) A limitation not to perform duties as single cabin crew member should be considered.

(3) The AME or OHMP should provide written advice to the cabin crew member and supervising physician regarding potentially significant complications of pregnancy resulting from flying duties.

AMC10 MED.C.025 Musculoskeletal system

(a) A cabin crew member should have sufficient standing height, arm and leg length and muscular strength for the safe exercise of their duties and responsibilities.

(b) A cabin crew member should have satisfactory functional use of the musculoskeletal system.

AMC11 MED.C.025 Psychiatry

(a) Cabin crew members with a mental or behavioural disorder due to alcohol or other problematic substance use should be assessed as unfit pending recovery and freedom from problematic substance use and subject to satisfactory psychiatric evaluation.

(b) Cabin crew members with an established history or clinical diagnosis of schizophrenia, schizotypal or delusional disorder should be assessed as unfit.

(c) Cabin crew members with a psychiatric condition such as:

(1) mood disorder;

(2) neurotic disorder;

(3) personality disorder; or

(4) mental or behavioural disorder

should undergo satisfactory psychiatric evaluation before a fit assessment can be made.

(d) Cabin crew members with a history of a single or repeated acts of deliberate self-harm should be assessed as unfit. Cabin crew members should undergo satisfactory psychiatric evaluation before a fit assessment can be considered.

AMC12 MED.C.025 Psychology

(a) Where there is established evidence that a cabin crew member has a psychological disorder, he/she should be referred for psychological opinion and advice.

(b) The psychological evaluation may include a collection of biographical data, the review of aptitudes, and personality tests and psychological interview.

(c) The psychologist should submit a report to the AME or OHMP, detailing the results and recommendation.

(d) The cabin crew member may be assessed as fit to perform cabin crew duties, with limitation if and as appropriate.

AMC13 MED.C.025 Neurology

(a) Cabin crew members with an established history or clinical diagnosis of:

(1) epilepsy; or

(2) recurring episodes of disturbance of consciousness of uncertain cause

should be assessed as unfit.

(b) Cabin crew members with an established history or clinical diagnosis of:

(1) epilepsy without recurrence after five years of age and without treatment for more than ten years;

(2) epileptiform EEG abnormalities and focal slow waves;

(3) progressive or non-progressive disease of the nervous system;

(4) a single episode of disturbance of consciousness of uncertain cause;

(5) loss of consciousness after head injury;

(6) penetrating brain injury; or

(7) spinal or peripheral nerve injury

should undergo further evaluation before a fit assessment can be considered.

AMC14 MED.C.025 Visual system

(a) Examination

(1) a routine eye examination should form part of the initial and all further assessments and/or examinations; and

(2) an extended eye examination should be undertaken when clinically indicated.

(b) Distant visual acuity, with or without correction, should be with both eyes 6/9 or better.

(c) A cabin crew member should be able to read an N5 chart (or equivalent) at 30–50 cm, with correction if prescribed.

(d) Cabin crew members should be required to have normal fields of vision and normal binocular function.

(e) Cabin crew members who have undergone refractive surgery may be assessed as fit subject to satisfactory ophthalmic evaluation.

(f) Cabin crew members with diplopia should be assessed as unfit.

(g) Spectacles and contact lenses:

If satisfactory visual function is achieved only with the use of correction:

(1) in the case of myopia, spectacles or contact lenses should be worn whilst on duty;

(2) in the case of hyperopia, spectacles or contact lenses should be readily available for immediate use;

(3) the correction should provide optimal visual function and be well tolerated;

(4) orthokeratologic lenses should not be used.

AMC15 MED.C.025 Colour vision

Cabin crew members should be able to correctly identify 9 of the first 15 plates of the 24-plate edition of Ishihara pseudoisochromatic plates. Alternatively, cabin crew members should demonstrate that they are colour safe.

AMC16 MED.C.025 Otorhino-laryngology

(a) Hearing should be satisfactory for the safe exercise of cabin crew duties and responsibilities. Cabin crew with hypoacusis should demonstrate satisfactory functional hearing abilities.

(b) Examination

(1) An ear, nose and throat (ENT) examination should form part of all examinations and/or assessments.

(2) Hearing should be tested at all assessments and/or examinations:

(i) the cabin crew member should understand correctly conversational speech when tested with each ear at a distance of 2 meters from and with the cabin crew member's back turned towards the examiner;

(ii) notwithstanding (i) above, hearing should be tested with pure tone audiometry at the initial examination and when clinically indicated;

(iii) at initial examination the cabin crew member should not have a hearing loss of more than 35 dB at any of the frequencies 500 Hz, 1 000 Hz or 2 000 Hz, or more than 50 dB at 3 000 Hz, in either ear separately.

(c) Cabin crew members with:

(1) an active pathological process, acute or chronic, of the internal or middle ear;

(2) unhealed perforation or dysfunction of the tympanic membrane(s);

(3) disturbance of vestibular function;

(4) significant restriction of the nasal passages;

(5) sinus dysfunction;

(6) significant malformation or significant, acute or chronic infection of the oral cavity or upper respiratory tract;

(7) significant disorder of speech or voice

should undergo further medical examination and assessment to establish that the condition does not interfere with the safe exercise of their duties and responsibilities.

AMC17 MED.C.025 Dermatology

In cases where a dermatological condition is associated with a systemic illness, full consideration should be given to the underlying illness before a fit assessment may be made.

AMC18 MED.C.025 Oncology

(a) After treatment for malignant disease, cabin crew members should undergo satisfactory oncological and aero-medical evaluation before a fit assessment may be considered.

(b) Cabin crew members with an established history or clinical diagnosis of intracerebral malignant tumour should be assessed as unfit. Considering the histology of the tumour, a fit assessment may be considered after successful treatment and full recovery.

GM1 MED.C.025 Content of aero-medical assessments

(a) When conducting aero-medical examinations and/or assessments, typical cabin crew duties as listed in (b) and (c), particularly those to be performed during abnormal operations and emergency situations, and cabin crew responsibilities to the travelling public should be considered in order to identify:

(1) any physical and/or mental conditions that could be detrimental to the performance of the duties required from cabin crew; and

(2) which examination(s), test(s) or investigation(s) should be undergone to complete an appropriate aero-medical assessment.

(b) Main cabin crew duties and responsibilities during day-to-day normal operations

(1) During pre/post-flight ground operations with/without passengers on board:

(i) monitoring of situation inside the aircraft cabin and awareness of conditions outside the aircraft including observation of visible aircraft surfaces and information to flight crew of any surface contamination such as ice or snow;

(ii) assistance to special categories of passengers (SCPs) such as infants and children (accompanied or unaccompanied), persons with disabilities or reduced mobility, medical cases with or without medical escort, and inadmissible, deportees and passengers in custody;

(iii) observation of passengers (any suspicious behaviour, passengers under the influence of alcohol and/or drugs, mentally disturbed), observation of potential able-bodied persons, crowd control during boarding and disembarkation;

(iv) safe stowage of cabin luggage, safety demonstrations and cabin secured checks, management of passengers and ground services during re-fuelling, observation of use of portable electronic devices;

(v) preparedness to carry out safety and emergency duties at any time, and security alertness.

(2) During flight:

(i) operation and monitoring of aircraft systems, surveillance of the cabin, lavatories, galleys, crew areas and flight crew compartment;

(ii) coordination with flight crew on situation in the cabin and turbulence events/effects;

(iii) management and observation of passengers (consumption of alcohol, behaviour, potential medical issues), observation of use of portable electronic devices;

(iv) safety and security awareness and preparedness to carry out safety and emergency duties at any time, and cabin secured checks prior to landing.

(c) Main cabin crew duties and responsibilities during abnormal and emergency operations

(1) In case of planned or unplanned emergency evacuation: briefing and/or commands to passengers including SCPs and selection and briefing to able-bodied persons; crowd control monitoring and evacuation conduct including in the absence of command from the flight crew; post-evacuation duties including assistance, first aid and management of survivors and survival in particular environment; activation of applicable communication means towards search and rescue services.

(2) In case of decompression: checking of crew members, passengers, cabin, lavatories, galleys, crew rest areas and flight crew compartment, and administering oxygen to crew members and passengers as necessary.

(3) In case of pilot incapacitation: secure pilot in his/her seat or remove from flight crew compartment; administer first aid and assist operating pilot as required.

(4) In case of fire or smoke: identify source/cause/type of fire/smoke to perform the necessary required actions; coordinate with other cabin crew members and flight crew; select appropriate extinguisher/agent and fight the fire using portable breathing equipment (PBE), gloves, and protective clothing as required; management of necessary passengers movement if possible; instructions to passengers to prevent smoke inhalation/suffocation; give first aid as necessary;

monitor the affected area until landing; preparation for possible emergency landing.

(5) In case of first aid and medical emergencies: assistance to crew members and/or passengers; correct assessment and correct use of therapeutic oxygen, defibrillator, first-aid kits/emergency medical kit contents as required; management of events, of incapacitated person(s) and of other passengers; coordination and effective communication with other crew members, in particular when medical advice is transmitted by frequency to flight crew or by a telecommunication connection.

(6) In case of disruptive passenger behaviour: passenger management as appropriate including use of restraint technique as considered required.

(7) In case of security threats (bomb threat on ground or in-flight and/or hijack): control of cabin areas and passengers' management as required by the type of threat, management of suspicious device, protection of flight crew compartment door.

(8) In case of handling of dangerous goods: observing safety procedures when handling the affected device, in particular when handling chemical substances that are leaking; protection and management of self and passengers and effective coordination and communication with other crew members.

Section 3 - Additional requirements for applicants for, and holders of, a cabin crew attestation

AMC1 MED.C.030 Cabin crew medical report

The cabin crew medical report to be provided in writing to the applicants for, and holders of, a cabin crew attestation after completion of each aero-medical assessment should be issued:

(a) in the national language(s) and/or in English; and

(b) according to the format below, or another format if all, and only, the elements specified below are provided.

CABIN CREW MEDICAL REPORT FOR CABIN CREW ATTESTATION (CCA) APPLICANT OR HOLDER		
(1)	State where the aero-medical assessment of the CCA applicant/holder was conducted:	
(2)	Name of CCA applicant/holder:	
(3)	Nationality of CCA applicant/holder:	
(4)	Date and place of birth of CCA applicant/holder: (*dd/mm/yyyy*)	
(5)	Expiry date of the previous aero-medical assessment: (*dd/mm/yyyy*)	
(6)	Date of the aero-medical assessment: (*dd/mm/yyyy*)	

(7)	Aero-medical assessment: (*fit or unfit*)	
(8)	Limitation(s) if applicable:	
(9)	Date of the next required aero-medical assessment: (*dd/mm/yyyy*)	
(10)	Date of issue and signature of the AME, or OHMP, who issued the cabin crew medical report:	
(11)	Seal or stamp:	
(12)	Signature of CCA applicant/holder:	

AMC1 MED.C.035 Limitations

When assessing whether the holder of a cabin crew attestation may be able to perform cabin crew duties safely if complying with one or more limitations, the following possible limitations should be considered:

(a) a restriction to operate only in multi-cabin crew operations (MCL);

(b) a restriction to specified aircraft type(s) (OAL) or to a specified type of operation (OOL);

(c) a requirement to undergo the next aero-medical examination and/or assessment at an earlier date than required by MED.C.005(b) (TML);

(d) a requirement to undergo specific regular medical examination(s) (SIC);

(e) a requirement for visual correction (CVL), or by means of corrective lenses only (CCL);

(f) a requirement to use hearing aids (HAL); and

(g) special restriction as specified (SSL).

SUBPART D - Aero-medical examiners (AMEs)

AMC1 MED.D.010 Requirements for the issue of an AME certificate

(a) Basic training course for AMEs

The basic training course for AMEs should consist of 60 hours theoretical and practical training, including specific examination techniques.

(b) The syllabus for the basic training course should cover at least the following subjects:

— Introduction to aviation medicine;
— Physics of atmosphere and space;
— Basic aeronautical knowledge;
— Aviation physiology;
— Ophthalmology, including demonstration and practical;
— Otorhinolaryngology, including demonstration and practical;
— Cardiology and general medicine;
— Neurology;
— Psychiatry in aviation medicine;
— Psychology;
— Dentistry;
— Accidents, escape and survival;
— Legislation, rules and regulations;
— Air evacuation, including demonstration and practical;
— Medication and flying.

AMC1 MED.D.015 Requirements for the extension of privileges

(a) Advanced training course for AMEs

The advanced training course for AMEs should consist of another 60 hours of theoretical and practical training, including specific examination techniques.

(b) The syllabus for the advanced training course should cover at least the following subjects:

— Pilot working environment;
— Aerospace physiology, including demonstration and practical;
— Ophthalmology, including demonstration and practical;
— Otorhinolaryngology, including demonstration and practical;
— Cardiology and general medicine, including demonstration and practical;
— Neurology/psychiatry, including demonstration and practical;
— Human factors in aviation, including demonstration and practical;
— Tropical medicine;
— Hygiene, including demonstration and practical;

— Space medicine.

(c) Practical training in an AeMC should be under the guidance and supervision of the head of the AeMC.

(d) After the successful completion of the practical training, a report of demonstrated competency should be issued.

GM1 MED.D.030 Refresher training in aviation medicine

(a) During the period of authorisation, an AME should attend 20 hours of refresher training.

(b) A proportionate number of refresher training hours should be provided by, or conducted under the direct supervision of the competent authority or the Medical Assessor.

(c) Attendance at scientific meetings, congresses and flight deck experience may be approved by the competent authority for a specified number of hours against the training obligations of the AME.

(d) Scientific meetings that should be accredited by the competent authority are:

(1) International Academy of Aviation and Space Medicine Annual Congresses;

(2) Aerospace Medical Association Annual Scientific Meetings; and

(3) other scientific meetings, as organised or approved by the Medical Assessor.

(e) Other refresher training may consist of:

(1) flight deck experience;

(2) jump seat experience;

(3) simulator experience; and

(4) aircraft piloting.

Guidance Material (GM) to Part-CC

Initial issue
19 April 2012

GM to Part-Cabin Crew (Part-CC)

Subpart TRA — TRAINING REQUIREMENTS FOR CABIN CREW ATTESTATION APPLICANTS AND HOLDERS

GM1 Appendix 1 to Part-CC(3) Initial training course and examination

CREW RESOURCE MANAGEMENT TRAINING TABLE

The CRM training table recapitulates all elements relevant to CRM training for cabin crew, indicating:

(a) those elements to be covered during the initial training course and the level to be attained; and

(b) for information those elements, identified as 'not required' for the initial training, which should be covered during other training in accordance with the applicable requirements of Part-ORO (organisation requirements for air operations).

CRM TRAINING TABLE Training elements	Introductory course on CRM
General Principles	
Human factors in aviation; General instructions on CRM principles and objectives; Human performance and limitations.	In depth
Relevant to the individual cabin crew member	
Personality awareness, human error and reliability, attitudes and behaviours, self-assessment; Stress and stress management; Fatigue and vigilance; Assertiveness; situation awareness, information acquisition and processing.	In depth
Relevant to the entire aircraft crew	
Error prevention and detection; Shared situation awareness, information acquisition & processing; Workload management; Effective communication and coordination between all crew members including the flight crew as well as inexperienced cabin crew members, cultural differences; Leadership, cooperation, synergy, decision-making, delegation; Individual and team responsibilities, decision making, and actions; Identification and management of passenger human factors: crowd control, passenger stress, conflict management, medical factors.	Not required
Specifics related to aircraft types (narrow/wide bodies, single/multi deck), flight crew and cabin crew composition and number of passengers	
Relevant to the operator and the organisation (principles)	
Company safety culture, standard operating procedures (SOPs), organisational factors, factors linked to the type of operations; Effective communication and coordination with other operational personnel and ground services; Participation in cabin safety incident and accident reporting.	Not required
Case studies	

Part-ARA

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19 April 2012

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AMC and GM to Annex VI AUTHORITY REQUIREMENTS FOR AIRCREW

(PART-ARA)

SUBPART GEN – GENERAL REQUIREMENTS

SECTION I - GENERAL

GM1 ARA.GEN.105 Definitions

The following provides a list of acronyms used throughout this Annex:

(A)	aeroplane
(H)	helicopter
A/C	aircraft
ACAS	airborne collision avoidance system
AeMC	aero-medical centre
ALARP	as low as reasonably practicable
AMC	Acceptable Means of Compliance
AME	aero-medical examiner
APU	auxiliary power unit
ARA	authority requirements for aircrew
ATO	approved training organisation
ATPL	airline transport pilot licence
BITD	basic instrument training device
bpm	beats per minute
CAT	category
CC	cabin crew
cm	centimetres
CPL	commercial pilot licence
CS	Certification Specification
CS-FSTD(A)	Certification Specifications for aeroplane flight simulation training devices
CS-FSTD(H)	Certification Specifications for helicopter flight simulation training devices
dB	decibel
DH	decision height
DPATO	defined point after take-off
DPBL	decision point before landing
EC	European Community
ECG	electrocardiogram
ENT	ear, nose and throat
EOG	electro-oculography
ETOPS	extended range operations with twin-engined aeroplanes

FANS	future air navigation system
FD	flight director
FEV_1	forced expiratory volume in 1 second
FFS	full flight simulator
FMECA	failure mode, effects and criticality analysis
FMGC	flight management and guidance computer
FMS	flight management system
FNPT	flight navigation and procedures trainer
FSTD	flight simulation training device
FTD	flight training device
FTE	full time equivalent
ft	feet
FVC	forced vital capacity
GM	Guidance Material
GPS	global positioning system
HF	human factors
Hg	mercury
HUD/HUGS	head-up display / head-up guidance system
Hz	Herz
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IGE	in ground effect
ILS	instrument landing system
IOS	instructor operating station
IR	Implementing Rule
IR	instrument rating
kg	kilogram
LDP	landing decision point
LVTO	low visibility take-off
m	metre
mm	millimetre
OGE	out of ground effect
ORA	organisation requirements for aircrew
ORO	organisation requirements for air operations
OSD	operational suitability data
QTG	qualification test guide
POM	proof of match
ROD	rate of descent
RVR	runway visual range
TDP	take-off decision point
VDR	validation data roadmap

AMC1 ARA.GEN.120(d)(3) Means of compliance

GENERAL

The information to be provided to other Member States following approval of an alternative means of compliance should contain a reference to the Acceptable Means of Compliance (AMC) to which such means of compliance provides an alternative, as well as a reference to the corresponding Implementing Rule, indicating as applicable the subparagraph(s) covered by the alternative means of compliance.

GM1 ARA.GEN.120 Means of compliance

GENERAL

Alternative means of compliance used by a competent authority or by organisations under its oversight may be used by other competent authorities or organisations only if processed again in accordance with ARA.GEN.120 (d) and (e).

SECTION II - MANAGEMENT

AMC1 ARA.GEN.200(a) Management system

GENERAL

(a) All of the following should be considered when deciding upon the required organisational structure:

(1) the number of certificates, attestations, authorisations and approvals to be issued;

(2) the number of certified persons and organisations exercising an activity within that Member State, including persons or organisations certified by other competent authorities;

(3) the possible use of qualified entities and of resources of other competent authorities to fulfil the continuing oversight obligations;

(4) the level of civil aviation activity in terms of:

(i) number and complexity of aircraft operated;

(ii) size and complexity of the Member State's aviation industry;

(5) the potential growth of activities in the field of civil aviation.

(b) The set-up of the organisational structure should ensure that the various tasks and obligations of the competent authority do not rely solely on individuals. A continuous and undisturbed fulfilment of these tasks and obligations of the competent authority should also be guaranteed in case of illness, accident or leave of individual employees.

GM1 ARA.GEN.200(a) Management system

GENERAL

(a) The competent authority designated by each Member State should be organised in such a way that:

(1) there is specific and effective management authority in the conduct of all relevant activities;

(2) the functions and processes described in the applicable requirements of Regulation (EC) No 216/2008[1] and its Implementing Rules and AMCs, Certification Specifications (CSs) and Guidance Material (GM) may be properly implemented;

(3) the competent authority's organisation and operating procedures for the implementation of the applicable requirements of Regulation (EC) No 216/2008 and its Implementing Rules are properly documented and applied;

(4) all competent authority personnel involved in the related activities are provided with training where necessary;

(5) specific and effective provision is made for the communication and interface as necessary with the Agency and the competent authorities of other Member States; and

(6) all functions related to implementing the applicable requirements are adequately described.

(b) A general policy in respect of activities related to the applicable requirements of Regulation (EC) No 216/2008 and its Implementing Rules should be developed, promoted and implemented by the manager at the highest appropriate level; for example the manager at the top of the functional area of the competent authority that is responsible for such activities.

(c) Appropriate steps should be taken to ensure that the policy is known and understood by all personnel involved, and all necessary steps should be taken to implement and maintain the policy.

(d) The general policy, whilst also satisfying additional national regulatory responsibilities, should in particular take into account:

(1) the provisions of Regulation (EC) No 216/2008;

(2) the provisions of the applicable Implementing Rules and their AMCs, CSs and GM;

(3) the needs of industry; and

(4) the needs of the Agency and of the competent authority.

(e) The policy should define specific objectives for key elements of the organisation and processes for implementing related activities, including the corresponding control procedures and the measurement of the achieved standard.

AMC1 ARA.GEN.200(a)(1) Management system

DOCUMENTED POLICIES AND PROCEDURES

(a) The various elements of the organisation involved with the activities related to Regulation (EC) No 216/2008 and its Implementing Rules should be documented in order to establish a reference source for the establishment and maintenance of this organisation.

(b) The documented procedures should be established in a way that facilitates their use. They should be clearly identified, kept up-to-date and made readily available to all personnel involved in the related activities.

(c) The documented procedures should cover, as a minimum, all of the following aspects:

(1) policy and objectives;

(2) organisational structure;

(3) responsibilities and associated authority;

(4) procedures and processes;

(5) internal and external interfaces;

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[1] Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC. *OJ L* 79, 19.3.2008, p. 1.

(6) internal control procedures;

(7) training of personnel;

(8) cross-references to associated documents;

(9) assistance from other competent authorities or the Agency (where required).

(d) It is likely that the information is held in more than one document or series of documents, and suitable cross-referencing should be provided. For example, organisational structure and job descriptions are not usually in the same documentation as the detailed working procedures. In such cases it is recommended that the documented procedures include an index of cross-references to all such other related information, and the related documentation should be readily available when required.

AMC1 ARA.GEN.200(a)(2) Management system

QUALIFICATION AND TRAINING - GENERAL

(a) The competent authority should ensure appropriate and adequate training of its personnel to meet the standard that is considered necessary to perform the work. To ensure personnel remain qualified, arrangements should be made for initial and recurrent training as required.

(b) The basic capability of the competent authority's personnel is a matter of recruitment and normal management functions in selection of personnel for particular duties. Moreover, the competent authority should provide training in the basic skills as required for those duties. However, to avoid differences in understanding and interpretation, all personnel should be provided with further training specifically related to Regulation (EC) No 216/2008, its Implementing Rules and related AMCs, CSs and GM, as well as related to the assessment of alternative means of compliance.

(c) The competent authority may provide training through its own training organisation with qualified trainers or through another qualified training source.

(d) When training is not provided through an internal training organisation, adequately experienced and qualified persons may act as trainers, provided their training skills have been assessed. If required, an individual training plan should be established covering specific training skills. Records should be kept of such training and of the assessment, as appropriate.

AMC2 ARA.GEN.200(a)(2) Management system

QUALIFICATION AND TRAINING - INSPECTORS

(a) Initial training programme:

The initial training programme for inspectors should include, as appropriate to their role, current knowledge, experience and skills in at least all of the following:

(1) aviation legislation organisation and structure;

(2) the Chicago Convention, relevant ICAO annexes and documents;

(3) the applicable requirements and procedures;

(4) management systems, including auditing, risk assessment and reporting techniques;

(5) human factors principles;

(6) rights and obligations of inspecting personnel of the competent authority;

(7) 'on-the-job' training;

(8) suitable technical training appropriate to the role and tasks of the inspector, in particular for those areas requiring approvals.

(b) Recurrent training programme:

The recurrent training programme should reflect, at least, changes in aviation legislation and industry. The programme should also cover the specific needs of the inspectors and the competent authority.

GM1 ARA.GEN.200(a)(2) Management system

SUFFICIENT PERSONNEL

(a) This GM on the determination of the required personnel is limited to the performance of certification and oversight tasks, excluding personnel required to perform tasks subject to any national regulatory requirements.

(b) The elements to be considered when determining required personnel and planning their availability may be divided into quantitative and qualitative elements:

(1) Quantitative elements:

(i) the estimated number of initial certificates to be issued;

(ii) the number of organisations certified by the competent authority;

(iii) the number of persons to whom the competent authority has issued a licence, certificate, rating, authorisation or attestation;

(iv) the estimated number of persons and organisations exercising their activity within the territory of the Member State and established or residing in another Member State.

(2) Qualitative elements:

(i) the size, nature and complexity of activities of certified organisations and FSTD qualification certificate holders (cf. AMC1 ORA.GEN.200(b)), taking into account:

(A) privileges of the organisation;

(B) type of approval, scope of approval, multiple certification;

(C) possible certification to industry standards;

(D) types of aircraft / flight simulation training devices (FSTDs) operated;

(E) number of personnel; and

(F) organisational structure, existence of subsidiaries;

(ii) the safety priorities identified;

(iii) the results of past oversight activities, including audits, inspections and reviews, in terms of risks and regulatory compliance, taking into account:

(A) number and level of findings;

(B) timeframe for implementation of corrective actions; and

(C) maturity of management systems implemented by organisations and their ability to effectively manage safety risks, taking into account also information provided by other competent authorities related to activities in the territory of the Member States concerned; and

(iv) the size and complexity of the Member State's aviation industry and the potential growth of activities in the field of civil aviation, which may be an indication of the number of new applications and changes to existing certificates to be expected.

(c) Based on existing data from previous oversight planning cycles and taking into account the situation within the Member State's aviation industry, the competent authority may estimate:

(1) the standard working time required for processing applications for new certificates (for persons, organisations and FSTD qualification);

(2) the number of new certificates to be issued for each planning period; and

(3) the number of changes to existing certificates to be processed for each planning period.

(d) In line with the competent authority's oversight policy, the following planning data should be determined specifically for each type of organisation certified by the competent authority (approved training organisation (ATO) and aero-medical centres (AeMC)) and for FSTD qualification certificate holders:

(1) standard number of audits to be performed per oversight planning cycle;

(2) standard duration of each audit;

(3) standard working time for audit preparation, on-site audit, reporting and follow-up, per inspector;

(4) standard number of ramp and unannounced inspections to be performed;

(5) standard duration of inspections, including preparation, reporting and follow-up, per inspector;

(6) minimum number and required qualification of inspectors for each audit/inspection.

(e) Standard working time could be expressed either in working hours per inspector or in working days per inspector. All planning calculations should then be based on the same unit (hours or working days).

(f) It is recommended to use a spreadsheet application to process data defined under (c) and (d), to assist in determining the total number of working hours / days per oversight planning cycle required for certification, oversight and enforcement activities. This application could also serve as a basis for implementing a system for planning the availability of personnel.

(g) For each type of organisation certified by the competent authority and for FSTD qualification certificate holders the number of working hours / days per planning period for each qualified inspector that may be allocated for certification, oversight and enforcement activities should be determined, taking into account:

(1) purely administrative tasks not directly related to oversight and certification;

(2) training;

(3) participation in other projects;

(4) planned absence; and

(5) the need to include a reserve for unplanned tasks or unforeseeable events.

(h) The determination of working time available for certification, oversight and enforcement activities should also consider:

(1) the possible use of qualified entities; and

(2) possible cooperation with other competent authorities for approvals involving more than one Member State.

(i) Based on the elements listed above, the competent authority should be able to:

(1) monitor dates when audits and inspections are due and when they have been carried out;

(2) implement a system to plan the availability of personnel; and

(3) identify possible gaps between the number and qualification of personnel and the required volume of certification and oversight.

Care should be taken to keep planning data up-to-date in line with changes in the underlying planning assumptions, with particular focus on risk-based oversight principles.

AMC1 ARA.GEN.210(d) Management system

PROCEDURES AVAILABLE TO THE AGENCY

(a) Copies of the procedures related to the competent authority's management system and their amendments to be made available to the Agency for the purpose of standardisation should provide at least the following information:

(1) Regarding continuing oversight functions undertaken by the competent authority, the competent authority's organisational structure with description of the main processes.

This information should demonstrate the allocation of responsibilities within the competent authority, and that the competent authority is capable of carrying out the full range of tasks regarding the size and complexity of the Member State's aviation industry. It should also consider overall proficiency and authorisation scope of competent authority personnel.

(2) For personnel involved in oversight activities, the minimum professional qualification requirements and experience and principles guiding appointment (e.g. assessment).

(3) How the following are carried out: assessing applications and evaluating compliance, issuance of certificates, performance of continuing oversight, follow-up of findings, enforcement measures and resolution of safety concerns.

(4) Principles of managing exemptions and derogations.

(5) Processes in place to disseminate applicable safety information for timely reaction to a safety problem.

(6) Criteria for planning continuing oversight (oversight programme), including adequate management of interfaces when conducting continuing oversight (air operations, flight crew licensing, continuing airworthiness management for example).

(7) Outline of the initial training of newly recruited oversight personnel (taking future activities into account), and the basic framework for continuation training of oversight personnel.

(b) As part of the continuous monitoring of a competent authority, the Agency may request details of the working methods used, in addition to the copy of the procedures of the competent authority's management system (and amendments). These additional details are the procedures and related guidance material describing working methods for competent authority personnel conducting oversight.

(c) Information related to the competent authority's management system may be submitted in electronic format.

GM1 ARA.GEN.205 Allocation of tasks to qualified entities

CERTIFICATION TASKS

The tasks that may be performed by a qualified entity on behalf of the competent authority include those related to the initial certification and continuing oversight of persons and organisations as defined in this Regulation, with the exclusion of the issuance of certificates, licences, ratings or approvals.

AMC1 ARA.GEN.220(a) Record-keeping

GENERAL

(a) The record-keeping system should ensure that all records are accessible whenever needed within a reasonable time. These records should be organised in a way that ensures traceability and retrievability throughout the required retention period.

(b) Records should be kept in paper form or in electronic format or a combination of both media. Records stored on microfilm or optical disc form are also acceptable. The records should remain legible and accessible throughout the required retention period. The retention period starts when the record has been created.

(c) Paper systems should use robust material, which can withstand normal handling and filing. Computer systems should have at least one backup system, which should be updated within 24 hours of any new entry. Computer systems should include safeguards against unauthorised alteration of data.

(d) All computer hardware used to ensure data backup should be stored in a different location from that containing the working data and in an environment that ensures they remain in good condition. When hardware- or software-changes take place, special care should be taken that all necessary data continue to be accessible at least through the full period specified in the relevant Subpart or by default in ARA.GEN.220 (c).

AMC1 ARA.GEN.220(a)(1);(2);(3) Record-keeping

COMPETENT AUTHORITY MANAGEMENT SYSTEM

Records related to the competent authority's management system should include, as a minimum and as applicable:

(a) the documented policies and procedures;

(b) the personnel files of competent authority personnel, with supporting documents related to training and qualifications;

(c) the results of the competent authority's internal audit and safety risk management processes, including audit findings and corrective actions; and

(d) the contract(s) established with qualified entities performing certification or oversight tasks on behalf of the competent authority.

AMC1 ARA.GEN.220(a)(4) Record-keeping

ORGANISATIONS

Records related to an organisation certified by the competent authority should include, as appropriate to the type of organisation:

(a) the application for an organisation approval;

(b) the documentation based on which the approval has been granted and any amendments to that documentation;

(c) the organisation approval certificate including any changes;

(d) a copy of the continuing oversight programme listing the dates when audits are due and when such audits were carried out;

(e) continuing oversight records including all audit and inspection records;

(f) copies of all relevant correspondence;

(g) details of any exemption and enforcement actions;

(h) any report from other competent authorities relating to the oversight of the organisation; and

(i) a copy of any other document approved by the competent authority.

GM1 ARA.GEN.220(a)(4) Record-keeping

ORGANISATIONS - DOCUMENTATION

Documentation to be kept as records in support of the approval include the management system documentation, including any technical manuals, such as the operations manual, and training manual, that have been submitted with the initial application, and any amendments to these documents.

AMC1 ARA.GEN.220(a)(5) Record-keeping

PERSONS

Records related to personnel licences, certificates, ratings, authorisations or attestations issued by the competent authority should include, as a minimum:

(a) the application for a licence, certificate, rating, authorisation or attestation or change to a licence, certificate, rating, authorisation or attestation;

(b) documentation in support of the application for a licence, certificate, rating, authorisation or attestation or change to a licence, certificate, rating, authorisation or attestation, covering as applicable:

    (1) theoretical examination(s);

    (2) skill test(s);

(3) proficiency check(s); and

(4) certificates attesting required experience;

(c) a copy of the licence or certificate including any changes;

(d) all relevant correspondence or copies thereof;

(e) details of any exemption;

(f) details of any enforcement action(s); and

(g) any report from other competent authorities relating to personnel licences, certificates, ratings, authorisations or attestations issued by the competent authority.

AMC1 ARA.GEN.220(a)(7) Record-keeping

ACTIVITIES PERFORMED IN THE TERRITORY OF A MEMBER STATE BY PERSONS OR ORGANISATIONS ESTABLISHED OR RESIDING IN ANOTHER MEMBER STATE

(a) Records related to the oversight of activities performed in the territory of a Member State by persons or organisations established or residing in another Member State should include, as a minimum:

(1) oversight records including all audit and inspection records and related correspondence;

(2) copies of all relevant correspondence to exchange information with other competent authorities relating to the oversight of such persons/organisations;

(3) details of any enforcement measures and penalties; and

(4) any report from other competent authorities relating to the oversight of these persons/organisations, including any notification of evidence showing non-compliance with the applicable requirements.

(b) Records should be kept by the competent authority having performed the audit or inspection and should be made available to other competent authorities at least in the following cases:

(1) serious incidents or accidents;

(2) findings through the oversight programme where organisations certified by another competent authority are involved, to determine the root cause;

(3) an organisation being certified or having approvals in several Member States.

(c) When records are requested by another competent authority, the reason for the request should be clearly stated.

(d) The records can be made available by sending a copy or by allowing access to them for consultation.

GM1 ARA.GEN.220 Record-keeping

GENERAL

Records are required to document results achieved or to provide evidence of activities performed. Records become factual when recorded. Therefore, they are not subject to version control. Even when a new record is produced covering the same issue, the previous record remains valid.

SECTION III - OVERSIGHT, CERTIFICATION AND ENFORCEMENT

AMC1 ARA.GEN.300(a);(b);(c) Oversight

EVALUATION OF APPROVED TRAINING ORGANISATIONS' OPERATIONAL SAFETY RISK ASSESSMENT

As part of the initial certification or the continuing oversight of an ato, the competent authority should normally evaluate its safety risk assessment processes related to hazards identified by the ATO as having an interface with its operations. These safety risk assessments should be identifiable processes of the ato's management system. As part of its continuing oversight, the competent authority should also remain satisfied as to the effectiveness of these safety risk assessments.

(a) General methodology for operational hazards
The competent authority should establish a methodology for evaluating the safety risk assessment processes of the ATO's management system.
When related to operational hazards, the competent authority's evaluation under its normal oversight process should be considered satisfactory if the ATO demonstrates its competence and capability to:

(1) understand the hazards identified and their consequences on its operations;
(2) be clear on where these hazards may exceed acceptable safety risk limits;
(3) identify and implement mitigations including suspension of operations where mitigation cannot reduce the risk to within safety risk limits;
(4) develop and execute effectively, robust procedures for the preparation and the safe operation of the flights subject to the hazards identified;
(5) assess the competence and currency of its staff in relation to the duties for the intended operations and implement any necessary training; and
(6) ensure sufficient numbers of qualified and competent staff for such duties.

The competent authority should take into account:

(1) the ATO's recorded mitigations for each unacceptable risk identified are in place;
(2) the operational procedures specified by the ATO with the most significance to safety appear to be robust; and
(3) that the staff on which the ATO depends in respect of those duties necessary for the intended operations are trained and assessed as competent in the relevant procedures.

EVALUATION OF APPROVED TRAINING ORGANISATIONS' VOLCANIC ASH SAFETY RISK ASSESSMENT

In addition to the general methodology for operational hazards, the competent authority's evaluation under its normal oversight process should also assess the ATO's competence and capability to:
(1) choose the correct information sources to use to interpret the information related to volcanic ash contamination forecast and to resolve correctly any conflicts among such sources; and
(2) take account of all information from its type certificate holders (TCHs) concerning volcanic ash-related airworthiness aspects of the aircraft it operates, and the related pre-flight, in-flight and post flight precautions to be observed;

GM1 ARA.GEN.300(a);(b);(c) Oversight

VOLCANIC ASH SAFETY RISK ASSESSMENT - ADDITIONAL GUIDANCE
Further guidance on the assessment of an ATO volcanic ash safety risk assessment is given in ICAO Doc. 9974 (Flight safety and volcanic ash – Risk management of flight operations with known or forecast volcanic ash contamination).

GM1 ARA.GEN.300(d) Oversight

ACTIVITIES WITHIN THE TERRITORY OF THE MEMBER STATE

(a) Activities performed in the territory of the Member State by persons or organisations established or residing in another Member State include:

(1) activities of organisations certified by the competent authority of any other Member State or the Agency;

(2) activities of persons holding a licence, certificate, rating, or attestation issued by the competent authority of any other Member State; and

(3) activities of persons making declarations to the competent authority of any other Member State.

(b) Audits and inspections of such activities, including ramp and unannounced inspections, should be prioritised towards those areas of greater safety concern, as identified through the analysis of data on safety hazards and their consequences in operations.

AMC1 ARA.GEN.305(b) Oversight programme

SPECIFIC NATURE AND COMPLEXITY OF THE ORGANISATION, RESULTS OF PAST OVERSIGHT

(a) When determining the oversight programme for an organisation the competent authority should consider in particular the following elements, as applicable:

 (1) the implementation by the organisation of industry standards, directly relevant to the organisation's activity subject to this Regulation;

 (2) the procedure applied for and scope of changes not requiring prior approval;

 (3) specific approvals held by the organisation;

 (4) specific procedures implemented by the organisation related to any alternative means of compliance used.

(b) For the purpose of assessing the complexity of an organisation's management system, AMC1 ORA.GEN.200(b) should be used.

(c) Regarding results of past oversight, the competent authority should also take into account relevant results of ramp inspections of organisations it has certified that were performed in other Member States in accordance with ARO.RAMP.

AMC1 ARA.GEN.305(b)(1) Oversight programme

AUDIT

(a) The oversight programme should indicate which aspects of the approval will be covered with each audit.

(b) Part of an audit should concentrate on the organisation's compliance monitoring reports produced by the compliance monitoring personnel to determine if the organisation is identifying and correcting its problems.

(c) At the conclusion of the audit, an audit report should be completed by the auditing inspector, including all findings raised.

AMC2 ARA.GEN.305(b)(1) Oversight programme

RAMP INSPECTIONS

When conducting a ramp inspection of aircraft used by organisations under its regulatory oversight the competent authority should, in as far as possible, comply with the requirements defined in ARO.RAMP.

AMC1 ARA.GEN.305(b);(c) Oversight programme

INDUSTRY STANDARDS

(a) For organisations having demonstrated compliance with industry standards, the competent authority may adapt its oversight programme, in order to avoid duplication of specific audit items.

(b) Demonstrated compliance with industry standards should not be considered in isolation from the other elements to be considered for the competent authority's risk-based oversight.

(c) In order to be able to credit any audits performed as part of certification in accordance with industry standards, the following should be considered:

 (1) the demonstration of compliance is based on certification auditing schemes providing for independent and systematic verification;

(2) the existence of an accreditation scheme and accreditation body for certification in accordance with the industry standards has been verified;

(3) certification audits are relevant to the requirements defined in Annex VII (Part-ORA) and other Annexes to this Regulation as applicable;

(4) the scope of such certification audits can easily be mapped against the scope of oversight in accordance with Part-ORA;

(5) audit results are accessible to the competent authority and open to exchange of information in accordance with Article 15(1) of Regulation (EC) No 216/2008; and

(6) the audit planning intervals of certification audits i.a.w. industry standards are compatible with the oversight planning cycle.

AMC1 ARA.GEN.305(c) Oversight programme

OVERSIGHT PLANNING CYCLE

(a) When determining the oversight planning cycle and defining the oversight programme, the competent authority should assess the risks related to the activity of each organisation and adapt the oversight to the level of risk identified and to the organisation's ability to effectively manage safety risks.

(b) The competent authority should establish a schedule of audits and inspections appropriate to each organisation. The planning of audits and inspections should take into account the results of the hazard identification and risk assessment conducted and maintained by the organisation as part of the organisation's management system. Inspectors should work in accordance with the schedule provided to them.

(c) When the competent authority, having regard to an organisation's safety performance, varies the frequency of an audit or inspection it should ensure that all aspects of the organisation's activity are audited and inspected within the applicable oversight planning cycle.

(d) The section(s) of the oversight programme dealing with ramp inspections should be developed based on geographical locations, taking into account aerodrome activity, and focusing on key issues that can be inspected in the time available without unnecessarily delaying the operations.

AMC2 ARA.GEN.305(c) Oversight programme

OVERSIGHT PLANNING CYCLE

(a) For each organisation certified by the competent authority and each FSTD qualification certificate holder all processes should be completely audited at periods not exceeding the applicable oversight planning cycle. The beginning of the first oversight planning cycle is normally determined by the date of issue of the first certificate. If the competent authority wishes to align the oversight planning cycle with the calendar year, it should shorten the first oversight planning cycle accordingly.

(b) The interval between two audits for a particular process should not exceed the interval of the applicable oversight planning cycle.

(c) Audits should include at least one on-site audit within each oversight planning cycle. For organisations exercising their regular activity at more than one site, the determination of the sites to be audited should consider the results of past oversight, the volume of activity at each site, as well as main risk areas identified.

(d) For organisations holding more than one certificate, the competent authority may define an integrated oversight schedule to include all applicable audit items. In order to avoid duplication of audits, credit may be granted for specific audit items already completed during the current oversight planning cycle, subject to four conditions:

(1) the specific audit item should be the same for all certificates under consideration;

(2) there should be satisfactory evidence on record that such specific audit items were carried out and that all corrective actions have been implemented to the satisfaction of the competent authority;

(3) the competent authority should be satisfied that there is no reason to believe standards have deteriorated in respect of those specific audit items being granted a credit;

(4) the interval between two audits for the specific item being granted a credit should not exceed the applicable oversight planning cycle.

AMC1 ARA.GEN.305(d) Oversight programme

PERSONS HOLDING A LICENCE, CERTIFICATE, RATING OR ATTESTATION

The oversight of persons holding a licence, certificate, rating or attestation should normally be ensured as part of the oversight of organisations. Additionally, the competent authority should verify compliance with applicable requirements when endorsing or renewing ratings.

To properly discharge its oversight responsibilities, the competent authority should perform a certain number of unannounced verifications.

AMC1 ARA.GEN.310(a) Initial certification procedure – organisations

VERIFICATION OF COMPLIANCE

(a) In order to verify the organisation's compliance with the applicable requirements, the competent authority should conduct an audit of the organisation, including interviews of personnel and inspections carried out at the organisation's facilities.

(b) The competent authority should only conduct such audit after being satisfied that the application shows compliance with the applicable requirements.

(c) The audit should focus on the following areas:

(1) detailed management structure, including names and qualifications of personnel required by ORA.GEN.210 and adequacy of the organisation and management structure;

(2) personnel:

(i) adequacy of number and qualifications with regard to the intended terms of approval and associated privileges;

(ii) validity of licences, ratings, certificates or attestations as applicable;

(3) processes for safety risk management and compliance monitoring;

(4) facilities – adequacy with regard to the organisation's scope of work;

(5) documentation based on which the certificate should be granted (organisation documentation as required by Part-ORA, including technical manuals, such as operations manual or training manual).

(d) In case of non-compliance, the applicant should be informed in writing of the corrections that are required.

(e) In cases where an application for an organisation certificate is refused, the applicant should be informed of the right of appeal as exists under national law.

AMC1 ARA.GEN.315(a) Procedure for issue, revalidation, renewal or change of licences, ratings or certificates – persons

VERIFICATION OF COMPLIANCE

(a) In order to verify that the applicant meets the requirements, the competent authority should review the application and any supporting documents submitted, for completeness and compliance with applicable requirements.

(b) As part of the verification that the applicant meets the requirements, the competent authority should check that he/she:

(1) was not holding any personnel licence, certificate, rating, authorisation or attestation with the same scope and in the same category issued in another Member State;

(2) has not applied for any personnel licence, certificate, rating, authorisation or attestation with the same scope and in the same category in another Member State; and

(3) has never held any personnel licence, certificate, rating, authorisation or attestation with the same scope and in the same category issued in another Member State which was revoked or suspended in any other Member State.

(c) The competent authority should request the applicant to make a declaration covering items (b)(1) to (b)(3). Such declaration should include a statement that any incorrect information could disqualify the applicant from being granted a personnel licence, certificate, rating, authorisation or attestation. In case of doubts, the competent authority should contact the competent authority of the Member State where the applicant may have previously held any personnel licence, certificate, rating, authorisation or attestation.

AMC1 ARA.GEN.330 Changes – organisations

GENERAL

(a) Changes in nominated persons:

The competent authority should be informed of any changes to personnel specified in Part-ORA that may affect the certificate or terms of approval/approval schedule attached to it. When an organisation submits the name of a new nominee for any of the persons nominated as per ORA.GEN.210 (b), the competent authority should require the organisation to produce a written résumé of the proposed person's qualifications. The competent authority should reserve the right to interview the nominee or call for additional evidence of his/her suitability before deciding upon his/her acceptability.

(b) A simple management system documentation status sheet should be maintained, which contains information on when an amendment was received by the competent authority and when it was approved.

(c) The organisation should provide each management system documentation amendment to the competent authority, including for the amendments that do not require prior approval by the competent authority. Where the amendment requires competent authority approval, the competent authority, when satisfied, should indicate its approval in writing. Where the amendment does not require prior approval, the competent authority should acknowledge receipt in writing within 10 working days.

(d) For changes requiring prior approval, in order to verify the organisation's compliance with the applicable requirements, the competent authority should conduct an audit of the organisation, limited to the extent of the changes. If required for verification, the audit should include interviews and inspections carried out at the organisation's facilities.

GM1 ARA.GEN.330 Changes – organisations

CHANGE OF NAME OF THE ORGANISATION

(a) On receipt of the application and the relevant parts of the organisation's documentation as required by Part-ORA, the competent authority should re-issue the certificate.

(b) A name change alone does not require the competent authority to audit the organisation, unless there is evidence that other aspects of the organisation have changed.

GM1 ARA.GEN.350 Findings and corrective actions – organisations

TRAINING

For a level 1 finding it may be necessary for the competent authority to ensure that further training by the organisation is carried out and audited by the competent authority before the activity is resumed, dependent upon the nature of the finding.

GM1 AMC1-ARA.GEN.355(e) Findings and enforcement measures – persons

This provision is necessary to ensure that enforcement measures will be taken also in cases where the competent authority may not act on the licence, certificate or attestation. The type of enforcement measure will depend on the applicable national law and may include for example the payment of a fine or the prohibition from exercising.

It covers two cases:

(a) persons subject to the requirements laid down in Regulation (EC) No 216/2008 and its Implementing Rules who are not required to hold a licence, certificate or attestation - for example general medical practitioners (GMPs); and

(b) persons who are required to hold a licence, rating, certificate or attestation, but who do not hold the appropriate licence, rating, certificate or attestation as required for the activity they perform.

SUBPART FCL - SPECIFIC REQUIREMENTS RELATING TO FLIGHT CREW LICENSING

SECTION II - LICENCES, RATINGS AND CERTIFICATES

AMC1 ARA.FCL.205 Monitoring of examiners

QUALIFICATION OF INSPECTORS

Inspectors of the competent authority supervising examiners should ideally meet the same requirements as the examiners being supervised. However, it is unlikely that they could be so qualified on the large variety of types and tasks for which they have a responsibility and, since they normally only observe training and testing, it is acceptable if they are qualified for the role of an inspector.

SECTION III - THEORETICAL KNOWLEDGE EXAMINATIONS

AMC1 ARA.FCL.300 Examination procedures

GENERAL

(a) The competent authority should provide suitable facilities for the conduct of examinations.

(b) The content of the examination papers should retain a confidential status until the end of the examination session.

(c) The identity of the applicant should be confirmed before an examination is taken.

(d) Examination applicants should be seated in a way so that they cannot read each other's examination papers. They should not speak to any person other than the invigilators.

(e) All examination papers, associated documents and additional papers handed out to the applicants for the examination should be handed back to the invigilator at the end of the examination.

(f) Only the examination paper, specific documentation and tools needed for the examination should be available to the applicant during the examination.

(g) Applicants may use the following equipment during an examination:

  (1) a scientific, non-programmable, non-alphanumeric calculator without specific aviation functions;

  (2) mechanical navigation slide-rule (DR calculator);

  (3) protractor;

  (4) compasses and dividers;

  (5) ruler.

(h) Applicants may use a translation dictionary at the discretion of the competent authority.

(i) Except equipment specified above, applicant(s) should not use any electronic equipment during the examination(s).

AMC1 ARA.FCL.300(b) Examination procedures

THEORETICAL KNOWLEDGE EXAMINATIONS FOR PROFESSIONAL LICENCES AND INSTRUMENT RATINGS

With regard to the IR(A), this table applies to theoretical knowledge examinations for applicants who have completed a modular training course for the IR(A) according to Appendix 6 section A.

Subject: 010 - AIR LAW						
Theoretical knowledge examination						
Exam length, total number of questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:00	0:45	1:00	0:45	0:45	0:45
Distribution of questions with regard to the topics of the syllabus						
010 01	3	2	3	3	2	XX
010 02	2	2	2	2	2	XX
010 03	1	1	1	1	1	XX
010 04	2	2	2	2	2	1
010 05	8	8	8	8	8	8
010 06	7	4	7	3	4	7
010 07	5	3	5	3	3	5
010 08	2	2	2	2	2	2
010 09	6	4	6	4	4	6
010 10	2	1	2	1	1	XX
010 11	2	2	2	2	2	XX
010 12	2	1	2	1	1	XX
010 13	2	1	2	1	1	XX
Total questions	44	33	44	33	33	29

Subject: 021 - AIRCRAFT GENERAL KNOWLEDGE - AIRFRAME/SYSTEMS/POWER PLANT
Theoretical knowledge examination
Exam length, total number of questions and distribution of questions

	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	2:00	1:30	2:00	2:00	1:30	XX
Distribution of questions with regard to the topics of the syllabus						
021 01	04	02	04	04	02	XX
021 02	04	04	04	04	02	XX
021 03	05	02	04	04	03	XX
021 04	05	06	04	04	02	XX
021 05	07	04	06	06	03	XX
021 06	05	04	04	04	02	XX
021 07	04	04	02	02	02	XX
021 08	06	04	04	04	04	XX
021 09	06	06	06	06	04	XX
021 10	06	14	06	06	08	XX
021 11	20	06	20	20	13	XX
021 12	04	02	02	02	02	XX
021 13	04	02	XX	XX	XX	XX
021 14	XX	XX	01	01	01	XX
021 15	XX	XX	04	04	03	XX
021 16	XX	XX	06	06	05	XX
021 17	XX	XX	03	03	04	XX
Total questions	80	60	80	80	60	XX

Subject: 022 - AIRCRAFT GENERAL KNOWLEDGE - INSTRUMENTATION						
Theoretical knowledge examination						
Exam length, total number of questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:30	1:00	1:30	1:30	1:00	0:30
Distribution of questions with regard to the topics of the syllabus						
022 01	08	08	08	08	08	XX
022 02	08	06	08	08	06	06
022 03	04	04	04	04	04	04
022 04	04	05	06	06	05	04
022 05	05	XX	03	03	XX	XX
022 06	08	06	XX	XX	XX	XX
022 07	XX	XX	14	14	08	XX
022 08	03	02	XX	XX	XX	XX
022 09	02	XX	XX	XX	XX	XX
022 10	02	XX	XX	XX	XX	XX
022 11	04	XX	04	04	XX	XX
022 12	06	04	06	06	04	03
022 13	04	04	05	05	04	03
022 14	01	XX	01	01	XX	XX
022 15	01	XX	01	01	XX	XX
Total questions	60	39	60	60	39	20

Subject: 031 - FLIGHT PERFORMANCE AND PLANNING - MASS AND BALANCE						
Theoretical knowledge examination						
Exam length, total number of questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:00	1:00	1:00	1:00	1:00	XX
Distribution of questions with regard to the topics of the syllabus						
031 01	03	03	03	03	03	XX
031 02	05	05	05	05	05	XX
031 03	05	05	05	05	05	XX
031 04	05	05	05	05	05	XX
031 05	05	05	05	05	05	XX
031 06	02	02	02	02	02	XX
Total questions	25	25	25	25	25	XX

Subject: 032 - FLIGHT PERFORMANCE AND PLANNING - PERFORMANCE (AEROPLANES)						
Theoretical knowledge examination						
Exam length, total number of questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:00	0:45	XX	XX	XX	XX
Distribution of questions with regard to the topics of the syllabus						
032 01	05	05	XX	XX	XX	XX
032 02	10	10	XX	XX	XX	XX
032 03	10	10	XX	XX	XX	XX
032 04	10	XX	XX	XX	XX	XX
Total questions	35	25	XX	XX	XX	XX

Subject: 033 - FLIGHT PERFORMANCE AND PLANNING - FLIGHT PLANNING AND MONITORING						
Theoretical knowledge examination						
Exam length, total number of questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	2:00	1:30	2:00	1:30	1:30	1:30
Distribution of questions with regard to the topics of the syllabus						
033 01	05	05	05	05	05	XX
033 02	10	XX	10	XX	XX	10
033 03	10	10	10	10	10	05
033 04	08	08	08	08	08	08
033 05	05	05	05	05	05	05
033 06	05	05	05	05	05	05
Total questions	43	33	43	33	33	33

Subject: 034 - FLIGHT PERFORMANCE AND PLANNING - PERFORMANCE (HELICOPTERS)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	XX	XX	1:00	1:00	0:45	XX
Distribution of questions with regard to the topics of the syllabus						
034 01	XX	XX	15	15	15	XX
034 02	XX	XX	05	05	05	XX
034 03	XX	XX	05	05	XX	XX
034 04	XX	XX	10	10	XX	XX
Total questions	XX	XX	35	35	20	XX

Subject: 040 - HUMAN PERFORMANCE						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:00	0:45	1:00	1:00	0:45	0:45
Distribution of questions with regard to the topics of the syllabus						
040 01	02	01	02	02	01	01
040 02	33	26	33	33	26	26
040 03	13	09	13	13	09	09
Total questions	48	36	48	48	36	36

Subject: 050 - METEOROLOGY						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	2:00	1:30	2:00	2:00	1:30	1:30
Distribution of questions with regard to the topics of the syllabus						
050 01	11	09	11	11	09	09
050 02	11	06	11	11	06	06
050 03	04	04	04	04	04	04
050 04	07	06	07	07	06	06
050 05	03	03	03	03	03	03
050 06	07	07	07	07	07	07
050 07	06	02	06	06	02	02
050 08	08	03	08	08	03	03
050 09	11	09	11	11	09	09
050 10	16	14	16	16	14	14
Total questions	84	63	84	84	63	63

Subject: 061 - GENERAL NAVIGATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	2:00	1:30	2:00	2:00	1:30	XX
Distribution of questions with regard to the topics of the syllabus						
061 01	12	07	12	12	07	XX
061 02	04	04	04	04	04	XX
061 03	14	12	14	14	12	XX
061 04	16	11	16	16	11	XX
061 05	14	11	14	14	11	XX
Total questions	60	45	60	60	45	XX

Subject: 062 - RADIO NAVIGATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:30	0:30	1:30	1:00	0:30	1:00
Distribution of questions with regard to the topics of the syllabus						
062 01	07	04	07	05	04	02
062 02	21	12	21	15	12	23
062 03	12	02	12	08	02	05
062 04	XX	XX	XX	XX	XX	XX
062 05	15	XX	15	XX	XX	10
062 06	11	04	11	06	04	04
Total questions	66	22	66	34	22	44

Subject: 070 - OPERATIONAL PROCEDURES						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:15	0:45	1:00	1:00	0:45	XX
Distribution of questions with regard to the topics of the syllabus						
071 01	25	18	18	18	14	XX
071 02	20	12	14	14	12	XX
071 03	XX	XX	06	06	04	XX
Total questions	45	30	38	38	30	XX

Subject: 081 - PRINCIPLES OF FLIGHT (AEROPLANES)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:00	0:45	XX	XX	XX	XX
Distribution of questions with regard to the topics of the syllabus						
081 01	17	14	XX	XX	XX	XX
081 02	06	XX	XX	XX	XX	XX
081 03	XX	XX	XX	XX	XX	XX
081 04	06	06	XX	XX	XX	XX
081 05	04	03	XX	XX	XX	XX
081 06	03	03	XX	XX	XX	XX
081 07	04	03	XX	XX	XX	XX
081 08	04	04	XX	XX	XX	XX
Total questions	44	33	XX	XX	XX	XX

Subject: 082 - PRINCIPLES OF FLIGHT (HELICOPTERS)						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	XX	XX	1:00	1:00	1:00	XX
Distribution of questions with regard to the topics of the syllabus						
082 01	XX	XX	05	05	05	XX
082 02	XX	XX	03	03	03	XX
082 03	XX	XX	01	01	01	XX
082 04	XX	XX	12	12	12	XX
082 05	XX	XX	10	10	10	XX
082 06	XX	XX	05	05	05	XX
082 07	XX	XX	05	05	05	XX
082 08	XX	XX	03	03	03	XX
Total questions	XX	XX	44	44	44	XX

Subject: 091 - VFR COMMUNICATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	00:30	00:30	00:30	00:30	00:30	XX
Distribution of questions with regard to the topics of the syllabus						
091 01	05	05	05	05	05	XX
091 02	11	11	11	11	11	XX
091 03	02	02	02	02	02	XX
091 04	02	02	02	02	02	XX
091 05	02	02	02	02	02	XX
091 06	02	02	02	02	02	XX
Total questions	24	24	24	24	24	XX

Subject: 092 - IFR COMMUNICATION						
Theoretical knowledge examination						
Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	00:30	XX	00:30	XX	XX	00:30
Distribution of questions with regard to the topics of the syllabus						
092 01	05	XX	05	XX	XX	05
092 02	11	XX	11	XX	XX	11
092 03	02	XX	02	XX	XX	02
092 04	02	XX	02	XX	XX	02
092 05	02	XX	02	XX	XX	02
092 06	02	XX	02	XX	XX	02
092 07	XX	XX	XX	XX	XX	XX
Total questions	24	XX	24	XX	XX	24

AMC2 ARA.FCL.300(b) Examination procedures

THEORETICAL KNOWLEGDE EXAMINATIONS FOR THE EN-ROUTE INSTRUMENT RATING (EIR) AND THE INSTRUMENT RATING (IR) OBTAINED THROUGH THE COMPETENCY-BASED MODULAR TRAINING COURSE

The following tables contain the number of questions, the distribution of questions related to the different syllabus topics and the time allowed for the theoretical knowledge examination.

Subject: 010 — AIR LAW Theoretical knowledge examination Exam length and total questions	
Time allowed	EIR FCL.825 & IR(A) Appendix 6 Aa 0:30
Distribution of questions with regard to the topics of the syllabus	
010 04 010 05	01 05
010 06 010 07 010 08	06 03 01
010 09 Total questions	02 18

Subject: 022 — AIRCRAFT GENERAL KNOWLEDGE — INSTRUMENTATION	
Theoretical knowledge examination	
Exam length and total questions	
Time allowed	EIR FCL.825 & IR(A) Appendix 6 Aa 0:20
Distribution of questions with regard to the topics of the syllabus	
022 02	05

Subject: 033 — FLIGHT PERFORMANCE AND PLANNING — FLIGHT PLANNING AND MONITORING	
Theoretical knowledge examination	
Exam length and total questions	
	EIR FCL.825 & IR(A) Appendix 6 Aa
Time allowed	0:40
Distribution of questions with regard to the topics of the syllabus	
033 02	10
033 03	4
033 04	7
033 05	5
Total questions	26

Subject: 040 — HUMAN PERFORMANCE Theoretical knowledge examination	
Exam length and total questions	
Time allowed	EIR FCL.825 & IR(A) Appendix 6 Aa 0:20
Distribution of questions with regard to the topics of the syllabus	
040 01	01
040 02	07
040 03	04
Total questions	12

Subject: 050 — METEOROLOGY Theoretical knowledge examination Exam length and total questions	
Time allowed	EIR FCL.825 & IR(A) Appendix 6 Aa 0:50
Distribution of questions with regard to the topics of the syllabus	
050 01	05
050 02	03
050 03 050 04 050 05 050 06	01 05 03 05
050 08	01
050 09	07
050 10	05
Total questions	35

'Subject: 062 — RADIO NAVIGATION						
Theoretical knowledge examination Exam length, total questions and distribution of questions						
	ATPL(A)	CPL(A)	ATPL(H)/IR	ATPL(H)	CPL(H)	IR(A) & (H)
Time allowed (hours)	1:30	0:30	1:30	1:00	0:30	1:00
Distribution of questions with regard to the topics of the syllabus						
062 01	07	04	07	05	04	02
062 02	21	12	21	15	12	23
062 03	12	02	12	08	02	05
062 04	XX	XX	XX	XX	XX	XX
062 05	10	XX	10	XX	XX	05
062 06	11	04	11	06	04	04
062 07	05	XX	05	XX	XX	05
Total questions	66	22	66	34	22	44'

Subject: 092 — IFR COMMUNICATION Theoretical knowledge examination Exam length and total questions	
Time allowed	EIR FCL.825 & IR(A) Appendix 6 Aa 0:30
Distribution of questions with regard to the topics of the syllabus	
092 01	05
092 02 092 03 092 04	10 02 02
092 05 092 06 Total questions	02 02 23

SUBPART CC – SPECIFIC REQUIREMENTS RELATING TO CABIN CREW

SECTION II – ORGANISATIONS PROVIDING CABIN CREW TRAINING OR ISSUING CABIN CREW ATTESTATIONS

AMC1 ARA.CC.200(b)(2) Approval of organisations to provide cabin crew training or to issue cabin crew attestations

PERSONNEL CONDUCTING EXAMINATIONS

For any element being examined for the issue of a cabin crew attestation as required in Part-CC, the person who delivered the associated training or instruction should not also conduct the examination. However, if the organisation has appropriate procedures in place to avoid conflict of interest regarding the conduct of the examination and/or the results, this restriction need not apply.

SUBPART ATO – SPECIFIC REQUIREMENTS RELATED TO APPROVED TRAINING ORGANISATIONS (ATOs)

SECTION I - GENERAL

AMC1 ARA.ATO.105 Oversight programme

GENERAL

(a) The audit or inspection of an ATO should be conducted on the basis of checking the facility for compliance, interviewing personnel and sampling any relevant training course for its conduct and standard.

(b) In addition to the items required in AMC1 ARA.GEN.310(a), such an audit or inspection should focus on:

(1) information on flight instructors, validity of licences, certificates, ratings and log books;

(2) evidence of sufficient funding;

(3) training aircraft in use, including their registration, associated documents and maintenance records;

(4) aerodromes, operating sites and associated facilities;

(5) facilities with regard to their adequacy to the courses being conducted and number of students;

(6) FSTDs, including their qualification certificates, associated documents and maintenance records;

(7) documentation, in particular documents related to courses, information on the updating system, and training and operations manual(s);

(8) training records and checking forms; and

(9) flight instruction, including pre-briefing, actual flight and debriefing.

AMC1 ARA.ATO.120 Record-keeping

FSTDs

Records relating to FSTDs should include, as a minimum:

(a) the application for an FSTD qualification;

(b) the FSTD qualification certificate including any changes;

(c) a copy of the evaluation programme listing the dates when evaluations are due and when evaluations were carried out;

(d) initial and recurrent evaluation records;

(e) copies of all relevant correspondence;

(f) details of any exemption and enforcement actions; and

(g) any report from other competent authorities relating to initial and recurrent evaluations.

SUBPART FSTD – SPECIFIC REQUIREMENTS RELATED TO THE QUALIFICATION OF FLIGHT SIMULATION TRAINING DEVICES (FSTDs)

AMC1 ARA.FSTD.100(a)(1) Initial evaluation procedure

ASSESSMENT PROCESS LEADING TO THE ISSUE OF AN FSTD QUALIFICATION

(a) FSTDs require evaluation leading to qualification. The required process should be accomplished in two distinct steps. First, a check should be made to determine whether or not the FSTD complies with the applicable requirements. When making this check, the competent authority should ensure that accountability for the issue of an FSTD qualification is clearly defined. In all cases an individual department manager of the competent authority should be appointed under whose personal responsibility the issue of an FSTD qualification is to be considered. The second step should be the grant (or refusal) of an FSTD qualification.

(b) When checking compliance with the applicable requirements, the competent authority should ensure that the following steps are taken:

(1) Once an FSTD is contracted to be built, the organisation that is to operate the FSTD should ensure that the regulatory standard upon which the FSTD will eventually be qualified against is acceptable to the competent authority. This should be the current applicable version of CS-FSTD(A) or CS-FSTD(H) at the time of application.

(2) A written application for an FSTD qualification should be submitted, in a format according to ORA.FSTD.200, at least 3 months before the date of intended operation. However, the qualification test guide (QTG) may be submitted later, but not less than 30 days before the date of intended evaluation. The application form should be printed in English and any other language(s) of the competent authority's choosing.

(3) An individual should be nominated by the department manager of the competent authority to oversee, and become the focal point for, all aspects of the FSTD qualification process, and to coordinate all necessary activity. The nominated person should be responsible to the department manager for confirming that all appropriate evaluations/inspections are made.

(4) The ability of the applicant to secure, in compliance with the applicable requirements and certification specifications, the safe and reliable operation and proper maintenance of the FSTD should be assessed.

(5) The applicant's proposed compliance monitoring system should be scrutinised with particular regard to the allocated resources. Care should be taken to verify that the system is comprehensive and likely to be effective.

(6) The competent authority should inform the applicant of its final decision concerning the qualification within 14 days of completion of the evaluation process irrespective of any temporary qualification issued.

(7) On completion of the evaluation process, the application, together with a written recommendation and evidence of the result of all evaluations or assessments, should be presented to the nominated person responsible for FSTD qualification. The presentation should be made by the person with overall responsibility, nominated in accordance with (b)(3).

(8) The department manager of the competent authority should only issue an FSTD qualification certificate if he/she is completely satisfied that all requirements have been met. If he/she is not satisfied, the applicant should be informed in writing of the improvements that are required in order to satisfy the competent authority.

(9) If an application for an FSTD qualification is refused, the applicant should be informed of such rights of appeal as exist under national regulations.

AMC2 ARA.FSTD.100(a)(1) Initial evaluation procedure

GENERAL

(a) During initial and recurrent FSTD evaluations it should be necessary for the competent authority to conduct an appropriate sample of the objective and subjective tests described in Part-ORA and detailed in CS-FSTD(A) and CS-FSTD(H), as applicable. There may be occasions when all tests cannot be completed – for example during recurrent evaluations on a convertible FSTD – but arrangements should be made for all tests to be completed within a reasonable time.

(b) Following an evaluation, it is possible that a number of defects are identified. Generally, these defects should be rectified and the competent authority notified of such action within 30 days. Serious defects, which affect flight crew training, testing and checking, could result in an immediate downgrading of the qualification level I. If any defect remains unattended without good reason for a period greater than 30 days, subsequent downgrading may occur or the FSTD qualification could be revoked.

(c) For the evaluation of an FSTD the standard form as mentioned in AMC5 ARA.FSTD.100(a)(1) should be used.

AMC3 ARA.FSTD.100(a)(1) Initial evaluation procedure

INITIAL EVALUATION

(a) The main focus of objective testing is the QTG. Well in advance of the evaluation date, the aircraft manufacturer and the competent authority should agree on the content and acceptability of the validation tests contained in the QTG data package. This will ensure that the content of the QTG is acceptable to the competent authority and avoid time being wasted during the initial qualification. The acceptability of all tests depends upon their content, accuracy, completeness and recency of the results.

(b) Much of the time allocated to objective tests depends upon the speed of the automatic and manual systems set up to run each test and whether or not special equipment is required. The competent authority should not necessarily warn the organisation operating an FSTD of the sample validations tests which should be run on the day of the evaluation, unless special equipment is required.

(c) The FSTD cannot be used for subjective tests while part of the QTG is being run. Therefore, sufficient time (at least 8 consecutive hours) should be set aside for the examination and running of the QTG.

(d) The subjective tests for the evaluation can be found in CS-FSTD(A) or CS-FSTD(H), and a suggested subjective test profile is described in AMC1 ARA.FSTD.100(a)(3). Essentially, 1 working day should be required for the subjective test routine, which effectively denies use of the FSTD for any other purpose.

(e) To ensure adequate coverage of subjective and objective tests and to allow for cost effective rectification and re-test before departure of the inspection team, adequate time (up to 3 consecutive days) should be dedicated to an initial evaluation of an FSTD.

AMC4 ARA.FSTD.100(a)(1) Initial evaluation procedure

COMPOSITION OF THE EVALUATION TEAM

(a) The competent authority should appoint a technical team to evaluate an FSTD in accordance with a structured routine to gain a qualification level. The team should normally consist of at least the following personnel:

  (1) A technical FSTD inspector of the competent authority, or an accredited inspector from another competent authority, qualified in all aspects of flight simulation hardware, software and computer modelling or, exceptionally, a person designated by the competent authority with equivalent qualifications; and

  (2) One of the following:

    (i) a flight inspector of the competent authority, or an accredited inspector from another competent authority, who is qualified in flight crew training procedures and holds a valid type rating on the aeroplane/helicopter (or for flight navigation procedures trainer (FNPT) and basic instrument training device (BITD), class rated on the class of aeroplane/type of helicopter) being simulated; or

(ii) a flight inspector of the competent authority who is qualified in flight crew training procedures, assisted by a type rating instructor holding a valid type rating on the aeroplane/helicopter (or for FNPT and BITD, class rated on the class of aeroplane/type of helicopter) being simulated; or, exceptionally,

(iii) a person designated by the competent authority who is qualified in flight crew training procedures and holds a valid type rating on the aeroplane/helicopter (or for FNPT and BITD, class rated on the class of aeroplane/type of helicopter) being simulated and sufficiently experienced to assist the technical team. This person should fly out at least part of the functions and subjective test profiles.

(3) Where a designee is used as a substitute for one of the competent authority's inspectors, the other person shall be a properly qualified inspector of the competent authority or an accredited inspector from another Member State's competent authority.

(b) For a flight training device (FTD) level 1 and FNPT Type I, one suitably qualified inspector may combine the functions in (a)(1) and (a)(2).

(c) For a BITD this team should consist of an inspector from a competent authority and one from another competent authority, including the manufacturer's competent authority, if applicable.

(d) Additionally, the following persons should be present:

(1) for a full flight simulator (FFS), FTD and FNPT a type or class rated instructor from the ATO operating an FSTD or from the main FSTD user;

(2) for all types, sufficient FSTD support staff to assist with the running of tests and operation of the instructor's station.

AMC5 ARA.FSTD.100(a)(1) Initial evaluation procedure

FSTD EVALUATION REPORT FOR INITIAL AND RECURRENT EVALUATION

FSTD Evaluation Report

Date:…………………………..

[competent authority]
FSTD EVALUATION REPORT

[Member State] FSTD code (if applicable):
EASA FSTD code (if applicable):
Aircraft type and variant:
Class of aeroplane / type of helicopter:
Engine fit(s) simulated:

Contents
1. Flight simulation training device (FSTD) characteristics
2. Evaluation details
3. Supplementary information
4. Training, testing and checking considerations
5. Classification of items
6. Results
7. Evaluation team

The conclusions presented are those of the evaluation team. The competent authority reserves the right to change these after internal review.

1. Flight simulation training device (FSTD)	
(a) Organisation operating the FSTD:	
(b) FSTD Location:	
(c) FSTD Identification (Member State FSTD code / EASA FSTD Code):	
(d) FSTD Manufacturer and FSTD Identification serial number:	
(e) First entry into service (month/year):	
(f) Visual system (manufacturer and type):	
(g) Motion system (manufacturer and type) :	
(h) Aircraft type and variant:	
(i) Engine fit(s):	
(k) Engine instrumentation: **Flight instrumentation:**	
2. Evaluation details	
(a) Date of evaluation:	(b) Date of previous evaluation:
(c) Type of evaluation: ☐ initial ☐ recurrent ☐ special	
(d) FSTD Qualification Level recommended: FFS ☐ A ☐ B ☐ C ☐ D ☐ AG ☐ BG ☐ CG ☐ DG ☐ SC FTD ☐ 1 ☐ 2 ☐ 3 FNPT ☐ I ☐ II ☐ III ☐ MCC BITD ☐	
Technical criteria primary reference document:	
Validation data roadmap (VDR) ID-No.:	

3. Supplementary information	
Company representative(s) (FSTD operator, Main FSTD user)	
FSTD seats available	
Visual databases used during evaluation	
Other	
4. Training, testing and checking considerations	
CAT I RVR m DH ft	
CAT II RVR m DH ft	
CAT III RVR m DH ft (lowest minimum)	
LVTO RVR m	
Recency	
IFR-training/check	
Type rating	
Proficiency checks	
Autocoupled approach	
Autoland/Roll out guidance	
ACAS I / II	
Windshear warning system/predictive windshear	
WX-Radar	
HUD/HUGS	
FANS	
GPWS/EGPWS	
ETOPS capability	
RNP APCH LNAV	
RNP APCH LNAV/VNAV	
RNP APCH LPV	
RNP AR APCH	
Other	

5. Classification of items

UNACCEPTABLE

An item that fails to comply with the required standard and, therefore, affects the level of qualification or the qualification itself. If these items will not be corrected or clarified within a given time limit, the *(competent authority)* should have to vary, limit, suspend or revoke the FSTD qualification.

RESERVATION

An item where compliance with the required standard is not clearly proven and the issue will be reserved for a later decision. Resolution of these items will require either:

1. a *competent authority* policy ruling; or
2. additional substantiation.

UNSERVICEABILITY
A device that is temporarily inoperative or performing below its nominal level.

LIMITATION
An item that prevents the full usage of the FSTD according to the training, testing and checking considerations due to the unusable devices, systems or parts thereof.

RECOMMENDATION FOR IMPROVEMENT
An item that meets the required standard, but where considerable improvement is strongly recommended.

COMMENT
Self-explanatory

Period of Rectification

As set out in AMC2 ARA.FSTD.100(a)(1) point (b):

Following an evaluation, it is possible that a number of defects are identified. Generally, these defects should be rectified and the competent authority notified of such action within 30 days. Serious defects, which affect flight crew training, testing and checking, could result in an immediate downgrading of the qualification level, or if any defect remains unattended without good reason for a period greater than 30 days, subsequent downgrading may occur or the FSTD qualification could be revoked.

6. Results

6.1 Subjective/Functional

A Unacceptable

1	

B Reservation

1	

C Unserviceability

1	

D Restriction

1	

E Recommendation for improvement

1	

F Comment

1	

6.2 Objective

A Unacceptable

1	

B Reservation

1	

E Recommendation for improvement

1	

F Comment

1	

7. Evaluation Team

Name	Position	Organisation	Signature
	Technical Inspector or person designated by the competent authority		
	Flight Inspector or person designated by the competent authority		
		[FSTD User]	
		[Organisation operating the FSTD]	

Signed: ……………………………For the competent authority

GM1 ARA.FSTD.100(a)(1) Initial evaluation procedure

INITIAL EVALUATION

A useful explanation of how the validation tests should be run is contained in the 'RAeS Aeroplane Flight Simulator Evaluation Handbook' (February 1995 or as amended) produced in support of the ICAO Doc 9625, 'Manual of Criteria for the Qualification of Flight Simulators'.

AMC1 ARA.FSTD.100(a)(3) Initial evaluation procedure

FUNCTIONS AND SUBJECTIVE TESTS – SUGGESTED TEST ROUTINE

(a) During initial and recurrent evaluations of an FSTD, the competent authority should conduct a series of functions and subjective tests that together with the objective tests complete the comparison of the FSTD with the aircraft, the class of aeroplane or type of helicopter.

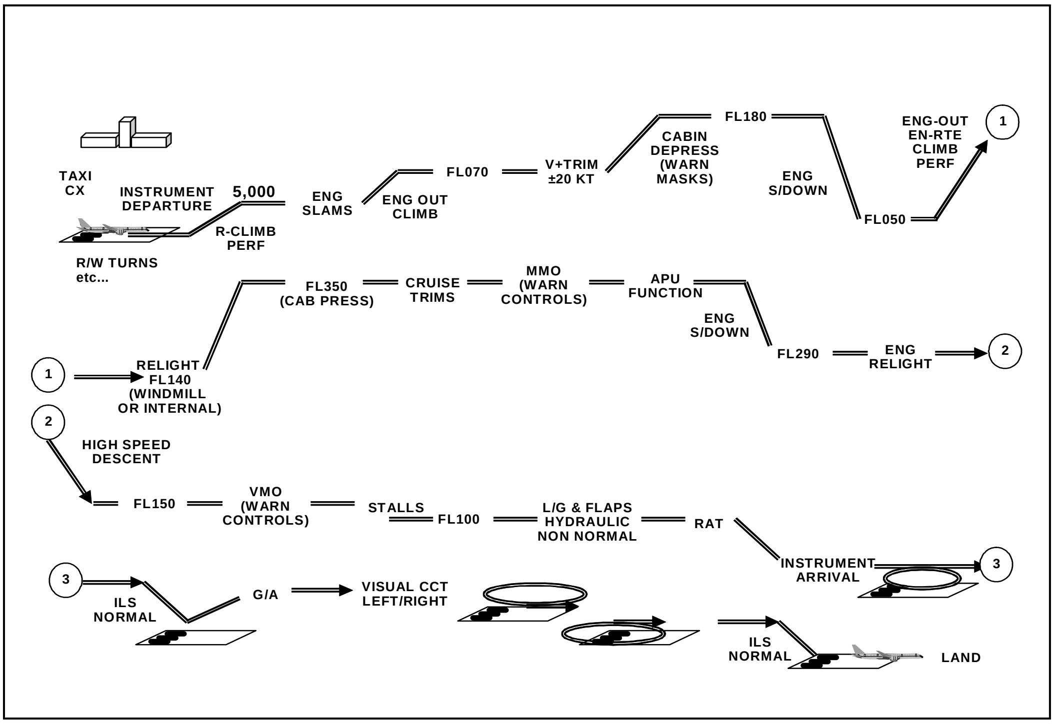
(b) Functions tests verify the acceptability of the simulated aircraft systems and their integration. Subjective tests verify the fitness of the FSTD in relation to training, checking and testing tasks.

(c) The FSTD should provide adequate flexibility to permit the accomplishment of the desired and required tasks while maintaining an adequate perception by the flight crew that they are operating in a real aircraft environment. Additionally, the instructor operating station (IOS) should not present an unnecessary distraction from observing the activities of the flight crew whilst providing adequate facilities for the tasks.

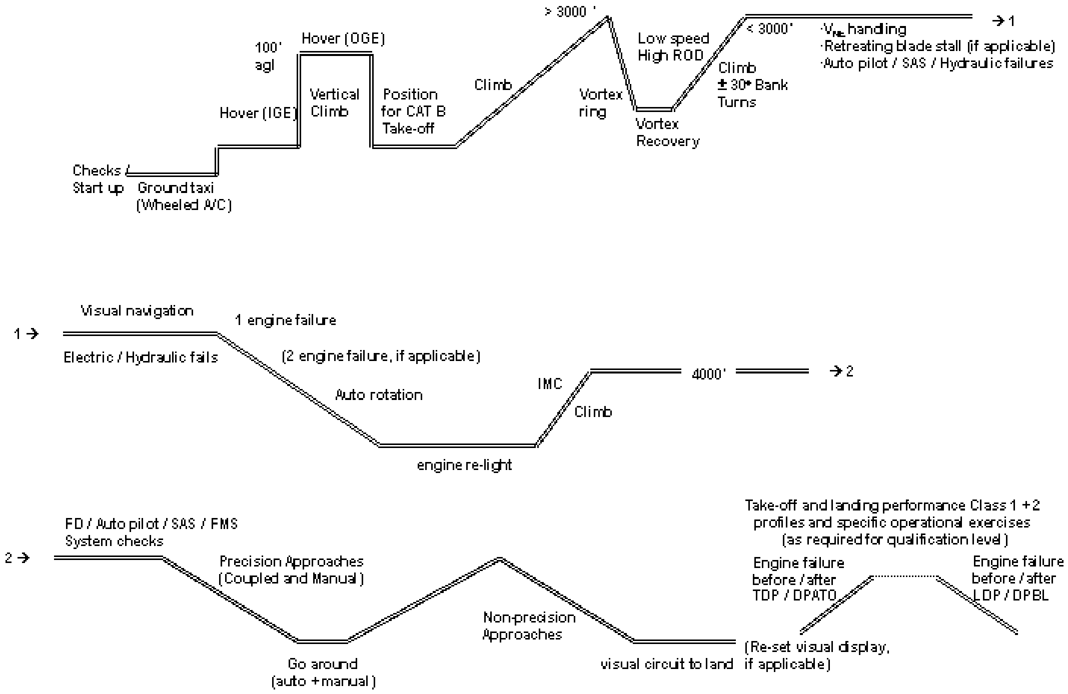
(d) It is important that both the competent authority and the organisation operating an FSTD understand what to expect from the routine of FSTD functions and subjective tests. Part of the subjective tests routine for an FSTD should involve an uninterrupted fly-out (except for FTD level 1) comparable with the duration of typical training sessions in addition to assessment of flight freeze and repositioning. An example of such a profile is to be found under points (f) and (g) (for BITD point (h)).

(e) The competent authorities, and organisations operating FSTD, who are unfamiliar with the evaluation process should contact the Agency or the competent authority of another Member State with adequate expertise in this field.

(f) Typical test profile for an FSTD aeroplane:



(g) Typical test profile for an FSTD helicopter:



(h) Typical subjective test profile for BITDs (approximately 2 hours) - items and altitudes, as applicable:

(1) instrument departure, climb performance,

(2) level-off at 4 000 ft,

(3) fail engine (if applicable),

(4) engine out climb to 6 000 ft (if applicable),

(5) engine out cruise performance (if applicable), restart engine,

(6) all engine cruise performance with different power settings,

(7) descent to 2 000 ft,

(8) all engine performance with different configurations, followed by instrument landing system (ILS) approach,

(9) all engine go-around,

(10) non-precision approach,

(11) go-around with engine failure (if applicable),

(12) engine out ILS approach (if applicable),

(13) go-around engine out (if applicable),

(14) non-precision approach engine out (if applicable), followed by go-around,

(15) restart engine (if applicable),

(16) climb to 4 000 ft,

(17) manoeuvring,

(18) normal turns left and right,

(19) steep turns left and right,

(20) acceleration and deceleration within operational range,

(21) approaching to stall in different configurations,

(22) recovery from spiral dive,

(23) auto flight performance (if applicable),

(24) system malfunctions,

(25) approach.

GM1 ARA.FSTD.100(a)(3) Initial evaluation procedure

GENERAL

A useful explanation of functions and subjective tests and an example of subjective test routine checklist may be found in the 'RAeS Airplane Flight Simulator Evaluation Handbook' Volume II (February 1995 or as amended) produced in support of ICAO Doc 9625, 'Manual of Criteria for the Qualification of Flight Simulators'.

AMC1 ARA.FSTD.110 Issue of an FSTD qualification certificate

BASIC INSTRUMENT TRAINING DEVICE (BITD)

(a) The competent authority should only grant a BITD qualification for the BITD model to a BITD manufacturer following satisfactory completion of an evaluation.

(b) This qualification should be valid for all serial numbers of this model without further technical evaluation.

(c) The BITD model should be clearly identified by a BITD model number. A running serial number should follow the BITD model identification number.

(d) The competent authority should establish and maintain a list of all BITD qualifications it has issued, containing the number of the BITD model with a reference to the hardware and software configuration.

AMC1 ARA.FSTD.115 Interim FSTD qualification

NEW AIRCRAFT FFS / FTD QUALIFICATION – ADDITIONAL INFORMATION

(a) Aircraft manufacturers' final data for performance, handling qualities, systems or avionics are seldom available until well after a new or derivative aircraft has entered service. Because it is often necessary to begin flight crew training and certification several months prior to the entry of the first aircraft into service, it may be necessary to use aircraft manufacturer-provided preliminary data for interim qualification of FSTDs. This is consistent with the possible interim approval of operational suitability data (OSD) relative to FFS in the type certification process under Part-21.

(b) In recognition of the sequence of events that should occur and the time required for final data to become available, the competent authority may accept the use of certain partially validated preliminary aircraft and systems data, and early release ('red label') avionics in order to permit the necessary programme schedule for training, certification and service introduction.

(c) Organisations seeking qualification based on preliminary data should, however, consult the competent authority as soon as it is known that special arrangements will be necessary, or as soon as it is clear that preliminary data will need to be used for FSTD qualification. Aircraft and FSTD manufacturers should also be made aware of the needs and agree on the data plan and FSTD qualification plan. There should be periodic meetings to keep the interested parties informed of the project's status.

(d) The precise procedure to be followed to gain competent authority acceptance to use preliminary data should vary from case to case and between aircraft manufacturers. Each aircraft manufacturer's new aircraft development and test programme is designed to suit the needs of the particular project and may not contain the same events or sequence of events as another manufacturer's programme or even the same manufacturer's programme for a different aircraft. Hence, there cannot be a prescribed invariable procedure for acceptance to use preliminary data. Instead there should be a statement describing the final sequence of events, data sources, and validation procedures agreed by the FSTD operator, the aircraft manufacturer, the FSTD manufacturer and the competent authority. The approval by the Agency of the definition of scope of the aircraft validation source data to support the objective qualification as part of the OSD can also be an interim approval in case of preliminary data. The preliminary data to be used should be based on this interim approval.

(e) There should be assurance that the preliminary data are the manufacturer's best representation of the aircraft and reasonable certainty that final data will not deviate to a large degree from these preliminary, but refined, estimates. First of all there should be an interim approval of OSD relative to flight simulators in the type certification process under Part-21. Furthermore, the data derived from these predictive or preliminary techniques should be validated by available sources including, at least, the following:

(1) *Manufacturer's engineering report*. Such reports explain the predictive method used and illustrate past successes of the method on similar projects. For example, the manufacturer could show the application of the method to an earlier aircraft model or predict the characteristics of an earlier model and compare the results to final data for that model.

(2) *Early flight tests results*. Such data will often be derived from aircraft certification tests, and should be used to maximum advantage for early FSTD validation. Certain critical tests, which would normally be done early in the aircraft certification programme, should be included to validate essential pilot training and certification manoeuvres. These include cases in which a pilot is expected to cope with an aircraft failure mode, including engine failures. The early data available will, however, depend on the aircraft manufacturer's flight test programme design and may not be the same in each case. However it is expected that the flight test programme of the aircraft manufacturer includes provisions for generation of very early flight tests results for FSTD validation.

(f) The use of preliminary data is not indefinite. The aircraft manufacturer's final data should be available within 6 months after the aircraft's first 'service entry' or as agreed by the competent authority, the organisation and the aircraft manufacturer, but usually not later than 1 year. When an organisation applies for an interim qualification using preliminary data, the organisation and the competent authority should agree upon the update programme. This should normally specify that the final data update will be installed in the FSTD within a period of 6 months following the final data release unless special conditions exist and a different schedule agreed. The FSTD performance and handling validation would then be based on data derived from flight tests. Initial aircraft systems data should be updated after engineering tests. Final aircraft systems data should also be used for FSTD programming and validation.

(g) FSTD avionics should stay essentially in step with aircraft avionics (hardware and software) updates. The permitted time lapse between aircraft and FSTD updates is not a fixed time but should be minimal. It may depend on the magnitude of the update and whether the QTG and pilot training and certification are affected. Permitted differences in aircraft and FSTD avionics versions and the resulting effects on FSTD qualification should be agreed between the organisation and the competent authority. Consultation with the FSTD manufacturer is desirable throughout the agreement of the qualification process.

(h) The following describes an example of the design data and sources which might be used in the development of an interim qualification plan:

(1) The plan should consist of the development of a QTG based upon a mix of flight test and engineering simulation data. For data collected from specific aircraft flight tests or other flights, the required designed model and data changes necessary to support an acceptable proof of match (POM) should be generated by the aircraft manufacturer.

(2) In order that the two sets of data are properly validated, the aircraft manufacturer should compare their simulation model responses against the flight test data, when driven by the same control inputs and subjected to the same atmospheric conditions as were recorded in the flight test. The model responses should result from a

simulation where the following systems are run in an integrated fashion and are consistent with the design data released to the FSTD manufacturer:

(i) propulsion,

(ii) aerodynamics,

(iii) mass properties,

(iv) flight controls,

(v) stability augmentation,

(vi) brakes and landing gear.

(i) For the qualification of FSTD of new aircraft types, it may be beneficial that the services of a suitably qualified test pilot are used for the purpose of assessing handling qualities and performance evaluation.

GM1 ARA.FSTD.115 Interim FSTD qualification

NEW AIRCRAFT FFS/FTD QUALIFICATION – ADDITIONAL INFORMATION

(a) A description of aircraft manufacturer-provided data needed for flight simulator modelling and validation is to be found in the IATA Document *Flight Simulator Design and Performance Data Requirements* (Edition 6 2000 or as amended).

(b) The proof of match should meet the relevant tolerances in AMC1 CS-FSTD(A).300 respectively AMC1 CS-FSTD(H).300.

AMC1 ARA.FSTD.120 Continuation of an FSTD qualification

GENERAL

(a) *Objective Testing*. During recurrent evaluations, the competent authority should wish to see evidence of the successful running of the QTG between evaluations. The competent authority should select a number of tests to be run during the evaluation, including those that may be cause for concern. Again adequate notification would be given when special equipment is required for the test.

(b) Essentially the time taken to run the objective tests depends upon the need for special equipment, if any, and the test system, and the FSTD cannot be used for subjective tests or other functions whilst testing is in progress.

(c) For a modern FSTD incorporating an automatic test system, four hours would normally be required. FSTDs that rely upon manual testing may require a longer period of time.

(d) *Subjective Testing*. Essentially the same subjective test routine should be flown as per the profile described in AMC1 ARA.FSTD.100(a)(3) with a selection of the subjective tests taken from CS-FSTD(A) or CS-FSTD(H), as appropriate.

(e) Normally, the time taken for recurrent subjective testing is about 4 hours, and the FSTD should not perform other functions during this time.

(f) To ensure adequate coverage of subjective and objective tests during a recurrent evaluation, a total of 8 hours should be allocated, (4 hours for a BITD). However, it should be remembered that any FSTD deficiency that arises during the evaluation could necessitate the extension of the evaluation period.

AMC2 ARA.FSTD.120 Continuation of an FSTD qualification

COMPOSITION OF THE EVALUATION TEAM

(a) The composition of the evaluation team for a recurrent evaluation should be the same as for the initial evaluation (see AMC4 ARA.FSTD.100(a)(1).

On a case-by-case basis (except for BITD), when a specific FSTD in operation by a specific organisation is being evaluated, the competent authority may reduce the evaluation team to:

(1) the competent authority's flight inspector; and

(2) a type rated instructor (or class rated instructor for FNPT) from a main FSTD user.

(b) Evaluations with a reduced evaluation team in line with (a) may only take place if:

(1) this composition is not being used prior to the second recurrent evaluation;

(2) such an evaluation is followed by an evaluation with a full competent authority evaluation team;

(3) the competent authority's flight inspector performs some spot checks in the area of objective testing;

(4) no major change or upgrading has been applied since the directly preceding evaluation;

(5) no relocation of the FSTD has taken place since the last evaluation;

(6) a system is established enabling the competent authority to monitor and analyse the status of the FSTD on a continuous basis; and

(7) the FSTD hardware and software has been working reliably for the previous years. This should be reflected in the number and kind of discrepancies (technical log entries) and the results of the compliance monitoring system audits.

(c) In the case of a BITD, the recurrent evaluation may be conducted by one suitably qualified flight inspector only, in conjunction with the inspection of any ATO, using the BITD.

AMC1 ARA.FSTD.130 Changes

GENERAL

(a) The organisation operating an FSTD who wishes to modify, upgrade, de-activate or re-locate its FSTD should notify the competent authority. When considering applications for a change of the existing FSTD qualification level, the competent authority should ensure that accountability for the change is clearly defined.

(b) An individual department manager of the competent authority should be appointed under whose personal authority an FSTD qualification may be changed.

(c) The written application for a change, including appropriate extracts from the qualification test guide indicating proposed amendments should be submitted in a format and manner as specified by the competent authority. This application should be submitted no later than 30 days before the date of intended change, unless otherwise agreed with the competent authority.

(d) On receipt of an application for a change of the existing FSTD qualification level, the competent authority should conduct such evaluations and inspections as are necessary to ensure that the full implications of the request have been addressed by the organisation operating the FSTD.

(e) During the processing of a change request, the continued adequacy of the compliance monitoring should be reviewed.

(f) When the request has been considered and examined, the competent authority should decide on the depth of inspection of the FSTD that is required.

(g) The department manager, if satisfied that the organisation operating the FSTD remains competent and the qualification level of the FSTD can be maintained, should issue revised FSTD qualification documentation, as appropriate.

(h) The competent authority should inform the organisation operating the FSTD of its decision within 30 days of receipt of all documentation where no evaluation is required, or within 14 days of any subsequent evaluation.

(i) Such documentation includes the appropriate extracts from the QTG amended, when necessary, to the competent authority's satisfaction.

GM1 ARA.FSTD.130 Changes

QUALIFICATION OF NEW TECHNOLOGY OR SYSTEMS

Where an update to an FSTD involves a change of technology or the addition of a new system or equipment that is not covered by the qualification basis used for the existing qualification, an evaluation of such changes may not be possible using this original qualification basis. For these cases, the specific changes can be qualified by using newer Certification Specifications, new AMCs or alternative means of compliance, that apply to these changes, without affecting the overall qualification of the FSTD. This approach should be documented.

AMC1 ARA.FSTD.135 Findings and corrective actions - FSTD qualification certificate

GENERAL

(a) The competent authority's inspection and monitoring process should confirm the competent authority's continued confidence in the effectiveness of the compliance monitoring system of the organisation operating an FSTD, and its ability to maintain an adequate standard.

(b) If the competent authority is not satisfied, the organisation operating an FSTD should be informed in writing of the details of the conduct of its operation which are causing the competent authority concern. The competent authority should require corrective action to be taken within a specified period (see AMC2 ARA.FSTD.100(a)(1) point (b)).

(c) In the event that an organisation operating an FSTD fails, in spite of warning and advice, to satisfy the competent authority's concerns, a final written warning should, whenever possible, be given to the organisation together with a firm date by which specified action to satisfy the competent authority should be taken. It should be made clear that failure to comply may result in enforced limitation or suspension of the FSTD's qualification.

(d) Circumstances may, however, preclude recourse to the process described under (a) to (c). In such cases the competent authority's duty to preserve quality of training, testing and checking is of paramount importance and therefore the competent authority may immediately limit or suspend any FSTD qualification which it has issued.

AMC2 ARA.FSTD.135 Findings and corrective actions - FSTD qualification certificate

SUSPENSION AND LIMITATION

(a) When a decision has been taken to suspend, or limit, an FSTD qualification certificate, the organisation operating an FSTD should be informed immediately by the quickest available means.

(b) In the event of full suspension of an FSTD qualification certificate, the organisation operating an FSTD should be instructed that the FSTD concerned cannot be used for any credited training, testing or checking. The "quickest available means" will in most situations mean the use of a facsimile or email message.

(c) This should be followed by a formal letter giving notice of suspension, or limitation, restating the requirement to cease operations as applicable, and also setting out the conditions on which suspension may be lifted.

(d) If it becomes apparent to the competent authority that all operations have ceased over a period in excess of 6 months, the competent authority should consider opening the warning process described in AMC1 ARA.FSTD.135, points (a) to (d).

(e) The FSTD qualification certificate should not remain suspended indefinitely. Further steps may be taken by the organisation operating an FSTD to reinstate the FSTD qualification or, in default, should be taken by the competent authority to revoke the FSTD qualification certificate. Should an organisation operating an FSTD wish to dispute the suspension of its FSTD's qualification certificate, it should be informed of such rights of appeal as exist under national regulations. If an appeal is lodged, the FSTD qualification may remain suspended until the appeal process is complete.

(f) Suspension of an FSTD qualification certificate may be lifted on appeal or if the organisation operating an FSTD restores the FSTD to its previously acceptable standard.

(g) In neither case should operations be permitted to restart until it has been demonstrated that the cause of the suspension or limitation has been rectified. The competent authority may require a special evaluation depending on the severity of the problem.

(h) The competent authority should issue a formal notice of the lifting of suspension before the organisation operating an FSTD is permitted to resume use of an FSTD.

AMC3 ARA.FSTD.135 Findings and corrective actions - FSTD qualification certificate

REVOCATION

(a) The competent authority should give the organisation operating an FSTD notice that it intends to revoke the FSTD qualification followed by a formal letter of revocation.

(b) Should an organisation operating an FSTD wish to dispute this revocation, it should be informed of such rights of appeal as exist under applicable regulations. Once revoked, there can be no further activities under the terms of the FSTD qualification.

SUBPART MED - SPECIFIC REQUIREMENTS RELATING TO AERO-MEDICAL CERTIFICATION

SECTION I - GENERAL

AMC1 ARA.MED.120 Medical assessors

EXPERIENCE AND KNOWLEDGE

Medical assessors should:

(a) have considerable experience of aero-medical practice and have undertaken a minimum of 200 class 1 medical examinations or equivalent; and

(b) maintain their medical professional competence in aviation medicine. The following should count towards maintaining medical professional competence:

 (1) undertaking regular refresher training;

 (2) participating in international aviation medicine conferences;

 (3) undertaking research activities, including publication of results of the research.

AMC2 ARA.MED.120 Medical assessors

TASKS

Medical assessors should:

(a) provide lectures in basic, advanced and refresher training courses for aero-medical examiners (AMEs) and aero-medical centres (AeMCs);

(b) carry out supervision and audits of AeMCs, AMEs and AME training facilities; and

(c) perform the aero-medical assessment of applicants for, or holders of, medical certificates after referral to the licensing authority.

AMC1 ARA.MED.125 Referral to the licensing authority

REFERRAL TO THE LICENSING AUTHORITY

(a) The licensing authority should supply the AeMC or AME with all necessary information that led to the decision on aero-medical fitness.

(b) The licensing authority should ensure that unusual or borderline cases are evaluated on a common basis.

AMC1 ARA.MED.130 Medical certificate format

STANDARD EASA MEDICAL CERTIFICATE FORMAT

The format of the medical certificate should be as shown below.

Competent authority name and logo (English and any language(s) determined by the competent authority) EUROPEAN UNION (English only) Class 1/2/LAPL MEDICAL CERTIFICATE pertaining to a Part-FCL licence (English and any language(s) determined by the competent authority) Issued in accordance with Part-MED This medical certificate complies with ICAO standards, except for the LAPL medical certificate (English and any language(s) determined by the competent authority) .	Requirements "European Union" to be deleted for non-EU Member States Size of each page shall be one eighth A4

I	National language(s)/ *Authority that issued or is to issue the pilot licence*
III	National language(s):/Certificate number
IV	National language(s):/ Last and first name of holder:
XIV	National language(s):/*Date of birth: (dd/mm/yyyy)*
VI	National language(s)/*Nationality:*
VII	National language(s)/ Signature of holder:
	2

XIII	National language(s)/*Limitations:* Code. Description :
X	National language(s)/* *Date of issue:* (dd/mm/yyyy) Signature of issuing AME/medical assessor /(GMP):
XI	National language(s)/*Stamp:*
	3

	IX Nat. lang(s)/ Expiry date of this certificate		Class 1 single pilot commercial operations carrying passengers (dd/mm/yyyy)	
			Class 1 (dd/mm/yyyy)	
			Class 2 (dd/mm/yyyy)	
			LAPL (dd/mm/yyyy)	
	Nat. lang(s)./Examination date: (dd/mm/yyyy)			

MED.A.020 Decrease in medical fitness

(a) Licence holders shall not exercise the privileges of their licence and related ratings or certificates at any time when they:

(1) are aware of any decrease in their medical fitness that might render them unable to safely exercise those privileges;

(2) take or use any prescribed or non-prescribed medication that is likely to interfere with the safe exercise of the privileges of the applicable licence; or

(3) receive any medical, surgical or other treatment that is likely to interfere with flight safety.

(b) In addition, licence holders shall, without undue delay, seek aero-medical advice when they:

(1) have undergone a surgical operation or invasive procedure;

(2) have commenced the regular use of any medication;

(3) have suffered any significant personal injury involving incapacity to function as a member of the flight crew;

(4) have been suffering from any significant illness involving incapacity to function as a member of the flight crew;

(5) are pregnant;

(6) have been admitted to hospital or medical clinic; or

(7) first require correcting lenses.

4

* Date of issue is the date the certificate is issued and signed

AMC1 ARA.MED.135(a) Aero-medical forms

APPLICATION FORM FOR A MEDICAL CERTIFICATE

The form referred to in ARA.MED.135 (a) should reflect the information indicated in the following form and corresponding instructions for completion.

LOGO

CIVIL AVIATION ADMINISTRATION/MEMBER STATE

APPLICATION FORM FOR A MEDICAL CERTIFICATE

MEDICAL IN CONFIDENCE

Complete this page fully and in block capitals - Refer to instructions for completion.

(1) State of licence issue:	(2) Medical certificate applied for: class 1 ☐ class 2 ☐ LAPL ☐	
(3) Surname:	(4) Previous surname(s):	(12) Application: Initial ☐ Revalidation/Renewal ☐
(5) Forename(s):	(6) Date of birth(dd/mm/yyyy): (7) Sex: Male ☐ Female ☐	(13) Reference number:
(8) Place and country of birth:	(9) Nationality:	(14) Type of licence applied for:
(10) Permanent address: Country: Telephone No.: Mobile No.: E-mail:	(11) Postal address (if different): Country: Telephone No.:	(15) Occupation (principal): (16) Employer: (17) Last medical examination: Date: Place:

(18) Licence(s) held (type): Licence number: State of issue:	(19) Any limitations on licence(s)/medical certificate held No ☐ Yes ☐ Details:
(20) Have you ever had a medical certificate denied, suspended or revoked by any licensing authority? No ☐ Yes ☐ Date: Country: Details:	(21) Flight time total: (22) Flight time since last medical: (23) Aircraft class/type(s) presently flown:
(24) Any aviation accident or reported incident since last medical examination? No ☐ Yes ☐ Date: Place: Details:	(25) Type of flying intended: (26) Present flying activity: Single pilot ☐ Multi pilot ☐
(27) Do you drink alcohol? ☐ No ☐ Yes, amount (29) Do you smoke tobacco? ☐ No, never ☐ No, date stopped: ☐ Yes, state type and amount:	(28) Do you currently use any medication? No ☐ Yes ☐ State medication, dose, date started and why:

General and medical history: Do you have, or have you ever had, any of the following? (Please tick). If yes, give details in remarks section (30).

	Yes	No		Yes	No		Yes	No	**Family history of:**	Yes	No
101 Eye trouble/eye operation			112 Nose, throat or speech disorder			123 Malaria or other tropical disease			170 Heart disease		
102 Spectacles and/or contact lenses ever worn			113 Head injury or concussion			124 A positive HIV test			171 High blood pressure		
			114 Frequent or severe headaches			125 Sexually transmitted disease			172 High cholesterol level		
103 Spectacle/contact lens prescriptions change since last medical exam.			115 Dizziness or fainting spells			126 Sleep disorder/apnoea syndrome			173 Epilepsy		
			116 Unconsciousness for any reason			127 Musculoskeletal illness/impairment			174 Mental illness		
104 Hay fever, other allergy			117 Neurological disorders; stroke, epilepsy, seizure, paralysis, etc.			128 Any other illness or injury			175 Diabetes		
105 Asthma, lung disease						129 Admission to hospital			176 Tuberculosis		
106 Heart or vascular trouble			118 Psychological/psychiatric trouble of any sort			130 Visit to medical practitioner since last medical examination			177 Allergy/asthma/eczema		
107 High or low blood pressure									178 Inherited disorders		
108 Kidney stone or blood in urine			119 Alcohol/drug/substance abuse			131 Refusal of life insurance			179 Glaucoma		
109 Diabetes, hormone disorder			120 Attempted suicide			132 Refusal of flying licence			**Females only:**		
110 Stomach, liver or intestinal trouble			121 Motion sickness requiring medication			133 Medical rejection from or for military service			150 Gynaecological, menstrual problems		
111 Deafness, ear disorder			122 Anaemia/sickle cell trait/other blood disorders			134 Award of pension or compensation for injury or illness			151 Are you pregnant?		

(30) **Remarks:** If previously reported and no change since, so state.

(31) **Declaration:** I hereby declare that I have carefully considered the statements made above and to the best of my belief they are complete and correct and that I have not withheld any relevant information or made any misleading statements. I understand that, if I have made any false or misleading statements in connection with this application, or fail to release the supporting medical information, the licensing authority may refuse to grant me a medical certificate or may withdraw any medical certificate granted, without prejudice to any other action applicable under national law.

CONSENT TO RELEASE OF MEDICAL INFORMATION: I hereby authorise the release of all information contained in this report and any or all attachments to the AME and, where necessary, to the medical assessor of the licensing authority, recognising that these documents or electronically stored data are to be used for completion of a medical assessment and will become and remain the property of the licensing authority, providing that I or my physician may have access to them according to national law. Medical confidentiality will be respected at all times.

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Date	Signature of applicant	Signature of AME/(GMP)/(medical assessor)

INSTRUCTIONS FOR COMPLETION OF THE APPLICATION FORM FOR A MEDICAL CERTIFICATE

This application form and all attached report forms will be transmitted to the licensing authority. Medical confidentiality shall be respected at all times.

The applicant should personally complete, in full, all questions (sections) on the application form. Writing should be legible and in block capitals, using a ball-point pen. Completion of this form by typing/printing is also acceptable. If more space is required to answer any questions, a plain sheet of paper should be used, bearing the applicant's name and signature, and the date of signing. The following numbered instructions apply to the numbered headings on the application form for a medical certificate.

Failure to complete the application form in full, or to write legibly, may result in non-acceptance of the application form. The making of false or misleading statements or the withholding of relevant information in respect of this application may result in criminal prosecution, denial of this application and/or withdrawal of any medical certificate(s) granted.

1. LICENSING AUTHORITY: State name of country this application is to be forwarded to.	**17. LAST APPLICATION FOR A MEDICAL CERTIFICATE:** State date (day, month, year) and place (town, country) Initial applicants state 'NONE'.
2. MEDICAL CERTIFICATE APPLIED FOR: Tick appropriate box. Class 1: Professional Pilot Class 2: Private Pilot LAPL	**18. LICENCE(S) HELD (TYPE):** State type of licence(s) held. Enter licence number and State of issue. If no licences are held, state 'NONE'.
3. SURNAME: State surname/family name.	**19. ANY LIMITATIONS ON THE LICENCE(S)/MEDICAL CERTIFICATE:** Tick appropriate box and give details of any limitations on your licence(s)/medical certificate, e.g. vision, colour vision, safety pilot, etc.
4. PREVIOUS SURNAME(S): If your surname or family name has changed for any reason, state previous name(s).	**20. MEDICAL CERTIFICATE DENIAL, SUSPENSION OR REVOCATION:** Tick 'YES' box if you have ever had a medical certificate denied, suspended or revoked, even if only temporary. If 'YES', state date (dd/mm/yyyy) and country where it occurred.
5. FORENAME(S): State first and middle names (maximum three).	**21. FLIGHT TIME TOTAL:** State total number of hours flown.
6. DATE OF BIRTH: Specify in order dd/mm/yyyy.	**22. FLIGHT TIME SINCE LAST MEDICAL:** State number of hours flown since your last medical examination.
7. SEX: Tick appropriate box.	**23. AIRCRAFT CLASS/TYPE(S) PRESENTLY FLOWN:** State name of principal aircraft flown, e.g. Boeing 737, Cessna 150, etc.
8. PLACE AND COUNTRY OF BIRTH: State town and country of birth.	**24. ANY AVIATION ACCIDENT OR REPORTED INCIDENT SINCE LAST MEDICAL EXAMINATION:** If 'YES' box ticked, state date (dd/mm/yyyy) and country of accident/incident.
9. NATIONALITY: State name of country of citizenship.	**25. TYPE OF FLYING INTENDED:** State whether airline, charter, single-pilot, commercial air transport, carrying passengers, agriculture, pleasure, etc.
10. PERMANENT ADDRESS: State permanent postal address and country. Enter telephone area code as well as telephone number.	**26. PRESENT FLYING ACTIVITY:** Tick appropriate box to indicate whether you fly as the SOLE pilot or not.
11. POSTAL ADDRESS (IF DIFFERENT): If different from permanent address, state full current postal address including telephone number and area code. If the same, enter 'SAME'.	**27. DO YOU DRINK ALCOHOL?** Tick applicable box. If yes, state weekly alcohol consumption e.g. 2 litres beer.
12. APPLICATION: Tick appropriate box.	**28. DO YOU CURRENTLY USE ANY MEDICATION?:** If 'YES', give full details - name, how much you take and when, etc. Include any non-prescription medication.
13. REFERENCE NUMBER: State reference number allocated to you by the licensing authority Initial applicants enter 'NONE'.	**29. DO YOU SMOKE TOBACCO?** Tick applicable box. Current smokers state type (cigarettes, cigars, pipe) and amount (e.g. 2 cigars daily; pipe – 1 oz. weekly)
14. TYPE OF LICENCE APPLIED FOR: State type of licence applied for from the following list: Aeroplane Transport Pilot Licence Multi-Pilot Licence Commercial Pilot Licence/Instrument Rating Commercial Pilot Licence Private Pilot Licence/Instrument Rating Private Pilot Licence Sailplane Pilot Licence Balloon Pilot Licence Light Aircraft Pilot Licence And whether Fixed Wing / Rotary Wing / Both Other – Please specify **15. OCCUPATION (PRINCIPAL):** Indicate your principal employment.	**GENERAL AND MEDICAL HISTORY** All items under this heading from number 101 to 179 inclusive should have the answer 'YES' or 'NO' ticked. You should tick 'YES' if you have ever had the condition in your life and describe the condition and approximate date in the (30) remarks section. All questions asked are medically important even though this may not be readily apparent. Items numbered 170 to 179 relate to immediate family history, whereas items numbered 150 to 151 should be answered by female applicants only. If information has been reported on a previous application form for a medical certificate and there has been no change in your condition, you may state 'Previously reported; no change since'. However, you should still tick 'YES' to the condition. Do not report occasional common illnesses such as colds.
16. EMPLOYER: If principal occupation is pilot, then state employer's name or if self-employed, state 'self'.	**31. DECLARATION AND CONSENT TO OBTAINING AND RELEASING INFORMATION:** Do not sign or date these declarations until indicated to do so by the AME/GMP who will act as witness and sign accordingly.

AMC1 ARA.MED.135(b);(c) Aero-medical forms

MEDICAL EXAMINATION REPORT FORMS

The forms referred to in ARA.MED.135 (b) and (c) should reflect the information indicated in the following forms and corresponding instructions for completion.

MEDICAL EXAMINATION REPORT FORM FOR CLASS 1 & CLASS 2 APPLICANTS

MEDICAL IN CONFIDENCE

(201) Examination category	(202) Height (cm)	(203) Weight (kg)	(204) Colour eye	(205) Colour hair	(206) Blood pressure-seated (mmHg)		(207) Pulse - resting	
Initial ☐ Revalidation ☐ Renewal ☐ Special referral ☐					Systolic	Diastolic	Rate (bpm)	Rhythm: regular ☐ irregular ☐

Clinical exam: Check each item

	Normal	Abnormal		Normal	Abnormal
(208) Head, face, neck, scalp			(218) Abdomen, hernia, liver, spleen		
(209) Mouth, throat, teeth			(219) Anus, rectum		
(210) Nose, sinuses			(220) Genito-urinary system		
(211) Ears, drums, eardrum motility			(221) Endocrine system		
(212) Eyes - orbit & adnexa; visual fields			(222) Upper & lower limbs, joints		
(213) Eyes - pupils and optic fundi			(223) Spine, other musculoskeletal		
(214) Eyes - ocular motility; nystagmus			(224) Neurologic - reflexes, etc.		
(215) Lungs, chest, breasts			(225) Psychiatric		
(216) Heart			(226) Skin, identifying marks and lymphatics		
(217) Vascular system			(227) General systemic		

(228) **Notes:** Describe every abnormal finding. Enter applicable item number before each comment.

Visual acuity

(229) *Distant vision at 5m/6m*

	Uncorrected		Spectacles	Contact lenses
Right eye		Corr. to		
Left eye		Corr. to		
Both eyes		Corr. to		

(230) *Intermediate vision*	Uncorrected		Corrected	
N14 at 100 cm	Yes	No	Yes	No
Right eye				
Left eye				
Both eyes				

(231) *Near vision*	Uncorrected		Corrected	
N5 at 30-50 cm	Yes	No	Yes	No
Right eye				
Left eye				
Both eyes				

(232) **Spectacles** | (233) **Contact lenses**

Yes ☐ No ☐	Yes ☐ No ☐
Type:	Type:

Refraction	Sph	Cyl	Axis	Add
Right eye				
Left eye				

(313) **Colour perception** Normal ☐ Abnormal ☐

Pseudo-isochromatic plates	Type: Ishihara (24 plates)
No of plates:	No of errors:

(234) **Hearing**

(when 239/241 not performed)	Right ear	Left ear
Conversational voice test (2m) with back turned to examiner	Yes ☐ No ☐	Yes ☐ No ☐

Audiometry

Hz	500	1000	2000	3000
Right				
Left				

(236) **Pulmonary function** | (237) **Haemoglobin**

FEV_1/FVC __________ %	____________ ______ ***(unit)***
Normal ☐ Abnormal ☐	Normal ☐ Abnormal ☐

(235) **Urinalysis** Normal ☐ Abnormal ☐

Glucose	Protein	Blood	Other

Accompanying reports

	Not performed	Normal	Abnormal/Comment
(238) ECG			
(239) Audiogram			
(240) Ophthalmology			
(241) ORL (ENT)			
(242) Blood lipids			
(243) Pulmonary function			
(244) Other (what?)			

(247) **AME recommendation:**

Name of applicant: Date of birth: Reference number:

-- ---------------------------- ----------------------------

☐ Fit for class: ----------------

☐ Medical certificate issued by undersigned (copy attached) for class: -----------------

☐ Unfit for class: ----------------

☐ Deferred for further evaluation. If yes, why and to whom?

(248) **Comments, limitations**

(249) **AME declaration:**

I hereby certify that I/my AME group have personally examined the applicant named on this medical examination report and that this report with any attachment embodies my findings completely and correctly.

(250) Place and date:	AME name and address:	AME certificate No.:
AME signature:	E-mail: Telephone No.: Telefax No.:	

Shaded areas do not require completion

MEDICAL EXAMINATION REPORT FORM FOR LAPL APPLICANTS

MEDICAL IN CONFIDENCE

(201) Examination category	(202) Height (cm)	(203) Weight (kg)	(204) Colour eye	(205) Colour hair	(206) Blood pressure-seated (mmHg)		(207) Pulse - resting	
Initial ☐ Revalidation ☐ Renewal ☐ Special referral ☐					Systolic	Diastolic	Rate (bpm)	Rhythm: regular ☐ irregular ☐

Clinical exam: Check each item

	Normal	Abnormal		Normal	Abnormal
(208) Head, face, neck, scalp			(218) Abdomen, hernia, liver, spleen		
(209) Mouth, throat, teeth			(219) Anus, rectum		
(210) Nose, sinuses			(220) Genito-urinary system		
(211) Ears, drums, eardrum motility			(221) Endocrine system		
(212) Eyes - orbit & adnexa; visual fields			(222) Upper & lower limbs, joints		
(213) Eyes - pupils and optic fundi			(223) Spine, other musculoskeletal		
(214) Eyes - ocular motility; nystagmus			(224) Neurologic - reflexes, etc.		
(215) Lungs, chest, breasts			(225) Psychiatric		
(216) Heart			(226) Skin, identifying marks and lymphatics		
(217) Vascular system			(227) General systemic		

(228) **Notes:** Describe every abnormal finding. Enter applicable item number before each comment.

Visual acuity

(229) *Distant vision at 5m /6m*

	Uncorrected		Spectacles	Contact lenses
Right eye		Corr. to		
Left eye		Corr. to		
Both eyes		Corr. to		

(230) *Intermediate vision*	Uncorrected		Corrected	
N14 at 100 cm	Yes	No	Yes	No
Right eye				
Left eye				
Both eyes				

(231) *Near vision*	Uncorrected		Corrected	
N5 at 30-50 cm	Yes	No	Yes	No
Right eye				
Left eye				
Both eyes				

(232) **Spectacles** (233) **Contact lenses**

(232) Spectacles			(233) Contact lenses	
Yes ☐ No ☐ Type:			Yes ☐ No ☐ Type:	
Refraction	Sph	Cyl	Axis	Add
Right eye				
Left eye				

(313) **Colour perception**	Normal ☐ Abnormal ☐
Pseudo-isochromatic plates No of plates:	Type: Ishihara (24 plates) No of errors:

(234) **Hearing**

(when 239/241 not performed)	Right ear	Left ear
Conversational voice test (2m) with back turned to examiner	Yes ☐ No ☐	Yes ☐ No ☐

Audiometry				
Hz	500	1000	2000	3000
Right				
Left				

(236) **Pulmonary function**	(237) **Haemoglobin**
FEV_1/FVC __________ %	____________ ______ ***(unit)***
Normal ☐ Abnormal ☐	Normal ☐ Abnormal ☐

(235) **Urinalysis** Normal ☐ Abnormal ☐

Glucose	Protein	Blood	Other

Accompanying reports

	Not performed	Normal	Abnormal/Comment
(238) ECG			
(239) Audiogram			
(240) Ophthalmology			
(241) ORL (ENT)			
(242) Blood lipids			
(243) Pulmonary function			
(244) Other (what?)			

(247) **AME/GMP recommendation:**

Name of applicant: Date of birth: Reference number:

------------------------------------ ------------------------------ ------------------------------

☐ Fit for medical certificate for LAPL

☐ Medical certificate issued by undersigned (copy attached) for LAPL

☐ Unfit for class: -------------

☐ Deferred for further evaluation. If yes, why and to whom?

(248) **Comments, limitations**

(249) **AME/GMP declaration:**

I hereby certify that I have personally examined the applicant named on this medical examination report and that this report with any attachment embodies my findings completely and correctly.

(250) Place and date:	AME/GMP name and address: E-mail: Telephone No.: Telefax No.:	AME certificate No./GMP identification No.:
AME/GMP signature:		

INSTRUCTIONS FOR COMPLETION OF THE MEDICAL EXAMINATION REPORT FORMS

The AME performing the examination should verify the identity of the applicant.

All questions (sections) on the medical examination report form should be completed in full. If an otorhinolaryngology examination report form is attached, then questions 209, 210, 211, and 234 may be omitted. If an ophthalmology examination report form is attached, then questions 212, 213, 214, 229, 230, 231, 232, and 233 may be omitted.

Writing should be legible and in block capitals using a ball-point pen. Completion of this form by typing/printing is also acceptable. If more space is required to answer any question, a plain sheet of paper should be used, bearing the applicant's name, the AME's name and signature, and the date of signing. The following numbered instructions apply to the numbered headings on the medical examination report form.

Failure to complete the medical examination report form in full, as required, or to write legibly, may result in non-acceptance of the application in total and may lead to withdrawal of any medical certificate issued. The making of false or misleading statements or the withholding of relevant information by an AME may result in criminal prosecution, denial of an application or withdrawal of any medical certificate(s) granted.

Shaded areas do not require completion for the medical examination report form for the LAPL.

201 EXAMINATION CATEGORY – Tick appropriate box.

Initial – Initial examination for either LAPL, class 1 or 2; also initial examination for upgrading from LAPL to class 2, or class 2 to 1 (notate 'upgrading' in box 248).

Renewal/Revalidation – Subsequent ROUTINE examinations.

Extended Renewal/Revalidation – Subsequent ROUTINE examinations, which include comprehensive ophthalmological and otorhinolaryngology examinations.

202 HEIGHT – Measure height, without shoes, in centimetres to nearest cm.

203 WEIGHT – Measure weight, in indoor clothes, in kilograms to nearest kg.

204 COLOUR EYE – State colour of applicant's eyes from the following list: brown, blue, green, hazel, grey, multi.

205 COLOUR HAIR – State colour of applicant's hair from the following list: brown, black, red, fair, bald.

206 BLOOD PRESSURE – Blood pressure readings should be recorded as Phase 1 for Systolic pressure and Phase 5 for Diastolic pressure. The applicant should be seated and rested. Recordings in mm Hg.

207 PULSE (RESTING) – The pulse rate should be recorded in beats per minute and the rhythm should be recorded as regular or irregular. Further comments if necessary may be written in section 228, 248 or separately.

208 to 227 inclusive constitute the general clinical examination, and each of the boxes should be marked (with a tick) as normal or abnormal.

208 HEAD, FACE, NECK, SCALP – To include appearance, range of neck and facial movements, symmetry, etc.

209 MOUTH, THROAT, TEETH – To include appearance of buccal cavity, palate motility, tonsillar area, pharynx and also gums, teeth and tongue.

210 NOSE, SINUSES – To include appearance and any evidence of nasal obstruction or sinus tenderness on palpation.

211 EARS, DRUMS, EARDRUM MOTILITY – To include otoscopy of external ear, canal, tympanic membrane. Eardrum motility by valsalva manoeuvre or by pneumatic otoscopy.

212 EYES – ORBIT AND ADNEXA; VISUAL FIELDS – To include appearance, position and movement of eyes and their surrounding structures in general, including eyelids and conjunctiva. Visual fields check by campimetry, perimetry or confrontation.

213 EYES – PUPILS AND OPTIC FUNDI – To include appearance, size, reflexes, red reflex and fundoscopy. Special note of corneal scars.

214 EYES – OCULAR MOTILITY, NYSTAGMUS – To include range of movement of eyes in all directions; symmetry of movement of both eyes; ocular muscle balance; convergence; accommodation; signs of nystagmus.

215 LUNGS, CHEST, BREASTS – To include inspection of chest for deformities, operation scars, abnormality of respiratory movement, auscultation of breath sounds. Physical examination of female applicant's breasts should only be performed with informed consent.

216 HEART – To include apical heartbeat, position, auscultation for murmurs, carotid bruits, palpation for trills.

217 VASCULAR SYSTEM – To include examination for varicose veins, character and feel of pulse, peripheral pulses, evidence of peripheral circulatory disease.

218 ABDOMEN, HERNIA, LIVER, SPLEEN – To include inspection of abdomen; palpation of internal organs; check for inquinal hernias in particular.

219 ANUS, RECTUM – Examination only with informed consent.

220 GENITO-URINARY SYSTEM – To include renal palpation; inspection palpation male/female reproductive organs only with informed consent.

221 ENDOCRINE SYSTEM – To include inspection, palpation for evidence of hormonal abnormalities/imbalance; thyroid gland.

222 UPPER AND LOWER LIMBS, JOINTS – To include full range of movements of joints and limbs, any deformities, weakness or loss. Evidence of arthritis.

223 SPINE, OTHER MUSCULOSKELETAL – To include range of movements, abnormalities of joints.

224 NEUROLOGIC – REFLEXES ETC. To include reflexes, sensation, power, vestibular system – balance, romberg test, etc.

225 PSYCHIATRIC – To include appearance, appropriate mood/thought, unusual behaviour.

226 SKIN, IDENTIFYING MARKS AND LYMPHATICS – To include inspection of skin; inspection, palpation for lymphadenopathy, etc. Briefly describe scars, tattoos, birthmarks, etc. which could be used for identification purposes.

227 GENERAL SYSTEMIC – All other areas, systems and nutritional status.

228 NOTES – Any notes, comments or abnormalities to be described – extra notes if required on separate sheet of paper, signed and dated.

229 DISTANT VISION AT 5/6 METRES – Each eye to be examined separately and then both together. First without correction, then with spectacles (if used) and lastly with contact lenses, if used. Record visual acuity in appropriate boxes. Visual acuity to be tested at either 5 or 6 metres with the appropriate chart for the distance.

230 INTERMEDIATE VISION AT 100 CM – Each eye to be examined separately and then both together. First without correction, then with spectacles if used and lastly with contact lenses if used. Record visual acuity in appropriate boxes as ability to read N14 at 100 cm (Yes/No).

231 NEAR VISION AT 30-50 CM. – Each eye to be examined separately and then both together. First without correction, then with spectacles if used and lastly with contact lenses, if used. Record visual acuity in appropriate boxes as ability to read N5 at 30-50 cm (Yes/No).

Note: Bifocal contact lenses and contact lenses correcting for near vision only are not acceptable.

232 SPECTACLES – Tick appropriate box signifying if spectacles are or are not worn by applicant. If used, state whether unifocal, bifocal, varifocal or look-over.

233 CONTACT LENSES – Tick appropriate box signifying if contact lenses are or are not worn. If worn, state type from the following list; hard, soft, gas-permeable or disposable.

313 COLOUR PERCEPTION – Tick appropriate box signifying if colour perception is normal or not. If abnormal; state number of plates of the first 15 of the pseudo-isochromatic plates (Ishihara 24 plates) have not been read correctly.

234 HEARING – Tick appropriate box to indicate hearing level ability as tested separately in each ear at 2 m.

235 URINALYSIS – State whether result of urinalysis is normal or not by ticking appropriate box. If no abnormal constituents, state NIL in each appropriate box.

236 PULMONARY FUNCTION – When required or on indication, state actual FEV_1/FVC value obtained in % and state if normal or not with reference to height, age, sex and race.

237 HAEMOGLOBIN – Enter actual haemoglobin test result and state units used. Then state whether normal value or not, by ticking appropriate box.

238 to 244 inclusive: ACCOMPANYING REPORTS – One box opposite each of these sections must be ticked. If the test is not required and has not been performed, then tick the NOT PERFORMED box. If the test has been performed (whether required or on indication) complete the normal or abnormal box as appropriate. In the case of question 244, the number of other accompanying reports must be stated.

247 AME RECOMMENDATION – The applicant's name, date of birth and reference number, should be entered here in block capitals. The applicable class of medical certificate should be indicated by a tick in the appropriate box. If a fit assessment is recommended and a medical certificate has been issued, this should be indicated in the appropriate box. An applicant may be recommended as fit for a lower class of medical certificate (e.g. class 2), but also be deferred or recommended as unfit for a higher class of medical certificate (e.g. class 1). If an unfit recommendation is made, applicable Part-MED paragraph references should be entered. If an applicant is deferred for further evaluation, the reason and the doctor or licensing authority to whom the applicant is referred should be indicated.

248 COMMENTS, LIMITATIONS, ETC. – The AME's findings and assessment of any abnormality in the history or examination, should be entered here. The AME should also state any limitation required.

249 AME DETAILS – The AME should sign the declaration, complete his/her name and address in block capitals, contact details and lastly stamp the relevant section with his/her designated AME stamp incorporating his/her AME number. The GMP identification no. is the number provided by the national medical system.

250 PLACE AND DATE – The place (town or city) and the date of examination should be entered here. The date of examination is the date of the general examination and not the date of finalisation of the form. If the medical examination report is finalised on a different date, the date of finalisation should be entered in section 248 as 'Report finalised on ....'.

GM1 ARA.MED.135 (b);(c) Aero-medical forms

OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY EXAMINATION REPORT FORMS

The ophthalmology and otorhinolaryngology examination report forms may be used as indicated in the following forms and corresponding instructions for completion.

OPHTHALMOLOGY EXAMINATION REPORT FORM

Complete this page fully and in block capitals – Refer to instructions for completion.

MEDICAL IN CONFIDENCE

Applicant's details

(1) State applied to:	(2) Medical certificate applied for:		class 1 ☐ class 2 ☐
(3) Surname:	(4) Previous surname(s):		(12) Application: Initial ☐ Revalidation/Renewal ☐
(5) Forename(s):	(6) Date of birth:	(7) Sex: Male ☐ Female ☐	(13) Reference number:

(301) **Consent to release of medical information:** I hereby authorise the release of all information contained in this report and any or all attachments to the AME and, where necessary, to the medical assessor of the licensing authority, recognising that these documents or electronically stored data, are to be used for completion of a medical assessment and will become and remain the property of the licensing authority, providing that I or my physician may have access to them according to national law. Medical confidentiality will be respected at all times.

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Date	Signature of applicant	Signature of AME

(302) Examination category: Initial ☐ Revalidation ☐ Renewal ☐ Special referral ☐	(303) Ophthalmological history:

Clinical examination

Check each item

		Normal	Abnormal
(304) Eyes, external & eyelids			
(305) Eyes, Exterior (slit lamp, ophth.)			
(306) Eye position and movements			
(307) Visual fields (confrontation)			
(308) Pupillary reflexes			
(309) Fundi (Ophthalmoscopy)			
(310) Convergence	cm		
(311) Accommodation	D		

(312) *Ocular muscle balance* (in prisme dioptres)

Distant at 5m/6m	Near at 30-50 cm
Ortho	Ortho
Eso	Eso
Exo	Exo
Hyper	Hyper
Cyclo	Cyclo
Tropia Yes No	Phoria Yes No
Fusional reserve testing Not performed Normal Abnormal	

(313) *Colour perception*

Pseudo-Isochromatic plates	Type: Ishihara (24 plates)
No of plates:	No of errors:
Advanced colour perception testing indicated Yes No Method:	
Colour SAFE	Colour UNSAFE

Visual acuity

(314) *Distant vision at 5m/6m*

	Uncorrected		Spectacles	Contact lenses
Right eye		Corrected to		
Left eye		Corrected to		
Both eyes		Corrected to		

(315) *Intermediate vision at 1m*

	Uncorrected		Spectacles	Contact lenses
Right eye		Corrected to		
Left eye		Corrected to		
Both eyes		Corrected to		

(316) *Near vision at 30-50cm*

	Uncorrected		Spectacles	Contact lenses
Right eye		Corrected to		
Left eye		Corrected to		
Both eyes		Corrected to		

(317) *Refraction*	Sph	Cylinder	Axis	Near (add)
Right eye				
Left eye				
Actual refraction examined	Spectacles prescription based			

(318) *Spectacles*	(319) *Contact lenses*
Yes ☐ No ☐ Type:	Yes ☐ No ☐ Type:

(320) *Intra-ocular pressure*	
Right (mmHg)	Left (mmHg)
Method	Normal ☐ Abnormal ☐

(321) **Ophthalmological remarks and recommendation:**

(322) **Examiner's declaration:**

I hereby certify that I/my AME group have personally examined the applicant named on this medical examination report and that this report with any attachment embodies my findings completely and correctly.

(323) Place and date:	Ophth examiner's name and address: (block capitals) E-mail: Telephone No.: Telefax No.:	AME or specialist stamp with No.:
AME signature:		

INSTRUCTIONS FOR COMPLETION OF THE OPHTHALMOLOGY EXAMINATION REPORT FORM

Writing should be legible and in block capitals using a ball-point pen. Completion of this form by typing or printing is also acceptable. If more space is required to answer any question, a plain sheet of paper should be used, bearing the applicant's name, the name and signature of the AME or ophthalmology specialist performing the examination and the date of signing. The following numbered instructions apply to the numbered headings on the ophthalmology examination report form.

Failure to complete the medical examination report form in full, as required, or to write legibly may result in non-acceptance of the application in total and may lead to withdrawal of any medical certificate issued. The making of false or misleading statements or the withholding of relevant information by an examiner may result in criminal prosecution, denial of an application or withdrawal of any medical certificate granted.

The AME or ophthalmology specialist performing the examination should verify the identity of the applicant. The applicant should then be requested to complete the sections 1, 2, 3, 4, 5, 6, 7, 12 and 13 on the form and then sign and date the consent to release of medical information (section 301) with the examiner countersigning as witness.

302 EXAMINATION CATEGORY – Tick appropriate box.

Initial – Initial examination for either class 1 or 2; also initial examination for upgrading from class 2 to 1 (notate 'upgrading' in section 303).

Renewal/Revalidation – Subsequent comprehensive ophthalmological examinations (due to refractive error).

Special referral – NON-ROUTINE examination for assessment of an ophthalmological symptom or finding.

303 OPHTHALMOLOGICAL HISTORY – Detail here any history of note or reasons for special referral.

304 to 309 inclusive: CLINICAL EXAMINATION – These sections together cover the general clinical examination and each of the sections should be marked (with a tick) as normal or abnormal. Any abnormal findings or comments on findings should be entered in section 321.

310 CONVERGENCE – Enter near point of convergence in cm, as measured using RAF near point rule or equivalent. Tick whether normal or abnormal. Any abnormal findings or comments on findings should be entered in section 321.

311 ACCOMMODATION – Enter measurement recorded in dioptres using RAF near point rule or equivalent. Tick whether normal or abnormal. Any abnormal findings or comments on findings should be entered in section 321.

312 OCULAR MUSCLE BALANCE – Ocular muscle balance is tested at distant 5 or 6 m and near at 30-50 cm and results recorded. Presence of tropia or phoria must be entered accordingly and also whether fusional reserve testing was NOT performed and if performed whether normal or not.

313 COLOUR PERCEPTION – Enter type of pseudo-isochromatic plates (ishihara) as well as number of plates presented with number of errors made by examinee. State whether advanced colour perception testing is indicated and what methods used (which colour lantern or anomaloscopy) and finally whether judged to be colour safe or unsafe. Advanced colour perception testing is usually only required for initial assessment, unless indicated by change in applicant's colour perception.

314–316 VISUAL ACUITY TESTING AT 5 m/6 m, 1 m and 30-50 cm – Record actual visual acuity obtained in appropriate boxes. If correction not worn nor required, put line through corrected vision boxes. Distant visual acuity to be tested at either 5 m or 6 m with the appropriate chart for that distance.

317 REFRACTION – Record results of refraction. Indicate also whether for class 2 applicants, refraction details are based upon spectacle prescription.

318 SPECTACLES – Tick appropriate box signifying if spectacles are or are not worn by applicant. If used, state whether unifocal, bifocal, varifocal or look-over.

319 CONTACT LENSES – Tick appropriate box signifying if contact lenses are or are not worn. If worn, state type from the following list; hard, soft, gas-permeable, disposable.

320 INTRA-OCULAR PRESSURE – Enter intra-ocular pressure recorded for right and left eyes and indicate whether normal or not. Also indicate method used – applanation, air etc.

321 OPHTHALMOLOGICAL REMARKS AND RECOMMENDATION – Enter here all remarks, abnormal findings and assessment results. Also enter any limitations recommended. If there is any doubt about findings or recommendations, the examiner may contact the AMS for advice before finalising the report form.

322 OPHTHALMOLOGY EXAMINER'S DETAILS – The ophthalmology examiner must sign the declaration, complete his/her name and address in block capitals, contact details and lastly stamp the report with his/her designated stamp incorporating his/her AME or specialist number.

323 PLACE AND DATE – Enter the place (town or city) and the date of examination. The date of examination is the date of the clinical examination and not the date of finalisation of form. If the ophthalmology examination report is finalised on a different date, enter date of finalisation on section 321 as 'Report finalised on ....'.

OTORHINOLARYNGOLOGY EXAMINATION REPORT FORM

Complete this page fully and in block capitals – Refer to instructions for completion.

MEDICAL IN CONFIDENCE

Applicant's details

(1) State applied to:	(2) Medical certificate applied for: class 1 ☐ class 2 ☐		
(3) Surname:	(4) Previous surname(s):		(12) Application: Initial ☐ Revalidation/Renewal ☐
(5) Forename(s):	(6) Date of birth:	(7) Sex: Male ☐ Female ☐	(13) Reference number:

(401) **Consent to release of medical information:** I hereby authorise the release of all information contained in this report and any or all attachments to the AME and, where necessary, to the medical assessor of the licensing authority, recognising that these documents, or any electronically stored data, are to be used for completion of a medical assessment and will become and remain the property of the licensing authority, providing that I or my physician may have access to them according to national law. Medical confidentiality will be respected at all times.

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Date	Signature of applicant	Signature of AME

(402) Examination category: Initial ☐ Special referral ☐	(403) Otorhinolaryngological history:

Clinical examination

Check each item	Normal	Abnormal
(404) Head, face, neck, scalp		
(405) Buccal cavity, teeth		
(406) Pharynx		
(407) Nasal passages and naso-pharynnx (incl. anterior rhinoscopy)		
(408) Vestibular system incl. Romberg test		
(409) Speech		
(410) Sinuses		
(411) Ext acoustic meati, tympanic membranes		
(412) Pneumatic otoscopy		
(413) Impedance tympanometry including Valsalva menoeuvre (initial only)		

(419) *Pure tone audiometry*

dB HL (hearing level)

Hz	Right ear	Left ear
250		
500		
1000		
2000		
3000		
4000		
6000		
8000		

Additional testing (if indicated)	Not performed	Normal	Abnormal
(414) Speech audiometry			
(415) Posterior rhinoscopy			
(416) EOG; spontaneous and positional nystagnus			
(417) Differential caloric test or vestibular autorotation test			
(418) Mirror or fibre laryngoscopy			

(420) *Audiogram*

o = Right — — — = Air
x = Left .... = Bone

dB/HL	250	500	1000	2000	3000	4000	6000	8000
–10								
0								
10								
20								
30								
40								
50								
60								
70								
80								
90								
100								
110								
120								
Hz	250	500	1000	2000	3000	4000	6000	8000

(421) **Otorhinolaryngology remarks and recommendation:**

(422) **Examiner's declaration:**

I hereby certify that I/my AME group have personally examined the applicant named on this medical examination report and that this report with any attachment embodies my findings completely and correctly.

(423) Place and date:	ORL examiner's name and address: (block capitals) E-mail: Telephone No.: Telefax No.:	AME or specialist stamp with No:
AME signature:		

INSTRUCTIONS FOR COMPLETION OF THE OTORHINOLARYNGOLOGY EXAMINATION REPORT FORM

Writing should be legible and in block capitals using a ball-point pen. Completion of this form by typing or printing is also acceptable. If more space is required to answer any question, a plain sheet of paper should be used, bearing the applicant's name, the name and signature of the AME or otorhinolaryngology specialist performing the examination and the date of signing. The following numbered instructions apply to the numbered headings on the otorhinolaryngology examination report form.

Failure to complete the medical examination report form in full, as required, or to write legibly may result in non-acceptance of the application in total and may lead to withdrawal of any medical certificate issued. The making of false or misleading statements or the withholding of relevant information by an examiner may result in criminal prosecution, denial of an application or withdrawal of any medical certificate granted.

The AME or otorhinolaryngology specialist performing the examination should verify the identity of the applicant. The applicant should then be requested to complete the sections 1, 2, 3, 4, 5, 6, 7, 12 and 13 on the form and then sign and date the consent to release of medical information (section 401) with the examiner countersigning as witness.

402 EXAMINATION CATEGORY – Tick appropriate box.

Initial – Initial examination for class 1; also initial examination for upgrading from class 2 to 1 (notate upgrading' in section 403)

Special Referral – NON-ROUTINE examination for assessment of an ORL symptom or finding

403 OTORHINOLARYNGOLOGICAL HISTORY – Detail here any history of note or reasons for special referral.

404-413 inclusive: CLINICAL EXAMINATION – These sections together cover the general clinical examination and each of the sections should be marked (with a tick) as normal or abnormal. Any abnormal findings or comments on findings should be entered in section 421.

414-418 inclusive: ADDITIONAL TESTING – These tests are only required to be performed if indicated by history or clinical findings and are not routinely required. For each test one of the boxes must be completed – if the test is not performed then tick that box – if the test has been performed then tick the appropriate box for a normal or abnormal result. All remarks and abnormal findings should be entered in section 421.

419 PURE TONE AUDIOMETRY – Complete figures for dB HL (hearing level) in each ear at all listed frequencies.

420 AUDIOGRAM – Complete audiogram from figures as listed in section 419.

421 OTORHINOLARYNGOLOGY REMARKS AND RECOMMENDATION – Enter here all remarks, abnormal findings and assessment results. Also enter any limitations recommended. If there is any doubt about findings or recommendations the examiner may contact the AMS for advice before finalising the report form.

422 OTORHINOLARYNGOLOGY EXAMINER'S DETAILS – The otorhinolaryngology examiner must sign the declaration, complete his/her name and address in block capitals, contact details and lastly stamp the report with his/her designated stamp incorporating his/her AME or specialist number.

423 PLACE AND DATE – Enter the place (town or city) and the date of examination. The date of examination is the date of the clinical examination and not the date of finalisation of form. If the ORL examination report is finalised on a different date, enter date of finalisation in section 421 as 'Report finalised on ....'.

AMC1 ARA.MED.150 Record-keeping

RELEASE OF AERO-MEDICAL RECORDS

In accordance with Directive 95/46/EC as implemented under national law, aero-medical records may also be released:

(a) upon written request of the applicant, to management of the competent authority, for review in response to a complaint;

(b) to research institutes for the purpose of scientific research, with assurance of de-identification prior to publication;

(c) to any investigation body (accident, security, police), when required under national law; and

(d) for any other circumstances, as required under national law.

SECTION II – AERO-MEDICAL EXAMINERS (AMEs)

AMC1 ARA.MED.200 Procedure for the issue, revalidation, renewal or change of an AME certificate

INSPECTION OF THE AME PRACTICE

Before issuing the AME certificate, the competent authority should conduct an inspection of the AME practice to verify compliance with ARA.MED.200 (a).

SECTION III – MEDICAL CERTIFICATION

AMC1 ARA.MED.315(a) Review of examination reports

GENERAL

(a) The process to review examination and assessment reports received from AeMCs, AMEs and GMPs should aim to check all reports received.

(b) The licensing authority should take account of the proportion of inconsistencies or errors found in the assessment process and adapt the sample size accordingly and to review all reports if necessary.

AMC1 ARA.MED.330 Special medical circumstances

GENERAL

The protocol should:

(a) assess the incapacitation risk;

(b) assess the risk of subtle impairment of performance;

(c) undertake a risk–benefit analysis;

(d) include a review of the regulations in use in other major aviation States and ICAO;

(e) determine which class of medical certificate is included in the scope;

(f) estimate the number of pilots likely to be included;

(g) list all anticipated risks to the protocol and provide a risk management strategy including appropriate limitations for every anticipated risk; where the risk of subtle impairment of performance is identified, the protocol should include requirements for minimum simulator testing or minimum line-flying under supervision or both;

(h) nominate medical research experts, if necessary, to provide advice on research methods.

AMC1 ARA.MED.330(b)(c) Special medical circumstances

GENERAL

Initial medical certificates issued on the basis of a protocol should only be issued by the competent authority. Thereafter, the competent authority should decide whether the AeMC or AME may issue the medical certificate

GM1 ARA.MED.330 Special medical circumstances

GENERAL

(a) When the terms 'medical assessment protocol', 'research protocol' and 'protocol' (as mentioned in ARA.MED.330 and its associated AMC) are used, they all refer to a 'medical assessment protocol'.

(b) The protocol is to enable experience to be gained in special medical circumstances in a controlled manner. This is to facilitate a better understanding of the treatment or condition, so that an evidence-based decision concerning its implementation may be considered.

(c) The protocol and its implementation should comply with the principles described in the following publication of the World Medical Association (WMA): "WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects", as last amended

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AMC and GM to Annex VII ORGANISATION REQUIREMENTS FOR AIRCREW

(PART-ORA)

SUBPART GEN – GENERAL REQUIREMENTS

SECTION I - GENERAL

GM1 ORA.GEN.005

The following provides a list of acronyms used throughout this Annex:

(A)	aeroplane
(H)	helicopter
ACAS	airborne collision avoidance system
AD	airworthiness directive
AIS	aeronautical information service
AM	accountable manager
AMC	Acceptable Means of Compliance
ARA	authority requirements for aircrew
ATA	Air Transport Association
ATC	air traffic control
ATO	approved training organisation
ATPL	airline transport pilot licence
BITD	basic instrument training device
BPL	balloon pilot licence
CBT	computer-based training
CFI	chief flying instructor
CM	compliance monitoring
CMP	compliance monitoring programme
CMS	compliance monitoring system
COP	code of practice
CRM	crew resource management
CS-FSTD(A)	Certification Specifications for aeroplane flight simulation training devices
CS-FSTD(H)	Certification Specifications for helicopter flight simulation training devices
CTKI	chief theoretical knowledge instructor
DG	dangerous goods
EC	European Community
ERP	emergency response plan
ETOPS	extended range operations with twin-engined aeroplanes
FATO	final approach and take-off area
FFS	full flight simulator
FMGC	flight management and guidance computer
FMS	flight management system
FNPT	flight navigation and procedures trainer
FSTD	flight simulation training device
FTD	flight training device
FTE	full-time equivalent
FTI	flight test instructor
GM	Guidance Material
GMP	general medical practitioner
HEMS	helicopter emergency medical service

HHO	helicopter hoist operation
HT	head of training
IFR	instrument flight rules
IMC	instrument meteorological conditions
IOS	instructor operation station
IR	Implementing Rule
LAPL	light aircraft pilot licence
LIFUS	line flying under supervision
LVO	low visibility operation
MCC	multi-crew cooperation
MMEL	master minimum equipment list
MPA	multi-pilot aeroplane
MPL	multi-crew pilot licence
NVIS	night vision imaging system
OPC	operator proficiency check
ORA	organisation requirements for aircrew
OSD	operational suitability data
OTD	other training device
PBN	performance-based navigation
PF	pilot flying
PIC	pilot-in-command
PPL	private pilot licence
QTG	qualification test guide
SMM	safety management manual
SOP	standard operating procedure
SPL	sailplane pilot licence
TAWS	terrain awareness warning system
TRE	type rating examiner
TRI	type rating instructor
VDR	validation data roadmap
ZFTT	zero flight-time training

AMC1 ORA.GEN.120(a) Means of compliance

DEMONSTRATION OF COMPLIANCE

In order to demonstrate that the Implementing Rules are met, a risk assessment should be completed and documented. The result of this risk assessment should demonstrate that an equivalent level of safety to that established by the Acceptable Means of Compliance (AMC) adopted by the Agency is reached.

AMC1 ORA.GEN.125 Terms of approval and privileges of an organisation

MANAGEMENT SYSTEM DOCUMENTATION

The management system documentation should contain the privileges and detailed scope of activities for which the organisation is certified, as relevant to the applicable requirements. The scope of activities defined in the management system documentation should be consistent with the terms of approval.

AMC1 ORA.GEN.130 Changes to organisations

APPLICATION TIME FRAMES

(a) The application for the amendment of an organisation certificate should be submitted at least 30 days before the date of the intended changes.

(b) In the case of a planned change of a nominated person, the organisation should inform the competent authority at least 10 days before the date of the proposed change.

(c) Unforeseen changes should be notified at the earliest opportunity, in order to enable the competent authority to determine continued compliance with the applicable requirements and to amend, if necessary, the organisation certificate and related terms of approval.

GM1 ORA.GEN.130(a) Changes to organisations

GENERAL

(a) Typical examples of changes that may affect the certificate or the terms of approval are listed below:

   (1) the name of the organisation;

   (2) the organisation's principal place of business;

   (3) the organisation's scope of activities;

   (4) additional locations of the organisation;

   (5) the accountable manager;

   (6) any of the persons referred to in ORA.GEN.210 (a) and (b);

   (7) the organisation's documentation as required by this Part, safety policy and procedures;

   (8) the facilities.

(b) Prior approval by the competent authority is required for any changes to the organisation's procedure describing how changes not requiring prior approval will be managed and notified to the competent authority.

(c) Changes requiring prior approval may only be implemented upon receipt of formal approval by the competent authority.

GM2 ORA.GEN.130(a) Changes to organisations

CHANGE OF NAME OF THE ORGANISATION

A change of name requires the organisation to submit a new application as a matter of urgency.

Where this is the only change to report, the new application can be accompanied by a copy of the documentation previously submitted to the competent authority under the previous name, as a means of demonstrating how the organisation complies with the applicable requirements.

AMC1 ORA.GEN.150(b) Findings

GENERAL

The corrective action plan defined by the organisation should address the effects of the non-conformity, as well as its root-cause.

GM1 ORA.GEN.150 Findings

GENERAL

(a) Corrective action is the action to eliminate or mitigate the root cause(s) and prevent recurrence of an existing detected non-compliance or other undesirable condition or situation.

(b) Proper determination of the root cause is crucial for defining effective corrective actions.

AMC1 ORA.GEN.160 Occurrence reporting

GENERAL

(a) The organisation should report all occurrences defined in AMC 20-8, and as required by the applicable national rules implementing Directive 2003/43/EC[2] on occurrence reporting in civil aviation.

(b) In addition to the reports required by AMC 20-8 and Directive 2003/43/EC, the organisation should report volcanic ash clouds encountered during flight.

SECTION II –MANAGEMENT

AMC1 ORA.GEN.200(a)(1);(2);(3);(5) Management system

NON-COMPLEX ORGANISATIONS - GENERAL

(a) Safety risk management may be performed using hazard checklists or similar risk management tools or processes, which are integrated into the activities of the organisation.

(b) The organisation should manage safety risks related to a change. The management of change should be a documented process to identify external and internal change that may have an adverse effect on safety. It should make use of the organisation's existing hazard identification, risk assessment and mitigation processes.

(c) The organisation should identify a person who fulfils the role of safety manager and who is responsible for coordinating the safety management system. This person may be the accountable manager or a person with an operational role in the organisation.

(d) Within the organisation, responsibilities should be identified for hazard identification, risk assessment and mitigation.

(e) The safety policy should include a commitment to improve towards the highest safety standards, comply with all applicable legal requirements, meet all applicable standards, consider best practices and provide appropriate resources.

(f) The organisation should, in cooperation with other stakeholders, develop, coordinate and maintain an emergency response plan (ERP) that ensures orderly and safe transition from normal to emergency operations and return to normal operations. The ERP should provide the actions to be taken by the organisation or specified individuals in an emergency and reflect the size, nature and complexity of the activities performed by the organisation.

AMC1 ORA.GEN.200(a)(1) Management system

COMPLEX ORGANISATIONS - ORGANISATION AND ACCOUNTABILITIES

The management system of an organisation should encompass safety by including a safety manager and a safety review board in the organisational structure.

(a) Safety manager

    (1) The safety manager should act as the focal point and be responsible for the development, administration and maintenance of an effective safety management system.

    (2) The functions of the safety manager should be to:

        (i) facilitate hazard identification, risk analysis and management;

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[2] Directive 2003/42/EC of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation *OJ L 167*, 4.7.2003, p. 23–36.

(ii) monitor the implementation of actions taken to mitigate risks, as listed in the safety action plan;

(iii) provide periodic reports on safety performance;

(iv) ensure maintenance of safety management documentation;

(v) ensure that there is safety management training available and that it meets acceptable standards;

(vi) provide advice on safety matters; and

(vii) ensure initiation and follow-up of internal occurrence / accident investigations.

(b) Safety review board

(1) The Safety review board should be a high level committee that considers matters of strategic safety in support of the accountable manager's safety accountability.

(2) The board should be chaired by the accountable manager and be composed of heads of functional areas.

(3) The safety review board should monitor:

(i) safety performance against the safety policy and objectives;

(ii) that any safety action is taken in a timely manner; and

(iii) the effectiveness of the organisation's safety management processes.

(c) The safety review board should ensure that appropriate resources are allocated to achieve the established safety performance.

(d) The safety manager or any other relevant person may attend, as appropriate, safety review board meetings. He/she may communicate to the accountable manager all information, as necessary, to allow decision making based on safety data.

GM1 ORA.GEN.200(a)(1) Management system

SAFETY MANAGER

(a) Depending on the size of the organisation and the nature and complexity of its activities, the safety manager may be assisted by additional safety personnel for the performance of all safety management related tasks.

(b) Regardless of the organisational set-up it is important that the safety manager remains the unique focal point as regards the development, administration and maintenance of the organisation's safety management system.

GM2 ORA.GEN.200(a)(1) Management system

COMPLEX ORGANISATIONS - SAFETY ACTION GROUP

(a) A safety action group may be established as a standing group or as an ad-hoc group to assist or act on behalf of the safety review board.

(b) More than one safety action group may be established depending on the scope of the task and specific expertise required.

(c) The safety action group should report to and take strategic direction from the safety review board and should be comprised of managers, supervisors and personnel from operational areas.

(d) The safety action group should:

(1) monitor operational safety;

(2) resolve identified risks;

(3) assess the impact on safety of operational changes; and

(4) ensure that safety actions are implemented within agreed timescales.

(e) The safety action group should review the effectiveness of previous safety recommendations and safety promotion.

AMC1 ORA.GEN.200(a)(2) Management system

COMPLEX ORGANISATIONS - SAFETY POLICY

(a) The safety policy should:

(1) be endorsed by the accountable manager;

(2) reflect organisational commitments regarding safety and its proactive and systematic management;

(3) be communicated, with visible endorsement, throughout the organisation; and

(4) include safety reporting principles.

(b) The safety policy should include a commitment:

(1) to improve towards the highest safety standards;

(2) to comply with all applicable legislation, meet all applicable standards and consider best practices;

(3) to provide appropriate resources;

(4) to enforce safety as one primary responsibility of all managers; and

(5) not to blame someone for reporting something which would not have been otherwise detected.

(c) Senior management should:

(1) continually promote the safety policy to all personnel and demonstrate their commitment to it;

(2) provide necessary human and financial resources for its implementation; and

(3) establish safety objectives and performance standards.

GM1 ORA.GEN.200(a)(2) Management system

SAFETY POLICY

The safety policy is the means whereby the organisation states its intention to maintain and, where practicable, improve safety levels in all its activities and to minimise its contribution to the risk of an aircraft accident as far as is reasonably practicable.

The safety policy should state that the purpose of safety reporting and internal investigations is to improve safety, not to apportion blame to individuals.

AMC1 ORA.GEN.200(a)(3) Management system

COMPLEX ORGANISATIONS - SAFETY RISK MANAGEMENT

(a) Hazard identification processes

(1) Reactive and proactive schemes for hazard identification should be the formal means of collecting, recording, analysing, acting on and

generating feedback about hazards and the associated risks that affect the safety of the operational activities of the organisation.

(2) All reporting systems, including confidential reporting schemes, should include an effective feedback process.

(b) Risk assessment and mitigation processes

(1) A formal risk management process should be developed and maintained that ensures analysis (in terms of likelihood and severity of occurrence), assessment (in terms of tolerability) and control (in terms of mitigation) of risks to an acceptable level.

(2) The levels of management who have the authority to make decisions regarding the tolerability of safety risks, in accordance with (b)(1), should be specified.

(c) Internal safety investigation

(1) The scope of internal safety investigations should extend beyond the scope of occurrences required to be reported to the competent authority.

(d) Safety performance monitoring and measurement

(1) Safety performance monitoring and measurement should be the process by which the safety performance of the organisation is verified in comparison to the safety policy and objectives.

(2) This process should include:

(i) safety reporting;

(ii) safety studies, that is, rather large analyses encompassing broad safety concerns;

(iii) safety reviews including trends reviews, which would be conducted during introduction and deployment of new technologies, change or implementation of procedures, or in situations of structural change in operations;

(iv) safety audits focussing on the integrity of the organisation's management system, and periodically assessing the status of safety risk controls; and

(v) safety surveys, examining particular elements or procedures of a specific operation, such as problem areas or bottlenecks in daily operations, perceptions and opinions of operational personnel and areas of dissent or confusion.

(e) The management of change

The organisation should manage safety risks related to a change. The management of change should be a documented process to identify external and internal change that may have an adverse effect on safety. It should make use of the organisation's existing hazard identification, risk assessment and mitigation processes.

(f) Continuous improvement

The organisation should continuously seek to improve its safety performance. Continuous improvement should be achieved through:

(1) proactive and reactive evaluations of facilities, equipment, documentation and procedures through safety audits and surveys;

(2) proactive evaluation of individuals' performance to verify the fulfilment of their safety responsibilities; and

(3) reactive evaluations in order to verify the effectiveness of the system for control and mitigation of risk.

(g) The emergency response plan (ERP)

(1) An ERP should be established that provides the actions to be taken by the organisation or specified individuals in an emergency. The ERP should reflect the size, nature and complexity of the activities performed by the organisation.

(2) The ERP should ensure:

(i) an orderly and safe transition from normal to emergency operations;

(ii) safe continuation of operations or return to normal operations as soon as practicable; and

(iii) coordination with the emergency response plans of other organisations, where appropriate.

GM1 ORA.GEN.200(a)(3) Management system

INTERNAL OCCURRENCE REPORTING SCHEME

(a) The overall purpose of the scheme is to use reported information to improve the level of safety performance of the organisation and not to attribute blame.

(b) The objectives of the scheme are to:

(1) enable an assessment to be made of the safety implications of each relevant incident and accident, including previous similar occurrences, so that any necessary action can be initiated; and

(2) ensure that knowledge of relevant incidents and accidents is disseminated, so that other persons and organisations may learn from them.

(c) The scheme is an essential part of the overall monitoring function and it is complementary to the normal day-to-day procedures and 'control' systems and is not intended to duplicate or supersede any of them. The scheme is a tool to identify those instances where routine procedures have failed.

(d) All occurrence reports judged reportable by the person submitting the report should be retained as the significance of such reports may only become obvious at a later date.

GM3 ORA.GEN.200(a)(3) Management system

APPROVED TRAINING ORGANISATIONS - RISK MANAGEMENT OF FLIGHT OPERATIONS WITH KNOWN OR FORECAST VOLCANIC ASH CONTAMINATION

(a) Responsibilities

The ATO is responsible for the safety of its operations, including within an area with known or forecast volcanic ash contamination.

The ATO should complete this assessment of safety risks related to known or forecast volcanic ash contamination as part of its management system before initiating operations into airspace forecast to be or aerodromes/operating sites known to be contaminated with volcanic ash.

This process is intended to ensure the ATO takes into account the likely accuracy and quality of the information sources it uses in its management system and to demonstrate its own competence and capability to interpret data from different sources in order to achieve the necessary level of data integrity reliably and correctly resolve any conflicts among data sources that may arise.

In order to decide whether or not to operate into airspace forecast to be or aerodromes/operating sites known to be contaminated with volcanic ash, the ATO should make use of the safety risk assessment within its management system as required by ORA.GEN.200.

The ATO's safety risk assessment should take into account all relevant data including data from the type certificate holders (TCHs) regarding the susceptibility of the aircraft they operate to volcanic cloud-related airworthiness effects, the nature and severity of these effects and the related pre-flight, in-flight and post-flight precautions to be observed by the ATO.

The ATO should ensure that personnel required to be familiar with the details of the safety risk assessments receives all relevant information (both pre-flight and in-flight) in order to be in a position to apply appropriate mitigation measures as specified by the safety risk assessments.

(b) Procedures

The ATO should have documented procedures for the management of operations into airspace forecast to be or aerodromes/operating sites known to be contaminated with volcanic ash.

These procedures should ensure that, at all times, flight operations remain within the accepted safety boundaries as established through the management system allowing for any variations in information sources, equipment, operational experience or organisation. Procedures should include those for flight crew and any other relevant personnel such that they are in a position to evaluate correctly the risk of flights into airspace forecast to be contaminated by volcanic ash and to plan accordingly.

Continuing airworthiness personnel should be provided with procedures allowing them to correctly assess the need for and to execute relevant maintenance or continuing airworthiness interventions.

The ATO should retain sufficient qualified and competent staff to generate well supported operational risk management decisions and ensure that its staff are appropriately trained and current. It is recommended that the ATO make the necessary arrangements for its relevant staff to take up opportunities to be involved in volcanic ash exercises conducted in their areas of operation.

(c) Volcanic activity information and the ATO's potential response Before and during operations, information valuable to the ATO is generated by various volcano agencies worldwide. The ATO's risk assessment and mitigating actions need to take account of and respond appropriately to the information likely to be available during each phase of the eruptive sequence from pre-eruption through to end of eruptive activity. It is nevertheless noted that eruptions rarely follow a deterministic pattern of behaviour. A typical ATO's response may consist of the following:

(1) Pre-eruption The ATO should have in place a robust mechanism for ensuring that it is constantly vigilant for any alerts of pre-eruption volcanic activity relevant to its operations. The staff involved need to understand the threat to safe operations that such alerts represent. An ATO whose areas of activity include large, active volcanic areas for which immediate International Airways Volcano Watch (IAVW) alerts may not be available, should define its strategy for capturing information about increased volcanic activity before pre-eruption alerts are generated. For example, an ATO may combine elevated activity information with information concerning the profile and history of the volcano to determine an operating policy, which could include re-routing or restrictions at night. This would be useful when dealing with the 60% of volcanoes which are unmonitored. Such an ATO should also ensure that its crews are aware that they may be the first to observe an eruption and so need to be vigilant and ready to ensure that this information is made available for wider dissemination as quickly as possible.

(2) Start of an eruption Given the likely uncertainty regarding the status of the eruption during the early stages of an event and regarding the associated volcanic cloud, the ATO's procedures should include a

requirement for crews to initiate re-routes to avoid the affected airspace. The ATO should ensure that flights are planned to remain clear of the affected areas and that consideration is given to available aerodromes/operating sites and fuel requirements. It is expected that the following initial actions will be taken by the ATO:

(i) determine if any aircraft in flight could be affected, alert the crew and provide advice on re-routing as required;

(ii) alert management;

(iii) for flight departures, brief flight crew and revise flight and fuel planning in accordance with the safety risk assessment;

(iv) alert flight crew to the need for increased monitoring of information (e.g. special air report (AIREP), volcanic activity report (VAR), significant weather information (SIGMET), NOTAMs and company messages);

(v) initiate the gathering of all data relevant to determining the risk; and

(vi) apply mitigations identified in the safety risk assessment.

(3) On-going eruption As the eruptive event develops, the ATO can expect the responsible Volcanic Ash Advisory Centre (VAAC) to provide volcanic ash advisory messages (VAA/VAGs) defining, as accurately as possible, the vertical and horizontal extent of areas and layers of volcanic clouds. As a minimum, the ATO should monitor, and take account of, this VAAC information as well as of relevant SIGMETs and NOTAMs. Other sources of information are likely to be available such as VAR/AIREPs, satellite imagery and a range of other information from State and commercial organisations. The ATO should plan its operations in accordance with its safety risk assessment taking into account the information that it considers accurate and relevant from these additional sources. The ATO should carefully consider and resolve differences or conflicts among the information sources, notably between published information and observations (pilot reports, airborne measurements, etc.). Given the dynamic nature of the volcanic hazards, the ATO should ensure that the situation is monitored closely and operations adjusted to suit changing conditions. The ATO should be aware that, depending on the State concerned the affected or danger areas may be established and presented in a different way than the one currently used in Europe as described in EUR Doc 019-NAT Doc 006. The ATO should require reports from its crews concerning any encounters with volcanic emissions. These reports should be passed immediately to the appropriate air traffic services (ATS) unit and to the ATO’s competent authority. For the purpose of flight planning, the ATO should treat the horizontal and vertical limits of the temporary danger area (TDA) or airspace forecast to be contaminated by volcanic ash as applicable, to be over-flown as it would mountainous terrain, modified in accordance with its safety risk assessment. The ATO should take account of the risk of cabin depressurisation or engine failure resulting in the inability to maintain level flight above a volcanic cloud. Additional minimum Equipment List (MEL) provisions, if applicable, should be considered in consultation with the TCHs. Flying below a volcanic ash contaminated airspace should be considered on a case by case basis. It should only be planned to reach or leave an aerodrome/operating site close to the boundary of this airspace or where the ash contamination is very high and stable. The establishment of Minimum Sector Altitude(MSA) and the availability of aerodromes/operating sites should be considered.

(d) Safety risk assessment When directed specifically at the issue of intended flight into airspace forecast to be or aerodromes/operating sites known to be contaminated with volcanic ash, the process should involve the following:

(1) Identifying the hazards The generic hazard, in the context of this document, is airspace forecast to beor aerodromes/operating sites known

to be contaminated with volcanic ash, and whose characteristics are harmful to the airworthiness and operation of the aircraft. This GM is referring to volcanic ash contamination since it is the most significant hazard for flight operations in the context of a volcanic eruption. Nevertheless, it might not be the only hazard and therefore the operator should consider additional hazards which could have an adverse effect on aircraft structure or passengers safety such as gases. Within this generic hazard, the ATO should develop its own list of specific hazards taking into account its specific aircraft, experience, knowledge and type of operation, and any other relevant data stemming from previous eruptions.

(2) Considering the severity and consequences of the hazard occurring (i.e. the nature and actual level of damage expected to be inflicted on the particular aircraft from exposure to that volcanic ash cloud).

(3) Evaluating the likelihood of encountering volcanic ash clouds with characteristics harmful to the safe operation of the aircraft. For each specific hazard within the generic hazard, the likelihood of adverse consequences should be assessed, either qualitatively or quantitatively.

(4) Determining whether the consequent risk is acceptable and within the ATO's risk performance criteria. At this stage of the process, the safety risks should be classified as acceptable or unacceptable. The assessment of tolerability will be subjective, based on qualitative data and expert judgement, until specific quantitative data are available in respect of a range of parameters.

(5) Taking action to reduce the safety risk to a level that is acceptable to the ATO's management. Appropriate mitigation for each unacceptable risk identified should then be considered in order to reduce the risk to a level acceptable to the ATO's management.

(e) Procedures to be considered when identifying possible mitigations actions When conducting a volcanic ash safety risk assessment, the ATO should consider the following non-exhaustive list of procedures and processes as mitigation:

(1) Type certificate holders Obtaining advice from the TCHs and other engineering sources concerning operations in potentially contaminated airspace and/or aerodromes/operating sites contaminated by volcanic ash. This advice should set out:

(i) the features of the aircraft that are susceptible to airworthiness effects related to volcanic ash;

(ii) the nature and severity of these effects;

(iii) the effect of volcanic ash on operations to/from contaminated aerodromes/operating sites, including the effect on take-off and landing aircraft performance;

(iv) the related pre-flight, in-flight and post-flight precautions to be observed by the ATO including any necessary amendments to aircraft operating manuals, aircraft maintenance manuals, master minimum equipment list/dispatch deviation or equivalents required to support the ATO; and

(v) the recommended inspections associated with inadvertent operations in volcanic ash contaminated airspace and operations to/from volcanic ash contaminated aerodromes/operating sites; this may take the form of instructions for continuing airworthiness or other advice.

(2) ATO/contracted organisations' personnel Definition of procedures for flight planning and operations ensuring that:

(i) flight crews are in a position to evaluate correctly the risk of encountering volcanic ash contaminated airspace, or aerodromes/operating sites, and can plan accordingly;

(ii) flight planning and operational procedures enable crews to avoid areas and aerodromes/operating sites with unacceptable volcanic ash contamination;
(iii) flight crew are aware of the possible signs of entry into a volcanic ash cloud and execute the associated procedures;
(iv) continuing airworthiness personnel are able to assess the need for, and to execute, any necessary maintenance or other required interventions; and
(v) crews are provided with appropriate aircraft performance data when operating to/from aerodromes/operating sites contaminated with volcanic ash.

(3) Provision of enhanced flight watch This should ensure:
(i) close and continuous monitoring of VAA, VAR/AIREP, SIGMET, NOTAM and ASHTAM and other relevant information, and information from crews, concerning the volcanic ash cloud hazard;
(ii) access to plots of the affected areas from SIGMETs, NOTAMs and other relevant information for crews; and
(iii) communication of the latest information to crews in a timely fashion.

(4) Flight planning Flexibility of the process to allow re-planning at short notice should conditions change.

(5) Departure, destination and alternate aerodromes For the airspace to be traversed, or the aerodromes/operating sites in use, parameters to evaluate and take account of:
(i) the probability of contamination;
(ii) any additional aircraft performance requirements;
(iii) required maintenance considerations;
(iv) fuel requirements for re-routeing and extended holding.

(6) Routing policy Parameters to evaluate and take account of:
(i) the shortest period in and over the forecast contaminated area;
(ii) the hazards associated with flying over the contaminated area;
(iii) drift down and emergency descent considerations;
(iv) the policy for flying below the contaminated airspace and the associated hazards.

(7) Diversion policy Parameters to evaluate and take account of:
(i) maximum allowed distance from a suitable aerodrome/operating site;
(ii) availability of aerodromes/operating sites outside the forecast contaminated area;
(iii) diversion policy after an volcanic ash encounter.

(8) Minimum equipment list Additional provisions in the MEL, if applicable, for dispatching aircraft with unserviceabilities that might affect the following non-exhaustive list of systems:
(i) air conditioning packs;
(ii) engine bleeds;
(iii) pressurisation system;
(iv) electrical power distribution system;
(v) air data system;
(vi) standby instruments;
(vii) navigation systems;
(viii) de-icing systems;
(ix) engine driven generators;
(x) auxiliary power unit (APU);
(xi) airborne collision avoidance system (ACAS);
(xii) terrain awareness warning system (TAWS);
(xiii) autoland systems;
(xiv) provision of crew oxygen;

(xv) supplemental oxygen for passengers.

(9) Standard operating procedures Crew training to ensure they are familiar with normal and abnormal operating procedures and particularly any changes regarding but not limited to:
  (i) pre-flight planning;
  (ii) in-flight monitoring of volcanic ash cloud affected areas and avoidance procedures;
  (iii) diversion;
  (iv) communications with ATC;
  (v) in-flight monitoring of engine and systems potentially affected by volcanic ash cloud contamination;
  (vi) recognition and detection of volcanic ash clouds and reporting procedures;
  (vii) in-flight indications of a volcanic ash cloud encounter;
  (viii) procedures to be followed if a volcanic ash cloud is encountered;
  (ix) unreliable or erroneous airspeed;
  (x) non-normal procedures for engines and systems potentially affected by volcanic ash cloud contamination;
  (xi) engine-out and engine relight;
  (xii) escape routes; and
  (xiii) operations to/from aerodromes/operating sites contaminated with volcanic ash.

(10) Provision for aircraft technical log This should ensure:
  (i) Systematic entry in the aircraft continuing airworthiness records or aircraft log if available related to any actual or suspected volcanic ash encounter whether in-flight or at an aerodrome/operating site; and
  (ii) Checking, prior to flight, of the completion of maintenance actions related to an entry in the continuing airworthiness records or aircraft log if available for a volcanic ash cloud encounter on a previous flight.

(11) Incident reporting Crew requirements for:
  (i) reporting an airborne volcanic ash cloud encounter (VAR);
  (ii) post-flight volcanic ash cloud reporting (VAR);
  (iii) reporting non encounters in airspace forecast to be contaminated; and
  (iv) filing a mandatory occurrence report in accordance with ORA.GEN.160.

(12) Continuing airworthiness procedures Procedures when operating in or near areas of volcanic ash cloud contamination:
  (i) enhancement of vigilance during inspections and regular maintenance and appropriate adjustments to maintenance practices;
  (ii) definition of a follow-up procedure when a volcanic ash cloud encounter has been reported or suspected;
  (iii) thorough investigation for any sign of unusual or accelerated abrasions or corrosion or of volcanic ash accumulation;
  (iv) reporting to TCHs and the relevant authorities observations and experiences from operations in areas of volcanic ash cloud contamination;
  (v) completion of any additional maintenance recommended by the TCH or by the competent authority.

(f) Reporting The ATO should ensure that reports are immediately submitted to the nearest ATS unit using the VAR/AIREP procedures followed up by a more detailed VAR on landing together with, as applicable, a report as defined in Regulation (EU) No 996/2010 and Directive 2003/42/EC, and an aircraft technical log entry for:

(1) any incident related to volcanic clouds;
(2) any observation of volcanic ash activity and
(3) anytime that volcanic ash is not encountered in an area where it was forecast to be.
(g) Additional guidance Further guidance on volcanic ash safety risk assessment is given in ICAO Doc. 9974 (Flight safety and volcanic ash – Risk management of flight operations with known or forecast volcanic ash contamination).

GM4 ORA.GEN.200(a)(3) Management system

SAFETY RISK ASSESSMENT – RISK REGISTER

The results of the assessment of the potential adverse consequences or outcome of each hazard may be recorded by the ATO in a risk register, an example of which is provided below.

AMC1 ORA.GEN.200(a)(4) Management system

TRAINING AND COMMUNICATION ON SAFETY

(a) Training
(1) All personnel should receive safety training as appropriate for their safety responsibilities.
(2) Adequate records of all safety training provided should be kept.

(b) Communication
(1) The organisation should establish communication about safety matters that:
(i) ensures that all personnel are aware of the safety management activities as appropriate for their safety responsibilities;
(ii) conveys safety critical information, especially relating to assessed risks and analysed hazards;
(iii) explains why particular actions are taken; and
(iv) explains why safety procedures are introduced or changed.
(2) Regular meetings with personnel where information, actions and procedures are discussed may be used to communicate safety matters.

GM1 ORA.GEN.200(a)(4) Management system

TRAINING AND COMMUNICATION ON SAFETY

The safety training programme may consist of self-instruction via a media (newsletters, flight safety magazines), class-room training, e-learning or similar training provided by training service providers.

AMC1 ORA.GEN.200(a)(5) Management system

ORGANISATION's MANAGEMENT SYSTEM DOCUMENTATION

(a) The organisation's management system documentation should at least include the following information:
(1) a statement signed by the accountable manager to confirm that the organisation will continuously work in accordance with the applicable requirements and the organisation's documentation as required by this Part;
(2) the organisation's scope of activities;
(3) the titles and names of persons referred to in ORA.GEN.210 (a) and (b);

(4) an organisation chart showing the lines of responsibility between the persons referred to in ORA.GEN.210;

(5) a general description and location of the facilities referred to in ORA.GEN.215;

(6) procedures specifying how the organisation ensures compliance with the applicable requirements;

(7) the amendment procedure for the organisation's management system documentation.

(b) The organisation's management system documentation may be included in a separate manual or in (one of) the manual(s) as required by the applicable Subpart(s). A cross reference should be included.

GM1 ORA.GEN.200(a)(5) Management system

ORGANISATION's MANAGEMENT SYSTEM DOCUMENTATION

(a) It is not required to duplicate information in several manuals. The information may be contained in any of the organisation manuals (e.g. operations manual, training manual), which may also be combined.

(b) The organisation may also choose to document some of the information required to be documented in separate documents (e.g. procedures). In this case, it should ensure that manuals contain adequate references to any document kept separately. Any such documents are then to be considered an integral part of the organisation's management system documentation.

AMC1 ORA.GEN.200(a)(5) Management system

COMPLEX ORGANISATIONS – ORGANISATION's SAFETY MANAGEMENT MANUAL

(a) The safety management manual (SMM) should be the key instrument for communicating the approach to safety for the whole of the organisation. The SMM should document all aspects of safety management, including the safety policy, objectives, procedures and individual safety responsibilities.

(b) The contents of the safety management manual should include all of the following:

(1) scope of the safety management system;

(2) safety policy and objectives;

(3) safety accountability of the accountable manager;

(4) safety responsibilities of key safety personnel;

(5) documentation control procedures;

(6) hazard identification and risk management schemes;

(7) safety action planning;

(8) safety performance monitoring;

(9) incident investigation and reporting;

(10) emergency response planning;

(11) management of change (including organisational changes with regard to safety responsibilities);

(12) safety promotion.

(c) The SMM may be contained in (one of) the manual(s) of the organisation.

AMC1 ORA.GEN.200(a)(6) Management system

COMPLIANCE MONITORING - GENERAL

(a) Compliance monitoring
The implementation and use of a compliance monitoring function should enable the organisation to monitor compliance with the relevant requirements of this Part and other applicable Parts.
  (1) The organisation should specify the basic structure of the compliance monitoring function applicable to the activities conducted.
  (2) The compliance monitoring function should be structured according to the size of the organisation and the complexity of the activities to be monitored.

(b) Organisations should monitor compliance with the procedures they have designed to ensure safe activities. In doing so, they should as a minimum, and where appropriate, monitor:
  (1) privileges of the organisation;
  (2) manuals, logs, and records;
  (3) training standards;
  (4) management system procedures and manuals.

(c) Organisational set up
  (1) To ensure that the organisation continues to meet the requirements of this Part and other applicable Parts, the accountable manager should designate a compliance monitoring manager. The role of the compliance monitoring manager is to ensure that the activities of the organisation are monitored for compliance with the applicable regulatory requirements , and any additional requirements as established by the organisation, and that these activities are being carried out properly under the supervision of the relevant head of functional area.
  (2) The compliance monitoring manager should be responsible for ensuring that the compliance monitoring programme is properly implemented, maintained and continually reviewed and improved.
  (3) The compliance monitoring manager should:
    (i) have direct access to the accountable manager;
    (ii) not be one of the other persons referred to in ORA.GEN.210 (b);
    (iii) be able to demonstrate relevant knowledge, background and appropriate experience related to the activities of the organisation; including knowledge and experience in compliance monitoring; and
    (iv) have access to all parts of the organisation, and as necessary, any contracted organisation.
  (4) In the case of a non-complex organisation, this task may be exercised by the accountable manager provided he/she has demonstrated having the related competence as defined in (c)(3)(iii).
  (5) In the case the same person acts as compliance monitoring manager and as safety manager, the accountable manager, with regards to his/her direct accountability for safety, should ensure that sufficient resources are allocated to both functions, taking into account the size of the organisation and the nature and complexity of its activities.
  (6) The independence of the compliance monitoring function should be established by ensuring that audits and inspections are carried out by

personnel not responsible for the function, procedure or products being audited.

(d) Compliance monitoring documentation

(1) Relevant documentation should include the relevant part(s) of the organisation's management system documentation.

(2) In addition, relevant documentation should also include the following:

(i) terminology;
(ii) specified activity standards;
(iii) a description of the organisation;
(iv) the allocation of duties and responsibilities;
(v) procedures to ensure regulatory compliance;
(vi) the compliance monitoring programme, reflecting:
(A) schedule of the monitoring programme;
(B) audit procedures;
(C) reporting procedures;
(D) follow-up and corrective action procedures; and
(E) recording system.
(vii) the training syllabus referred to in (e)(2);
(viii) document control.

(e) Training

(1) Correct and thorough training is essential to optimise compliance in every organisation. In order to achieve significant outcomes of such training, the organisation should ensure that all personnel understand the objectives as laid down in the organisation's management system documentation.

(2) Those responsible for managing the compliance monitoring function should receive training on this task. Such training should cover the requirements of compliance monitoring, manuals and procedures related to the task, audit techniques, reporting and recording.

(3) Time should be provided to train all personnel involved in compliance management and for briefing the remainder of the personnel.

(4) The allocation of time and resources should be governed by the volume and complexity of the activities concerned.

GM1 ORA.GEN.200(a)(6) Management system

COMPLIANCE MONITORING - GENERAL

(a) The organisational set-up of the compliance monitoring function should reflect the size of the organisation and the nature and complexity of its activities. The compliance monitoring manager may perform all audits and inspections himself/herself or appoint one or more auditors by choosing personnel having the related competence as defined in AMC1 ORA.GEN.200(a)(6) point (c)(3)(iii), either from within or outside the organisation.

(b) Regardless of the option chosen it must be ensured that the independence of the audit function is not affected, in particular in cases where those performing the audit or inspection are also responsible for other functions within the organisation.

(c) In case external personnel are used to perform compliance audits or inspections:

(1) any such audits or inspections are performed under the responsibility of the compliance monitoring manager; and

(2) the organisation remains responsible to ensure that the external personnel has relevant knowledge, background and experience as appropriate to the activities being audited or inspected; including knowledge and experience in compliance monitoring.

(d) The organisation retains the ultimate responsibility for the effectiveness of the compliance monitoring function in particular for the effective implementation and follow-up of all corrective actions.

GM2 ORA.GEN.200(a)(6) Management system

COMPLEX ORGANISATIONS - COMPLIANCE MONITORING PROGRAMME FOR ATOs

(a) Typical subject areas for compliance monitoring audits and inspections for approved training organisations (ATOs) should be the following:

(1) facilities;

(2) actual flight and ground training;

(3) technical standards.

(b) ATOs should monitor compliance with the training and operations manuals they have designed to ensure safe and efficient training. In doing so, they should, where appropriate, additionally monitor the following:

(1) training procedures;

(2) flight safety;

(3) flight and duty time limitations, rest requirements and scheduling;

(4) aircraft maintenance/operations interface.

GM3 ORA.GEN.200(a)(6) Management system

AUDIT AND inspection

(a) 'Audit' means a systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent to which requirements are complied with.

(b) 'Inspection' means an independent documented conformity evaluation by observation and judgement accompanied as appropriate by measurement, testing or gauging, in order to verify compliance with applicable requirements.

AMC1 ORA.GEN.200(b) Management system

SIZE, NATURE AND COMPLEXITY OF THE ACTIVITY

(a) An organisation should be considered as complex when it has a workforce of more than 20 full time equivalents (FTEs) involved in the activity subject to Regulation (EC) No 216/2008[3] and its Implementing Rules.

(b) Organisations with up to 20 full time equivalents (FTEs) involved in the activity subject to Regulation (EC) No 216/2008 and its Implementing Rules, may also be considered complex based on an assessment of the following factors:

(1) in terms of complexity, the extent and scope of contracted activities subject to the approval;

(2) in terms of risk criteria, whether any of the following are present:

(i) operations requiring the following specific approvals: performance-based navigation (PBN), low visibility operation (LVO), extended range operations with two-engined aeroplanes (ETOPS), helicopter hoist operation (HHO), helicopter emergency medical service (HEMS), night vision imaging system (NVIS) and dangerous goods (DG);

(ii) different types of aircraft used;

(iii) the environment (offshore, mountainous area etc.);

(c) Regardless of the criteria mentioned in (a) and (b), the following organisations should always be considered as non-complex:

(1) Approved Training Organisations (ATOs) only providing training for the light aircraft pilot licence (LAPL), private pilot licence (PPL), sailplane pilot licence (SPL) or balloon pilot licence (BPL) and the associated ratings and certificates;

(2) Aero-Medical Centres (AeMCs).

AMC1 ORA.GEN.200(c) Management system

ATOs PROVIDING TRAINING ONLY FOR THE LAPL, PPL, SPL AND BPL AND THE ASSOCIATED RATINGS OR CERTIFICATES — ORGANISATIONAL REVIEW

(a) The primary objective of the organisational review is to enable the organisation to ensure that its management system remains effective by verifying that it:

(1) has continually identified its aviation safety hazards;

(2) has effectively mitigated the associated risks; and

(3) monitors compliance with the applicable requirements.

(b) Safety risk management should:

(1) be performed using internal safety or occurrence reports, hazard checklists, risk registers or similar risk management tools or processes, integrated into the activities of the organisation;

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[3] Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC. *OJ L* 79, 19.3.2008, p. 1.

(2) in particular address safety risks related to a change; making use of the existing hazard identification, risk assessment and mitigation tools or processes; and

(3) include provisions for emergency response or a formal Emergency Response Plan (ERP).

(c) As part of the management system documentation required by ORA.GEN.200(a)(5), the organisation should describe the organisational review programme and related responsibilities. Persons responsible for the organisational review should have a thorough knowledge of the applicable requirements and of the organisation's procedures.

(d) The status of all corrective and risk mitigation actions should be monitored by the person responsible for the organisational review programme and implemented within a specified time frame. Action closure should be recorded by the person responsible for the organisational review programme, along with a summary of the action taken.

(e) The results of the organisational review, including all non-compliance findings and new risks identified during the review, should be presented to the accountable manager and the person or group of persons nominated in accordance with ORA.GEN.210(b) prior to notification to the competent authority. All level 1 findings in the sense of ARA.GEN.350 should be immediately notified to the competent authority and all necessary actions immediately taken.

(f) Based on the results of the organisational review, the accountable manager should determine the need for and initiate, as appropriate, further actions to address deficiencies in or further improve the organisation's management system.

GM1 ORA.GEN.200(c) Management system

ATOs PROVIDING TRAINING ONLY FOR THE LAPL, PPL, SPL OR BPL AND THE ASSOCIATED RATINGS OR CERTIFICATES — ORGANISATIONAL REVIEW PROGRAMME

(a) The organisational review programme may consist of:

(1) checklist(s) covering all items necessary to be addressed in order to ensure that the organisation identified its aviation safety hazards, effectively mitigates the associated risks and ensures effective compliance with the applicable requirements. These should address all procedures described in the management system documentation and training manual; and

(2) a schedule for the accomplishment of the different checklist items, with each item being checked at least once within any 12-month period. The organisation may choose to conduct one full review annually or to conduct several partial reviews.

(b) Performance of organisational reviews:

Each review item may be addressed using an appropriate combination of:

(1) review of training records, training documentation;

(2) review of internal safety reports (e.g. notified difficulties in using current procedures and training material, etc.);

(3) review of the risk register and hazard checklists, as applicable;

(4) sample check of training courses;

(5) witnessing of examinations, as appropriate;

(6) interview of the personnel involved; and

(7) review of the feedback provided by students and customers.

(c) It is recommended that internal safety reports and occurrence reports be reviewed on a continual basis with the aim of identifying possible corrective and risk mitigation actions.

GM2 ORA.GEN.200(c) Management system

ATOs PROVIDING TRAINING ONLY FOR THE LAPL, PPL, SPL OR BPL AND THE ASSOCIATED RATINGS OR CERTIFICATES — ORGANISATIONAL REVIEW ITEMS

The following provides a list of typical items for an organisational review checklist, to be adapted as necessary to cover all relevant procedures described in the management system documentation and training manual:

(a) Terms of approval

Check that:

(1) no training has been performed outside the terms of approval;

(2) changes not requiring prior approval have been properly managed.

(b) Training syllabi and course material

Check that:

(1) training syllabi and course materials are in compliance with the applicable requirements, as last amended;

(2) training practices are in compliance with the documentation; and

(3) instructor training practices are standardised.

(c) Training equipment and tools

Check that all equipment and tools other than aircraft and FSTDs are present and meet the criteria defined in the training manual.

(d) Facilities

Check that the facilities meet the criteria defined in the training manual.

(e) Training aircraft and FSTDs

Check that the training aircraft and FSTDs meet the criteria defined in the training manual.

(f) Personnel

Check that:

(1) the current accountable manager and other nominated persons are correctly identified;

(2) the organisation chart accurately indicates lines of responsibility and accountability throughout the organisation;

(3) the organisation remains in compliance with the applicable requirements, in case the number of personnel has decreased or if the activity has increased;

(4) the qualification of all new personnel (or personnel with new functions) has been appropriately assessed;

(5) staff involved in any safety management-related processes and tasks has been properly trained; and

(6) staff has been trained, as necessary, to cover changes in regulations, in competent authority publications, in the organisation, its management system documentation and in associated procedures, etc.

(g) Contracted activities (In case the organisation has contracted activities):

(1) Check that new providers have been assessed prior to the establishment of any contract;

(2) For existing providers approved for such activities: check the authorisation and approval status of the contracted organisation; and

(3) For existing providers not approved for such activities: check that the service provided conforms to the applicable requirements of this Part.

(h) Training and communication on safety

Check that:

(1) all personnel are aware of safety management policies, processes and tasks;

(2) safety-related documentations and publications are available; and

(3) safety-critical information derived from internal safety or occurrence reporting and hazard identification have been timely communicated to all staff concerned.

(i) Management system documentation

Check that:

(1) the documentation is adequate and updated;

(2) staff are aware of the safety policy; and

(3) staff can easily access such documentation when needed.

(j) Record-keeping

Check that:

(1) the records cover all the training activities and management system processes; and

(2) minimum record-keeping periods (random checks) are complied with.

(k) Emergency response provisions or ERP

Check that:

(1) emergency response information is up to date and readily available; and

(2) all staff are aware of emergency response information or the ERP, as applicable (random checks).

(l) Internal safety or occurrence reporting procedures

(1) Check the number of reports received since the last review;

(2) Check that:

(i) internal reporting and external occurrence reporting are performed in accordance with reporting procedures;

(ii) the safety or occurrence reports are analysed; and

(iii) feedback is provided to reporters.

(m) Other risk management tools or processes implemented

(1) As applicable, check that:

(i) records of hazards and risks are assessed; in particular following analysis of safety or occurrence reports and when significant changes occur (regulations, personnel, training aircraft, training courses, etc.);

(ii) the risks are assessed and the risk mitigation actions followed-up and recorded;

(iii) any risk that has been found acceptable is duly justified; and

(iv) the assumptions made for the risk assessment remain valid;

(2) Verify the effectiveness of all risk mitigation actions initiated since the last organisational review.

AMC1 ORA.GEN.205 Contracted activities

RESPONSIBILITY WHEN CONTRACTING ACTIVITIES

(a) The organisation may decide to contract certain activities to external organisations.

(b) A written agreement should exist between the organisation and the contracted organisation clearly defining the contracted activities and the applicable requirements.

(c) The contracted safety related activities relevant to the agreement should be included in the organisation's safety management and compliance monitoring programmes.

(d) The organisation should ensure that the contracted organisation has the necessary authorisation or approval when required, and commands the resources and competence to undertake the task.

GM1 ORA.GEN.205 Contracted activities

RESPONSIBILITY WHEN CONTRACTING ACTIVITIES

(a) Regardless of the approval status of the contracted organisation, the contracting organisation is responsible to ensure that all contracted activities are subject to hazard identification and risk management as required by ORA.GEN.200 (a)(3) and to compliance monitoring as required by ORA.GEN.200 (a)(6).

(b) When the contracted organisation is itself certified to carry out the contracted activities, the organisation’s compliance monitoring should at least check that the approval effectively covers the contracted activities and that it is still valid.

(c) If the organisation requires the contracted organisation to conduct an activity which exceeds the contracted organisation’s terms of approval, this will be considered as the contracted organisation working under the approval of the contracting organisation.

AMC1 ORA.GEN.215 Facility requirements

ATOs PROVIDING TRAINING FOR the CPL, MPL AND ATPL AND THE ASSOCIATED RATINGS AND CERTIFICATES

(a) For ATOs providing flight training, the following flight operations accommodation should be available:
   (1) an operations room with facilities to control flying operations;
   (2) a flight planning room with the following facilities:
      (i) appropriate current maps and charts;
      (ii) current aeronautical information service (AIS) information;
      (iii) current meteorological information;
      (iv) communications to air traffic control (ATC) and the operations room;
      (v) any other flight safety related material.
   (3) adequate briefing rooms/cubicles of sufficient size and number;
   (4) suitable offices for the supervisory personnel and room(s) to allow flight instructors to write reports on students, complete records and other related documentation;
   (5) furnished crew-room(s) for instructors and students.

(b) For ATOs providing theoretical knowledge training, the following facilities for theoretical knowledge instruction should be available:
   (1) adequate classroom accommodation for the current student population;
   (2) suitable demonstration equipment to support the theoretical knowledge instruction;
   (3) a radiotelephony training and testing facility;
   (4) a reference library containing publications giving coverage of the syllabus;
   (5) offices for the instructional personnel.

AMC2 ORA.GEN.215 Facility requirements

ATOs PROVIDING TRAINING FOR THE LAPL, PPL, SPL OR BPL AND THE ASSOCIATED RATINGS AND CERTIFICATES

(a) The following flight operations accommodation should be available:
   (1) a flight planning room with the following facilities:
      (i) appropriate current aviation maps and charts;
      (ii) current AIS information;
      (iii) current meteorological information;
      (iv) communications to ATC (if applicable);
      (v) any other flight safety related material.
   (2) adequate briefing room(s)/cubicles of sufficient size and number;
   (3) suitable office(s) to allow flight instructors to write reports on students, complete records and other related documentation;
   (4) suitable rest areas for instructors and students, where appropriate to the training task;
   (5) in the case of ATOs providing training for the BPL or LAPL(B) only, the flight operations accommodation listed in (a)(1) to (a)(4) may be replaced by other suitable facilities when operating outside aerodromes.

(b) The following facilities for theoretical knowledge instruction should be available:

(1) adequate classroom accommodation for the current student population;

(2) suitable demonstration equipment to support the theoretical knowledge instruction;

(3) suitable office(s) for the instructional personnel.

(c) A single room may be sufficient to provide the functions listed in (a) and (b).

AMC1 ORA.GEN.220(b) Record-keeping

GENERAL

(a) The record-keeping system should ensure that all records are accessible whenever needed within a reasonable time. These records should be organised in a way that ensures traceability and retrievability throughout the required retention period.

(b) Records should be kept in paper form or in electronic format or a combination of both. Records stored on microfilm or optical disc format are also acceptable. The records should remain legible throughout the required retention period. The retention period starts when the record has been created or last amended.

(c) Paper systems should use robust material which can withstand normal handling and filing. Computer systems should have at least one backup system which should be updated within 24 hours of any new entry. Computer systems should include safeguards against the ability of unauthorised personnel to alter the data.

(d) All computer hardware used to ensure data backup should be stored in a different location from that containing the working data and in an environment that ensures they remain in good condition. When hardware or software changes take place, special care should be taken that all necessary data continues to be accessible at least through the full period specified in the relevant Subpart. In the absence of such indication, all records should be kept for a minimum period of 5 years.

GM1 ORA.GEN.220(b) Record-keeping

RECORDS

Microfilming or optical storage of records may be carried out at any time. The records should be as legible as the original record and remain so for the required retention period.

Subpart ATO - Approved Training Organisations

SECTION I – GENERAL

GM1 ORA.ATO.100 Scope

The content of this Section contains the requirements applicable to all ATOs providing training for pilot licences and the associated ratings and certificates.

It is applicable to ATOs providing training for:

(a) the LAPL, PPL, SPL and BPL and the associated ratings and certificates; and

(b) the commercial pilot licence (CPL), multi-crew pilot licence (MPL) and airline transport pilot licence (ATPL) and the associated ratings and certificates.

AMC1 ORA.ATO.105 Application

APPLICATION FORM

APPLICATION FORM FOR AN ATO CERTIFICATE		
N°	**Question**	**Supplementary information**
1.	Name of training organisation under which the activity is to take place	address, fax number, e-mail, URL
2.	Training courses offered	theory and/or flight training
3.	Name of head of training	type and number of licence full/part-time
4.	Name of chief flight instructor	as (3)
5.	Name of chief theoretical knowledge instructor	as (3)
6.	Name of flight instructor(s), where applicable	as (3)
7.	Aerodrome(s) / operating site(s) to be used	IFR approaches, if applicable night flying, if applicable air traffic control flight testing facilities, if applicable data reply facilities, if applicable
8.	Flight operations accommodation	location, number and size of rooms
9.	Theoretical instruction facilities	location, number and size of rooms
10.	Description of training devices (as applicable)	FFS, FNPT I, II and III, FTD 1, 2 and 3, and 3, and BITD
11.	Description of aircraft	Class/type(s) of aircraft registration of aircraft IFR equipped, if applicable Flight test instrumentation, if applicable
12.	Proposed administration and manuals : (submit with application if required)	(a) course programmes (b) training records (c) operations manual (d) training manual
13.	Details of proposed compliance monitoring system	

Note 1: If answers to any of the above questions are incomplete, the applicant should provide full details of alternative arrangements separately.

Note 2: instrument flight rules (IFR), full flight simulator (FFS), flight and navigation procedures trainer (FNPT), flight training device (FTD), basic instrument training device (BITD)

I, *(name)*, on behalf of (*name of training organisation*) certify that all the above named persons are in compliance with the applicable requirements and that all the above information given is complete and correct.

(Date) (Signature)

AMC1 ORA.ATO.110(b) Personnel requirements

HEAD OF TRAINING

The nominated head of training (HT) should have the overall responsibility to ensure that the training is in compliance with the appropriate requirements. In an ATO providing training courses for different aircraft categories, the HT shall be assisted by one or more nominated deputy HT(s) for certain flight training courses.

AMC1 ORA.ATO.110(c) Personnel requirements

THEORETICAL KNOWLEDGE INSTRUCTORS

Theoretical knowledge instructors should, before appointment, prove their competency by giving a test lecture based on material they have developed for the subjects they are to teach.

AMC1 ORA.ATO.120(a);(b) Record-keeping

ATOs PROVIDING TRAINING ONLY FOR THE LAPL, PPL, SPL OR BPL AND THE ASSOCIATED RATINGS AND CERTIFICATES

The details of ground, flight and flight instruction by using FSTD given to a specific individual student and the detailed progress reports from instructors may be kept also in a student's progress card. This progress card should contain all the exercises of the training syllabus. The instructor should sign this card if a certain exercise has been completed or a specific assessment has been conducted.

AMC1 ORA.ATO.125 Training programme

GENERAL

Flight training in an FSTD and theoretical knowledge instruction should be phased in such a manner as to ensure that students are able to apply to flight exercises the knowledge gained on the ground. Arrangements should be made so that problems encountered during instruction can be resolved during subsequent training.

AMC2 ORA.ATO.125 Training programme

TYPE RATING COURSES – AEROPLANES

(a) Introduction

  (1) When developing the training programme for a type rating course, in addition to complying with the standards included in the operational suitability data (OSD), as established in accordance with Regulation (EC) 1702/2003[4] for the applicable type, the ATO should also follow any further recommendations contained therein.

  (2) The type rating course should, as far as possible, provide for a continual process of ground, FSTD and flight training to enable the student to assimilate the knowledge and skills required to operate a specific aircraft type safely and efficiently. The student's ability to do this should be determined by the demonstration of a satisfactory level of theoretical

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[4] Commission Regulation (EC) No 1702/2003 of 24 September 2003 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations (Part 21) (OJ L 243, 27.9.2003, p. 6). Regulation as last amended by Regulation (EC) No 1194/2009 (OJ L 321, 8.12.2009, p. 5).

knowledge of the aircraft determined by progressive checking of knowledge and examination, progressive assessment by the ATO during flight training and the successful completion of a practical skill test with an examiner.

(3) The type rating course should normally be conducted as a single, full-time course of study and training. However, in the situation where the course is intended to enable a pilot to fly a further aircraft type while continuing to fly a current type, such as to enable mixed fleet flying with the same operator, some elements of the theoretical knowledge course conducted by self-study may be undertaken while the student continues to fly the current type.

(b) Variants

(1) Familiarisation training: Where an aeroplane type rating also includes variants of the same aircraft type requiring familiarisation training, the additional familiarisation training may be included in the theoretical knowledge training of the initial type rating course. Flight training should be conducted on a single variant within the type.

(2) Differences training: Where an aeroplane type rating also includes variants of the same aircraft type for which difference training is required, the initial training course should be directed towards a single variant. Additional training to operate other variants within the same type rating should be completed after successful completion of the initial type rating course. However, elements of this differences training may be undertaken at appropriate stages of the initial course, with the agreement of the competent authority.

(c) Programme of theoretical knowledge and flight training

(1) The training programme should specify the time allocated to theoretical knowledge training, FSTD training and, if not approved for zero flight-time training (ZFTT), the aeroplane. The initial type rating course should be programmed on the basis that the student has the minimum licensing and experience requirements for entry to the course. For a first type rating on a multi-pilot aeroplane (MPA), the course should also provide for consolidation and type-specific training in those elements of basic multi-crew cooperation (MCC) training relevant to the type or variant.

(2) If the ATO wishes to provide a training course that includes credit for previous experience on similar types of aircraft, such as those with common systems or operating procedures with the new type, the entry requirements to such courses should be specified by the ATO and should define the minimum level of experience and qualification required of the flight crew member.

(3) The ATO is permitted to contract elements of training to a third party training provider. In such cases the contracted organisation should normally be approved to conduct such training. When the contracted organisation is not an ATO, the competent authority should, within the approval process of the ATO, include the contracted organisation and be satisfied that the standard of training intended to be given meets the requirements. The other obligations of the ATO, such as student progress monitoring and an adequate management system, can be exercised by the ATO seeking approval and which retains responsibility for the whole course.

GROUND TRAINING

(d) Syllabus
The ground training syllabus should provide for the student to gain a thorough understanding of the operation, function and, if appropriate, abnormal and emergency operation of all aircraft systems. This training should also include those systems essential to the operation of the aircraft, such as 'fly-by-wire' flight control systems, even if the flight crew have little or no control of their normal or abnormal operation.

(e) Theoretical knowledge instruction
The theoretical knowledge instruction training should meet the general objectives of (but not be limited to) giving the student:

(1) a thorough knowledge of the aircraft structure, powerplant and systems, and their associated limitations, including mass and balance, aircraft performance and flight planning considerations;

(2) a knowledge of the positioning and operation of the cockpit controls and indicators for the aircraft and its systems;

(3) an understanding of system malfunctions, their effect on aircraft operations and interaction with other systems; and

(4) the understanding of normal, abnormal and emergency procedures.

(f) Facilities and training aids
The ATO should provide adequate facilities for classroom instruction and have available appropriately qualified and experienced instructors. Training aids should enable students to gain practical experience of the operation of systems covered by the theoretical knowledge syllabus and, in the case of multi-pilot aeroplanes, enable such practical application of the knowledge to be carried out in a multi-crew environment. Facilities should be made available for student self-study outside the formal training programme.

(g) Computer-based training (CBT)
CBT provides a valuable source of theoretical instruction, enabling the students to progress at their own pace within specified time limits. Many such systems ensure that syllabus subjects are fully covered and progress can be denied until a satisfactory assimilation of knowledge has been demonstrated. Such systems may allow self-study or distance learning, if they incorporate adequate knowledge testing procedures. When CBT is used as part of the theoretical knowledge instruction phase, the student should also have access to a suitably qualified instructor able to assist with areas of difficulty for the student.

(h) Self-study and distance learning
Elements of the theoretical knowledge syllabus may be adequately addressed by distance learning, if approved, or self-study, particularly when utilising CBT. Progress testing, either by self-assessed or instructor-evaluated means should be included in any self-study programme. If self-study or distance learning is included in the theoretical knowledge training, the course should also provide for an adequate period of supervised consolidation and knowledge testing.

(i) Progress tests and final theoretical knowledge examination

(1) The theoretical knowledge training programme should provide for progressive testing of the assimilation of the required knowledge. This testing process should also provide for retesting of syllabus items so that a thorough understanding of the required knowledge is assured. This should be achieved by intervention by a qualified instructor or, if using CBT with a self-testing facility, and by further testing during the supervised consolidation phase of the ground course.

(2) The final theoretical knowledge examination should cover all areas of the theoretical knowledge syllabus. The final examination should be

conducted as a supervised written (including computer-based) knowledge test without reference to course material. The pass mark of 75% assumes the achievement of satisfactory levels of knowledge during the progressive phase tests of the course. The student should be advised of any areas of lack of knowledge displayed during the examination and, if necessary, given remedial instruction. A successful pass of the theoretical knowledge course and final examination should be a pre-requisite for progression to the flight training phase of the type rating course, unless otherwise determined in the OSD established in accordance with Regulation (EC) 1702/2003.

FLIGHT TRAINING

(j) Flight simulation training devices (FSTDs)
A type rating course for a multi-pilot aeroplane should include FSTD training.
The amount of training required when using FSTDs will depend on the complexity of the aeroplane concerned, and to some extent on the previous experience of the pilot. Except for those courses giving credit for previous experience (c.2.), a minimum of 32 hours of FSTD training should be programmed for a crew of a multi-pilot aeroplane, of which at least 16 hours should be in an FFS operating as a crew. FFS time may be reduced if other qualified FSTDs used during the flight training programme accurately replicate the cockpit environment, operation and aeroplane response. Such FSTDs may typically include flight management computer (FMC) training devices using hardware and computer programmes identical to those of the aeroplane.

(k) Aeroplane training with FFS

(1) with the exception of courses approved for ZFTT, certain training exercises normally involving take-off and landing in various configurations should be completed in the aeroplane rather than an FFS. For MPAs where the student pilot has more than 500 hours of MPA experience in aeroplanes of similar size and performance, these should include at least four landings of which at least one should be a full-stop landing, unless otherwise specified in the OSD established in accordance with Regulation (EC) 1702/2003, when available. In all other cases the student should complete at least six landings. This aeroplane training may be completed after the student pilot has completed the FSTD training and has successfully undertaken the type rating skill test, provided it does not exceed 2 hours of the flight training course.

(2) courses approved for ZFTT

During the specific simulator session before line flying under supervision (LIFUS), consideration should be given to varying conditions, for example:

(i) runway surface conditions;
(ii) runway length;
(iii) flap setting;
(iv) power setting;
(v) crosswind and turbulence conditions; and
(vi) maximum take-off mass (MTOM) and maximum landing mass (MLM).

(3) the landings should be conducted as full-stop landings. The session should be flown in normal operation.

Special attention should be given to the taxiing technique:

(i) a training methodology should be agreed with the competent authority that ensures the trainee is fully competent with the exterior inspection of the aeroplane before conducting such an inspection un-supervised;

(ii) the LIFUS should be performed as soon as possible after the specific FFS session;

(iii) the licence endorsement should be entered on the licence after the skill test, but before the first four take-offs and landings in the aeroplane. At the discretion of the competent authority, provisional or temporary endorsement and any restriction should be entered on the licence.

Where a specific arrangement exists between the ATO and the commercial air transport operator, the operator proficiency check (OPC) and the ZFTT specific details should be conducted using the operator's standard operating procedures (SOPs).

(l) Aeroplane without FFS

(1) Flight training conducted solely in an aeroplane without the use of FSTDs cannot cover the crew resource management (CRM) and multi-crew cockpit (MCC) aspects of MPA flight training, and for safety reasons cannot cover all emergency and abnormal aircraft operation required for the training and skill test. In such cases, the ATO should demonstrate to the competent authority that adequate training in these aspects can be achieved by other means. For training conducted solely on an MPA where two pilots are trained together without the use of an FSTD, a minimum of 8 hours of flight training as pilot flying (PF) for each pilot should normally be required. For training on a single-pilot aeroplane, 10 hours of flight training should normally be required. It is accepted that for some relatively simple single or multi-engine aircraft without systems such as pressurisation, flight management system (FMS) or electronic cockpit displays, this minimum may be reduced.

(2) Aeroplane training normally involves an inherent delay in achieving an acceptable flight situation and configuration for training to be carried out in accordance with the agreed syllabus. These could include ATC or other traffic delay on the ground prior to take-off, the necessity to climb to height or transit to suitable training areas and the unavoidable need to physically reposition the aircraft for subsequent or repeat manoeuvres or instrument approaches. In such cases it should be ensured that the training syllabus provides adequate flexibility to enable the minimum amount of required flight training to be carried out.

SKILL TEST

(m) Upon completion of the flight training, the pilot will be required to undergo a skill test with an examiner to demonstrate adequate competency of aircraft operation for issue of the type rating. The skill test should be separate from the flight training syllabus, and provision for it cannot be included in the minimum requirements or training hours of the agreed flight training programme. The skill test may be conducted in an FFS, the aeroplane or, in exceptional circumstances, a combination of both.

COURSE COMPLETION CERTIFICATE

(n) The HT, or a nominated representative, should certify that all training has been carried out before an applicant undertakes a skill test for the type rating to be included in the pilot’s licence. If an ATO is unable to provide certain elements of the training that is required to be carried out on an aircraft the ATO may issue such a certificate confirming the completion of the ground training or the training in an FSTD.

AMC3 ORA.ATO.125 Training programme

TYPE RATING COURSES - HELICOPTERS

(a) Introduction

(1) when developing the training programme for a type rating course, in addition to complying with the standards included in the OSD as established in accordance with Regulation (EC) 1702/2003 for the applicable type, the ATO should also follow any further recommendations contained therein.

(2) the course should, as far as possible, provide for integrated ground, FSTD and flight training designated to enable the student to operate safely and qualify for the grant of a type rating. The course should be directed towards a helicopter type, but where variants exist, all flying and ground training forming the basis of the course should relate to a single variant.

(b) Variants

(1) Familiarisation training: where a helicopter type rating also includes variants of the same aircraft type requiring familiarisation training, the additional familiarisation training may be included in the theoretical knowledge training of the initial type rating course.

(2) Differences training: where a helicopter type rating also includes variants of the same aircraft type for which difference training is required, the initial training course should be directed towards a single variant. Additional training to operate other variants within the same type rating should be completed after successful completion of the initial type rating course, although elements of this differences training may be undertaken at appropriate stages of the initial course, with the agreement of the competent authority.

(c) Training in helicopter and FSTDs

The training programme should specify the amounts of flight training in the helicopter type and in FSTDs (FFSs, flight training devices (FTDs), or other training devices (OTDs)). Where a suitable FFS is geographically remote from the normal training base, the competent authority may agree to some additional training being included in the programme at a remote facility.

(d) Skill test

The content of the flight training programme should be directed towards the skill test for that type. The practical training given in Part-FCL should be modified as necessary.

The skill test may be completed in a helicopter, in an FFS or partially in a helicopter and in an FSTD. The use of an FSTD for skill tests is governed by the level of approval of the flight simulator and the previous experience of the candidate. Where an FSTD is not available, abnormal operations of systems should not be practised in a helicopter other than as allowed for in the skill test form for the type.

(e) Phase progress tests and final theoretical knowledge examination

Prior to the final theoretical knowledge examination covering the whole syllabus, the training programme should provide for phase progress tests associated with each phase of theoretical knowledge instruction. The phase progress tests should assess the candidate's knowledge on completion of each phase of the training programme.

(f) Facilities: ground school equipment, training facilities and aids

The ATO should provide, as a minimum, facilities for classroom instruction. Additional classroom training aids and equipment including, where appropriate, computers, should reflect the content of the course and the complexity of the helicopter. For multi-engine and multi-pilot helicopters, the minimum level of ground training aids should include equipment that provides a realistic cockpit working environment. Task analysis and the latest state-of–the-art training technology is encouraged and should be fully incorporated into the training facilities wherever possible. Facilities for self and supervised testing should be available to the student.

(g) Training devices

An FTD or OTD may be provided to supplement classroom training in order to enable students to practice and consolidate theoretical instruction. Where suitable equipment is not available, or is not appropriate, a helicopter or flight simulator of the relevant variant should be available. If an FTD represents a different variant of the same helicopter type for which the student is being trained, then differences or familiarisation training is required.

(h) Computer-based training (CBT)

Where CBT aids are used as a training tool, the ATO should ensure that a fully qualified ground instructor is available at all times when such equipment is being used by course students. Other than for revision periods, CBT lessons should be briefed and debriefed by a qualified ground instructor.

(i) Theoretical knowledge instruction

The theoretical knowledge instruction training should meet the general objectives of giving the student:

(1) a thorough knowledge of the helicopter structure, transmissions, rotors and equipment, powerplant and systems, and their associated limitations;

(2) a knowledge of the positioning and operation of the cockpit controls and indicators for the helicopter and its systems;

(3) a knowledge of performance, flight planning and monitoring, mass and balance, servicing and optional equipment items;

(4) an understanding of system malfunctions, their effect on helicopter operations and interaction with other systems; and

(5) the understanding of normal, abnormal and emergency procedures and giving the student the understanding of potential control problems near the edge of the handling envelope. In particular, the phenomenon of 'servo transparency' (also known as 'jack stall') should be covered for those helicopter types where it is a known problem.

The amount of time and the contents of the theoretical instruction will depend on the complexity of the helicopter type involved and, to some extent, on the previous experience of the student.

(j) Flight training

(1) FSTDs

The level of qualification and the complexity of the type will determine the amount of practical training that may be accomplished in an FSTD, including completion of the skill test. Prior to undertaking the skill test, a student should demonstrate competency in the skill test items during the practical training.

(2) Helicopter (with FSTD)

With the exception of courses approved for ZFTT, the amount of flight time in a helicopter should be adequate for completion of the skill test.

(3) Helicopters (without FSTD)

Whenever a helicopter is used for training, the amount of flight time practical training should be adequate for the completion of the skill test. The amount of flight training will depend on the complexity of the helicopter type involved and, to some extent, on the previous experience of the applicant.

AMC4 ORA.ATO.125 Training programme

FLIGHT TEST TRAINING COURSES – AEROPLANES AND HELICOPTERS

(a) Introduction

(1) The flight test training course should, as far as possible, provide for a continuous process of ground and flight training to enable the student to assimilate the knowledge and skills required to conduct flight testing safely and efficiently. The student's ability to do this should be determined by the demonstration of a satisfactory level of theoretical knowledge of flight testing determined by progressive checking of knowledge and examination and progressive assessment by the ATO during flying training. There should be no difference in the level of knowledge or competency required of the student, irrespective of the intended role of the student as test pilot or other flight test personnel (for example, flight test engineer) within the flight crew.

(2) The flight test training course should normally be conducted as a single, full-time course of study and training.

(b) Programme of theoretical knowledge and flight training

(1) The training programme should specify the time allocated to theoretical knowledge training and flying training.

(2) If the ATO wishes to provide a flight test training course that includes credit for previous experience on flight testing activity, the entry requirements to such courses should be specified by the ATO and should define the minimum level of experience and qualification required of the flight test crew member.

GROUND TRAINING

(c) Syllabus

(1) The ground training syllabus should provide for the student to gain a thorough understanding of flight testing techniques.

(d) Theoretical knowledge instruction

(1) The theoretical knowledge instruction training should give the student a thorough knowledge of the academic requirements of flight testing.

(e) Facilities and training aids

(1) The ATO should provide adequate facilities for classroom instruction and have available appropriately qualified and experienced instructors. Training aids should enable students to gain practical experience of flight testing covered by the theoretical knowledge syllabus and enable such practical application of the knowledge to be carried out in a multi-crew environment. Facilities should be made available for student self-study outside the formal training programme.

(f) Computer-based training (CBT)

(1) CBT provides a valuable source of theoretical instruction, enabling the student to progress at his/her own pace within specified time limits. Many such systems ensure that syllabus subjects are fully covered and progress can be denied until a satisfactory assimilation of knowledge has been demonstrated. Such systems may allow self-study or distance learning, if they incorporate adequate knowledge testing procedures. When CBT is used as part of the theoretical knowledge instruction phase, the student should also have access to a suitably qualified instructor able to assist with areas of difficulty for the student.

(g) Self-study and distance learning

(1) Elements of the theoretical knowledge syllabus may be adequately addressed by distance learning, if approved, or self-study, particularly when utilising CBT. Progress testing, either by self-assessed or instructor-evaluated means, should be included in any self-study programme. If self-study or distance learning is included in the theoretical knowledge training, the course should also provide for an adequate period of supervised consolidation and knowledge testing prior to the commencement of flight training.

(h) Progress tests and final theoretical knowledge examination

(1) The theoretical knowledge training programme should provide for progressive testing of the assimilation of the required knowledge. This testing process should also provide for retesting of syllabus items so that a thorough understanding of the required knowledge is assured. This should be achieved by intervention by a qualified instructor or, if using CBT with a self-testing facility, and by further testing during the supervised consolidation phase of the ground course.

(2) The theoretical knowledge examinations should cover all areas of the theoretical knowledge syllabus. The examinations should be conducted as supervised written or oral knowledge tests without reference to course material. The pass mark (as defined by the ATO) assumes the achievement of satisfactory levels of knowledge during the progressive phase tests of the course. The student should be advised of any areas of lack of knowledge displayed during the examination and, if necessary, given remedial instruction.

FLIGHT TRAINING

(i) Aeroplane and helicopter training

(1) It is widely accepted that flying training normally involves inherent delay in achieving an acceptable flight situation and configuration for training to be carried out in accordance with the agreed syllabus. These could include ATC or other traffic delay on the ground prior to take off, the necessity to climb to height or transit to suitable training areas and the unavoidable need to physically reposition the aircraft for subsequent or repeat manoeuvres or instrument approaches. In such cases it should be ensured that the training syllabus provides adequate flexibility to enable the minimum amount of required flight training to be carried out.

FINAL IN-FLIGHT EXERCISE

(j) Upon completion of the flight test training, the test pilot or flight test engineer will be required to undergo in-flight exercise with a flight test instructor (FTI) to demonstrate adequate competency of flight testing for issue of the flight test rating. The final in-flight exercise must be conducted in an appropriate aeroplane or helicopter (as applicable).

COURSE COMPLETION CERTIFICATE

(k) The HT is required to certify that the applicant has successfully completed the training course.

AMC1 ORA.ATO.135 Training aircraft and FSTDs

ALL ATOs, EXCEPT THOSE PROVIDING FLIGHT TEST TRAINING

(a) The number of training aircraft may be affected by the availability of FSTDs.

(b) Each training aircraft should be:

(1) equipped as required in the training specifications concerning the course in which it is used;

(2) except in the case of balloons or single-seat aircraft, fitted with primary flight controls that are instantly accessible by both the student and the instructor (for example dual flight controls or a centre control stick). Swing-over flight controls should not be used.

(c) The fleet should include, as appropriate to the courses of training:

(1) aircraft suitably equipped to simulate instrument meteorological conditions (IMC) and for the instrument flight training required. For flight training and testing for the instrument rating and the en-route instrument rating (EIR), an adequate number of IFR-certificated aircraft should be available;

(2) in the case of aeroplanes and sailplanes, aircraft suitable for demonstrating stalling and spin avoidance;

(3) for the flight instructor (FI) training courses on aeroplanes and sailplanes, aircraft suitable for spin recovery at the developed stage;

(4) in the case of helicopters, helicopters suitable for autorotation demonstration;

(5) in the case of a non-complex ATO, one aircraft fulfilling all the required characteristics for a training aircraft might be sufficient;

(6) each FSTD should be equipped as required in the training specifications concerning the course in which it is used.

AMC1 ORA.ATO.140 Aerodromes and operating sites

GENERAL

(a) Except in the case of balloons, the base aerodrome or operating site and any alternative base aerodromes at which flight training is being conducted should have at least the following facilities:

(1) at least one runway or final approach and take-off area (FATO) that allows training aircraft to make a normal take-off or landing within the performance limits of all the aircraft used for the training flights.

(2) a wind direction indicator that is visible at ground level from the ends of each runway or at the appropriate holding points;

(3) adequate runway electrical lighting if used for night training;

(4) an air traffic service, except for uncontrolled aerodromes or operating sites where the training requirements may be satisfied safely by another acceptable means of air-to-ground communication.

(b) Except in the case of ATOs providing flight test training, in addition to (a), for helicopters, training sites should be available for:

(1) confined area operation training;

(2) simulated engine off autorotation; and

(3) sloping ground operation.

(c) In the case of balloons, the take-off sites used by the ATO should allow a normal take-off and clearing of all obstacles in the take-off flight path by at least 50 ft.

AMC1 ORA.ATO.145 Pre-requisites for training

ENTRANCE REQUIREMENTS

ATOs providing training for other than the LAPL, PPL, SPL or BPL and the associated ratings and certificates should establish entrance requirements for students in their procedures. The entrance requirements should ensure that the students have enough knowledge, particularly of physics and mathematics, to be able to follow the courses.

SECTION II - ADDITIONAL REQUIREMENTS FOR ATOs PROVIDING TRAINING FOR CPL, MPL AND ATPL AND THE ASSOCIATED RATINGS AND CERTIFICATES

AMC1 ORA.ATO.210 Personnel requirements

GENERAL

(a) The management structure should ensure supervision of all grades of personnel by persons having the experience and qualities necessary to ensure the maintenance of high standards. Details of the management structure, indicating individual responsibilities, should be included in the ATOs operations manual.

(b) The ATO should demonstrate to the competent authority that an adequate number of qualified, competent staff is employed.

(c) In the case of an ATO offering integrated courses, the HT, the chief flying instructor (CFI) and the chief theoretical knowledge instructor (CTKI) should be employed full-time or part-time, depending upon the scope of training offered.

(d) In the case of an ATO offering only one of the following:

  (1) modular courses,

  (2) type rating courses,

  (3) theoretical knowledge instruction,

  the positions of HT, CFI and CTKI may be combined and filled by one or two persons with extensive experience in the training conducted by the training organisation, full-time or part-time, depending upon the scope of training offered.

(e) The ratio of all students to flight instructors, excluding the HT, should not exceed 6:1.

(f) Class numbers in ground subjects involving a high degree of supervision or practical work should not exceed 28 students.

THEORETICAL KNOWLEDGE INSTRUCTORS

(g) The theoretical knowledge instruction for type or class ratings should be conducted by instructors holding the appropriate type or class rating, or having appropriate experience in aviation and knowledge of the aircraft concerned.

(h) For this purpose, a flight engineer, a maintenance engineer or a flight operations officer should be considered as having appropriate experience in aviation and knowledge of the aircraft concerned.

AMC2 ORA.ATO.210 Personnel requirements

QUALIFICATION OF HEAD OF TRAINING AND CHIEF FLIGHT INSTRUCTOR

(a) Head of training (HT)
The nominated HT should hold or have held in the 3 years prior to first appointment as HT, a professional pilot licence and associated ratings or certificates issued in accordance with Part-FCL, related to the flight training courses provided.

(b) Chief flight instructor (CFI)

  (1) The CFI may delegate standardisation and supervision to the flight instructors. In all cases it is the CFI who is ultimately responsible for ensuring quality and standards.

  (2) The CFI should, except in the case of ATOs providing flight test training, have completed 1 000 hours of flight time as pilot-in-command (PIC).

At least 500 of those hours should be on flying instructional duties related to the flying courses provided, of which 200 hours may be instrument ground time.

AMC1 ORA.ATO.230(a) Training manual and operations manual

TRAINING MANUAL

Training manuals for use at an ATO conducting integrated or modular flight training courses should include the following:

(a) The training plan:

(1) The aim of the course (ATP, CPL/IR, CPL, etc. as applicable)	A statement of what the student is expected to do as a result of the training, the level of performance, and the training constraints to be observed.
(2) Pre-entry requirements	(i) Minimum age, educational requirements (including language), medical requirements; (ii) Any individual Member State requirements.
(3) Credits for previous experience	To be obtained from the competent authority before training begins.
(4) Training syllabi	As applicable, the flying syllabus (single-engine or multi-engine, as applicable), the flight simulation training syllabus and the theoretical knowledge training syllabus.
(5) The time scale and scale, in weeks, for each syllabus	Arrangements of the course and the integration of syllabi time.
(6) Training programme	(i) The general arrangements of daily and weekly programmes for flying, theoretical knowledge training and training in FSTDs, if applicable; (ii) Bad weather constraints; (iii) Programme constraints in terms of maximum student training times, (flying, theoretical knowledge, on FSTDs), for example per day, week or month; (iv) Restrictions in respect of duty periods for students; (v) Duration of dual and solo flights at various stages; (vi) Maximum flying hours in any day or night; (vii) Maximum number of training flights in any day or night; (viii) Minimum rest period between duty periods.
(7) Training records	(i) Rules for security of records and documents; (ii) Attendance records; (iii) The form of training records to be kept; (iv) Persons responsible for checking records and students' log books; (v) The nature and frequency of record checks; (vi) Standardisation of entries in training records; (vii) Rules concerning log book entries.
(8) Safety training	(i) Individual responsibilities; (ii) Essential exercises; (iii) Emergency drills (frequency); (iv) Dual checks (frequency at various stages); (v) Requirement before first solo day, night or navigation etc. if applicable.

(9) Tests and examinations	(i) Flying: (A) progress checks; (B) skill tests. (ii) Theoretical knowledge: (A) progress tests; (B) theoretical knowledge examinations. (iii) Authorisation for test; (iv) Rules concerning refresher training before retest; (v) Test reports and records; (vi) Procedures for examination paper preparation, type of question and assessment, standard required for 'pass'; (vii) Procedure for question analysis and review and for raising replacement papers; (viii) Examination resit procedures.
(10) Training effectiveness	(i) Individual responsibilities; (ii) General assessment; (iii) Liaison between departments; (iv) Identification of unsatisfactory progress (individual students); (v) Actions to correct unsatisfactory progress; (vi) Procedure for changing instructors; (vii) Maximum number of instructor changes per student; (viii) Internal feedback system for detecting training deficiencies; (ix) Procedure for suspending a student from training; (x) Discipline; (xi) Reporting and documentation.
(11) Standards and level of performance at various stages	(i) Individual responsibilities; (ii) Standardisation; (iii) Standardisation requirements and procedures; (iv) Application of test criteria.

(b) Briefing and air exercises:

(1) Air exercise	A detailed statement of the content specification of all the air exercises to be taught, arranged in the sequence to be flown with main and subtitles.
(2) Air exercise reference list	An abbreviated list of the above exercises giving only main and subtitles for quick reference, and preferably in flip-card form to facilitate daily use by instructors.
(3) Course structure: phase of training	A statement of how the course will be divided into phases, indication of how the above air exercises will be divided between the phases and how they will be arranged to ensure that they are completed in the most suitable learning sequence and that essential (emergency) exercises are repeated at the correct frequency. Also, the syllabus hours for each phase and for groups of exercises within each phase should be stated and when progress tests are to be conducted, etc.

(4) Course structure: integration of syllabi	The manner in which theoretical knowledge and flight training in an aircraft or an FSTD will be integrated so that as the flying training exercises are carried out students will be able to apply the knowledge gained from the associated theoretical knowledge instruction and flight training.
(5) Student progress	The requirement for student progress and include a brief but specific statement of what a student is expected to be able to do and the standard of proficiency he/she must achieve before progressing from one phase of air exercise training to the next. Include minimum experience requirements in terms of hours, satisfactory exercise completion, etc. as necessary before significant exercises, for example night flying.
(6) Instructional methods	The ATO requirements, particularly in respect of pre- and post-flying briefing, adherence to syllabi and training specifications, authorisation of solo flights, etc.
(7) Progress tests	The instructions given to examining staff in respect of the conduct and documentation of all progress tests.
(8) Glossary of terms	Definition of significant terms as necessary.
(9) Appendices	(i) Progress test report forms; (ii) Skill test report forms; (iii) ATO certificates of experience, competence, etc. as required.

(c) Flight training in an FSTD, if applicable:
Structure generally as for (b)

(d) Theoretical knowledge instruction:

(1) Structure of the theoretical knowledge course	A statement of the structure of the course, including the general sequence of the topics to be taught in each subject, the time allocated to each topic, the breakdown per subject and an example of a course schedule. Distance learning courses should include instructions of the material to be studied for individual elements of the course.
(2) Lesson plans	A description of each lesson or group of lessons including teaching materials, training aids, progress test organisation and inter-connection of topics with other subjects.
(3) Teaching materials	Specification of the training aids to be used (for example study materials, course manual references, exercises, self-study materials, demonstration equipment).
(4) Student progress	The requirement for student progress, including a brief but specific statement of the standard that must be achieved and the mechanism for achieving this, before application for theoretical knowledge examinations.
(5) Progress testing	The organisation of progress testing in each subject, including topics covered, evaluation methods and documentation.
(6) Review procedure	The procedure to be followed if the standard required at any stage of the course is not achieved, including an agreed action plan with remedial training if required.

AMC1 ORA.ATO.230(b) Training manual and operations manual

ALL ATOs, EXCEPT THOSE PROVIDING FLIGHT TEST TRAINING

OPERATIONS MANUAL

The operations manual for use at an ATO conducting integrated or modular flight training courses should include the following:

(a) General:
  (1) a list and description of all volumes in the operations manual;
  (2) administration (function and management);
  (3) responsibilities (all management and administrative staff);
  (4) student discipline and disciplinary action;
  (5) approval or authorisation of flights;
  (6) preparation of flying programme (restriction of numbers of aircraft in poor weather);
  (7) command of aircraft;
  (8) responsibilities of the PIC;
  (9) carriage of passengers;
  (10) aircraft documentation;
  (11) retention of documents;
  (12) flight crew qualification records (licences and ratings);
  (13) revalidation (medical certificates and ratings);
  (14) flight duty period and flight time limitations (flying instructors);
  (15) flight duty period and flight time limitations (students);
  (16) rest periods (flight instructors);
  (17) rest periods (students);
  (18) pilots' log books;
  (19) flight planning (general);
  (20) safety (general): equipment, radio listening watch, hazards, accidents and incidents (including reports), safety pilots etc..

(b) Technical:
  (1) aircraft descriptive notes;
  (2) aircraft handling (including checklists, limitations, maintenance and technical logs, in accordance with relevant requirements, etc.);
  (3) emergency procedures;
  (4) radio and radio navigation aids;
  (5) allowable deficiencies (based on the master minimum equipment list (MMEL), if available).

(c) Route:
  (1) performance (legislation, take-off, route, landing etc.);
  (2) flight planning (fuel, oil, minimum safe altitude, navigation equipment etc.);

(3) loading (load sheets, mass, balance and limitations);

(4) weather minima (flying instructors);

(5) weather minima (students – at various stages of training);

(6) training routes or areas.

(d) Personnel training

(1) appointments of persons responsible for standards/competence of flight personnel;

(2) initial training;

(3) refresher training;

(4) standardisation training;

(5) proficiency checks;

(6) upgrading training;

(7) ATO personnel standards evaluation.

SECTION III - ADDITIONAL REQUIREMENTS FOR ATOs PROVIDING SPECIFIC TYPES OF TRAINING

Chapter 1 – Distance Learning Course

AMC1 ORA.ATO.300 General

DISTANCE LEARNING

(a) A variety of methods is open to ATOs to present course material. It is, however, necessary for ATOs to maintain comprehensive records in order to ensure that students make satisfactory academic progress and meet the time constraints laid down in Part-FCL for the completion of modular courses.

(b) The following are given as planning guidelines for ATOs developing the distance learning element of modular courses:

(1) an assumption that a student will study for at least 15 hours per week;

(2) an indication throughout the course material of what constitutes a week's study;

(3) a recommended course structure and order of teaching;

(4) one progress test for each subject for every 15 hours of study, which should be submitted to the ATO for assessment. Additional self-assessed progress tests should be completed at intervals of five to 10 study hours;

(5) appropriate contact times throughout the course when a student can have access to an instructor by telephone, fax, email or the Internet;

(6) measurement criteria to determine whether a student has satisfactorily completed the appropriate elements of the course to a standard that, in the judgement of the HT, or CGI, will enable them to be entered for the Part-FCL theoretical examinations with a good prospect of success;

(7) if the ATO provides the distance learning by help of IT solutions, for example the Internet, instructors should monitor students' progress by appropriate means.

Chapter 2 - Zero Flight-Time Training (ZFTT)

AMC1 ORA.ATO.330 General

INITIAL APPROVAL

For an initial approval to conduct ZFTT, the operator should have held an air operator's certificate for commercial air transport for at least 1 year. This period may be reduced where the operator and the ATO have experience of type rating training.

SUBPART FSTD –REQUIREMENTS FOR ORGANISATIONS OPERATING FLIGHT SIMULATION TRAINING DEVICES (FSTDS) AND THE QUALIFICATION OF FSTDS

SECTION I - REQUIREMENTS FOR ORGANISATIONS OPERATING FSTDS

AMC1 ORA.FSTD.100 General

COMPLIANCE MONITORING PROGRAMME – ORGANISATIONs OPERATING FSTDs

(a) Introduction.

(1) The purpose of this AMC is to provide additional and specific information to an organisation operating FSTDs on how to establish a compliance monitoring programme (CMP) that enables compliance with the applicable requirements.

(b) Compliance monitoring programme

(1) Typical subject areas for inspections are the following:

(i) actual FSTD operation;
(ii) maintenance;
(iii) technical Standards;
(iv) FSTD safety features.

(c) Audit scope

(1) Organisations operating FSTDs are required to monitor compliance with the procedures they have designed to ensure specified performance and functions. In doing so they should as a minimum, and where appropriate, monitor the following:

(i) organisation;
(ii) plans and objectives;
(iii) maintenance procedures;
(iv) FSTD qualification level;
(v) supervision;
(vi) FSTD technical status;
(vii) manuals, logs and records;
(viii) defect deferral;
(ix) personnel training;
(x) aircraft modifications;
(xi) FSTD configuration management.

AMC2 ORA.FSTD.100 General

COMPLIANCE MONITORING PROGRAMME –ORGANISATIONs OPERATING FSTDs

One acceptable means of measuring FSTD performance is contained in ARINC report 433-1 (December 14th, 2007 or as amended) *Standard Measurements for Flight Simulation Quality*.

AMC3 ORA.FSTD.100 General

COMPLIANCE MONITORING PROGRAMME – ORGANISATIONS OPERATING BASIC INSTRUMENT TRAINING DEVICES (BITDs)

(a) The compliance monitoring programme together with a statement acknowledging completion of a periodic review by the accountable manager should include the following:

(1) a maintenance facility that provides suitable BITD hardware and software test and maintenance capability;

(2) a recording system in the form of a technical log in which defects, deferred defects and development work are listed, interpreted, actioned and reviewed within a specified time scale; and

(3) planned routine maintenance of the BITD and periodic running of the qualification test guide (QTG) with adequate manning to cover BITD operating periods and routine maintenance work.

(b) A planned audit schedule and a periodic review should be used to verify that corrective action was carried out and that it was effective. The auditor should have adequate knowledge of BITDs.

GM1 ORA.FSTD.100 General

COMPLIANCE MONITORING – ORGANISATIONs OPERATING FSTDs – GENERAL

(a) The concept of compliance monitoring (CM) is a fundamental requirement for organisations operating FSTDs. An effective CM function is vitally important in supporting operation of the devices, in a structured way, to ensure they remain in compliance with the technical standards of CS-FSTD(A) and CS-FSTD(H) and continue to be effective training tools. An effective CM function is also essential to support any level of extended recurrent evaluation period as permitted by ORA.FSTD.225(b).

(b) The following guidance has been developed to provide additional material to help both organisations operating FSTDs and competent authorities in developing effective CM that satisfy the applicable requirements and ensure the highest standards of training are maintained.

(c) Additional GM provide a compliance checklist for organisations operating FSTDs (GM2 ORA.FSTD.100) and guidance detailing the preparation for an evaluation by the competent authority (GM3 ORA.FSTD.100). The compliance checklist should be used by the competent authorities as a standardised checklist for the elements that are expected in the CM function of an organisation operating FSTDs. The organisation should complete as a minimum the second column of the checklist by providing appropriate manual or procedure references for each of the identified elements of the CM function. Additional information can be provided in the third column to aid assessment of the checklist as appropriate. This would then be provided to the competent authority. Use of this checklist should assist in ensuring a consistent approach by the competent authorities and also provide organisations operating FSTDs with additional guidance on all the elements of a CM function that the competent authorities will expect. The guidance is provided to help organisations operating FSTDs to prepare for authority visits.

(d) The documentation of the CM may be electronic, provided the necessary controls can be demonstrated. This should include control of any paper copies that may be downloaded for use by individuals. It is recommended that any such copies are automatically designated as uncontrolled as part of the download process. Whilst electronic signatures on master documents may be accepted, with appropriate protections, a hardcopy master of the CM manual should be provided, with wet-ink signatures to be held by the applicant.

(e) It should be recognised that whatever CM is developed, it will not be effective unless it becomes an integral part of the way in which the organisation works. It includes both the necessary procedures for maintaining compliance with all the applicable requirements and a compliance monitoring programme (CMP) to monitor the execution of these procedures. A successful CM will ensure that the highest training tool is available at all times. If the CM is viewed as an add-on to existing processes it will become a burden and it will never be wholly effective. It should also be noted that compliance control or inspection is only a small part of a CM. If the CM is working effectively, inspections such as fly-outs should become routine revealing little beyond day-to-day unserviceabilities. Systematic defects should be captured by the CMP.

(f) The competent authority should be satisfied that the accountable manager is able to adequately provide the required level of resources to properly support the FSTD. Detailed knowledge of FSTD requirement standards are not necessary, only sufficient to understand his/her responsibility for ensuring the FSTD is properly supported. The assessment of the compliance monitoring manager should concentrate on establishing that the nominee has sufficient knowledge and experience of both CM management and FSTD operations to operate a compliance monitoring system (CMS) within an organisation operating FSTDs. This is likely to require experience of working in the compliance monitoring field and sufficient knowledge of FSTDs and the technical standards with which they should comply.

(g) If an organisation operating FSTDs is certified under any international quality standard it should assure that it fully covers the applicable organisation requirements of Part-ORA and the qualification basis.

(h) For small organisations, it is perfectly acceptable to combine the roles of compliance monitoring manager and accountable manager. For other organisations that hold multiple certificates and may cover multiple sites, it is advantageous to have a common CM function with an overall compliance monitoring manager. However, it is essential, particularly where sites may be significantly separated geographically, that there is a nominated representative at each site and possibly for each certificate. These representatives should hold the delegated responsibility of the CM manager for the day-to-day CM role at their site and in their function and have the necessary direct reporting line to the overall CM manager. It will also be necessary to ensure that local representatives are also acceptable to the local competent authority. In many cases the local representatives may perform other functions in addition to this role. This is acceptable provided the necessary independence of any compliance monitoring activity is maintained.

(i) CM, as a whole, begins with the requirements with which the system seeks to comply. These include both the technical standards, in this case the relevant parts of CS-FSTD(A)/(H) plus any other specific standards, for example health and safety regulations, and the compliance monitoring objectives, such as defect rates and rectification intervals and FSTD reliability targets. The CM should define the process by which these standards are made available to those who require them.

(j) The next part of CM is that part which defines the day-to-day procedures or working practices by which the standards will be achieved. These procedures should include as a minimum defect reporting systems, defect rectification processes, tracking mechanisms, preventative maintenance programmes, spares handling, equipment calibration and configuration management of the device. They should include checks to assess the compliance of the performed actions. These procedures and standards should be made readily available to anybody involved in the maintenance and day-to-day operation of the FSTD.

(k) The third part of CM is the method by which the organisation operating an FSTD confirms the device is maintained in compliance with the defined standards and is being operated in accordance with the defined procedures. This is the compliance monitoring programme (CMP) and includes the audit methods, reporting and corrective action procedures and feedback, management reviews and schedules for audits of all aspects of the FSTD operation.

(l) Across all aspects of CM, and most important to it, are the people. CM includes the definition of the responsibilities of all staff and should include a declaration of the minimum levels of resource proposed for the direct support of the FSTD plus the levels of support and managerial staff proposed. The levels of resource can be affected by factors such as local health and safety regulations, existence of weekend and/or night usage of the device(s), etc. CM also includes definition of the skills and experience required for staff and leads to definition of any required training programmes. Training needs cover both technical training and audit training, including QTG running and checking and fly-out techniques for flight crew.

(m) The documentation of CM may be provided in any number of documents provided there are appropriate cross-references in all documents such that the system is fully traceable in both directions from end to end. For all but small organisations at least two documents would be expected:

(1) Firstly, a CM manual containing the policy, terminology, organisational charts and responsibilities, an overview of all processes, within the system, including those for maintaining regulatory compliance such as QTG running and fly-outs (function and subjective testing), CMP including the audit schedule and audit procedures including reporting and corrective action procedures. In addition, the CM manual should include, either directly or by reference, the identification of skills and experience and associated training.

(2) Secondly, a procedures manual containing, as a minimum, software and hardware control procedures, configuration control procedures including, for example, control of training loads, updates to visual models, navigation and instructor operation station (IOS) databases, QTG running and checking procedures, fly-out procedures, maintenance procedures including both defect rectification and preventative maintenance processes. Any standard forms and checklists should also be included.

(n) The CM documentation also includes all records such as technical logs, QTG runs, fly-out reports and maintenance job cards.

(o) For organisations with several certificates, separate and modular procedures manuals with a single CM manual covering all approvals, may be acceptable.

(p) It is important to understand the difference between compliance assurance and compliance control. An effective CM will contain elements of both. Compliance control is normally done by inspection of the product; it provides confirmation at the time of the inspection that the product conforms to a defined standard.

(q) The compliance assurance element is essential to ensure the standard is maintained throughout the periods between product (FSTD) inspections. Within a CMP, the processes are defined that are necessary to provide confidence that the FSTD(s) is/are being supported and maintained to the highest possible standard and in compliance with the relevant requirements. A programme of internal audits is then set in place to confirm that the processes are being followed and are effective. The competent authority would normally oversee a certified organisation by process and system audit, however, in the case of FSTDs, authority oversight includes an inspection element in the form of the recurrent FSTD evaluation.

(r) In addition to the normal process and system audits, the compliance assurance audit schedule should include the schedule for each FSTD for fly-outs and QTG running through the audit year.

(s) The audit procedure should include, at least, the following: statement of scope, planning, initiation of audit, collection of evidence, analysis, reporting of findings, identification and agreement of corrective actions and feedback, including reporting significant findings to the competent authority, where appropriate. The review of published material could include, in addition to the CM and procedures manuals, QTG records, fly-out reports, technical log sheets, maintenance records and configuration control records.

(t) In addition to basic knowledge of FSTD requirements and operation, it is expected that auditors have received training in CM and audit techniques.

(u) The routine fly-outs of the device are a specialised part of the audit programme. It is essential that the pilots tasked with carrying out these fly-outs are adequately experienced. They would be expected to be type rating instructor/examiner (TRI/TRE) qualified on the type, and should have experience of simulator evaluations carried out by the competent authority. The assignment of such pilots can present difficulties, particularly for the independent organisation operating FSTDs not directly associated with an airline. It is vital for the organisation to ensure their users are aware of the importance of the fly-outs as part of the continued qualification of the device and the need to assist in the provision of suitably qualified pilots to carry them out. It is worth noting that simulator users are required to satisfy themselves that the training devices they use are assessed for continued suitability, as part of their own CMP. Involvement in fly-outs assists in meeting this need.

(v) Whilst it is accepted that the number of audits required in an organisation with a single device will be significantly less than those in larger organisations with multiple devices, the CMP should still meet the same criteria, and cover all aspects of the operation within a 12 month period. The independence of the audit personnel should be maintained at all times. The audit programme, whether by full audit or by using a checklist system should still be sufficiently comprehensive to provide the necessary level of confidence that the device is maintained and operated to the highest possible standard. This includes monitoring and review of corrective actions and feedback processes.

(w) The successful use of sub-contractors who play a significant role in the provision of services, such as maintenance or engineering services, to an organisation operating FSTDs is reliant on the sub-contractor operating under the CM of the organisation. All requirements that an organisation is expected to meet are equally applicable to his/her sub-contractor. It is the organisation's responsibility to ensure that the sub-contractor complies with its CM.

(x) It is essential that a proper understanding of the CM and how it applies to each and every staff member is provided by appropriate training to all, not just those directly involved in operating the CM, such as the accountable manager, the CM manager, representatives and the auditors. The training given to those directly involved in CM should cover the CM, audit techniques and applicable technical standards. CM familiarisation training should be an integral part of any induction training and recurrent training. Update training on technical standards for audit personnel, is also of particular importance.

(y) Any effective CM will include measurement of its effectiveness. The organisation should develop performance measures that can be monitored against objectives. Such measures, often referred to as metrics, should be reviewed by the competent authority as part of its oversight of the CM within the organisation and during recurrent evaluations. In addition they should form part of the data reviewed during scheduled management reviews as part of the CM.

(z) ARINC 433 provides good guidance on FSTD compliance measurement. Metrics should monitor not only individual FSTD performance but, for larger organisations, how each FSTD is performing within the fleet. It is also recommended that metrics data be shared, regularly, with the FSTD manufacturers to allow monitoring for generic problems such as design issues, which may be best addressed with a fleet-wide solution.

GM2 ORA.FSTD.100 General

COMPLIANCE MONITORING – ASSESSMENT FOR ORGANISATIONS OPERATING FSTDs

COMPLIANCE MONITORING ASSESSMENT FOR ORGANISATIONS OPERATING FSTDs			
Organisation:			
Site Assessed:			
Date of Assessment:			
Accountable Manager:			
Compliance Monitoring Manager:			
Number and Type of FSTDs:			
CM Manual Reference:			
Audit Area	**CM/Proc Ref**	**Comments**	**Satisfactory Y/N**
1. ACCOUNTABLE MANAGER			
Has an accountable manager (AM) with overall responsibility for compliance monitoring (CM) been nominated?			
Does the accountable manager have corporate authority to ensure all necessary activities can be financed and carried out to the standard required by the competent authority?			
Has a formal written compliance policy statement been established, included in the CM manual and signed by the accountable manager?			
2. COMPLIANCE MONITORING MANAGER			
Has a compliance monitoring manager (CM manager) been nominated?			
Are the posts of CM manager and AM combined? If so, is the independence of compliance audits assured?			

Does the CM manager have overall responsibility and authority to: a) verify that standards are met; and b) ensure that the compliance monitoring programme is established, implemented and maintained?			
Does the CM manager have direct access to the AM?			
Does the CM manager have access to all parts of the organisation operating an FSTD and as necessary any sub-contractor's organisation?			
3. COMPLIANCE MONITORING (CM)			
Has CM been established by the operator?			
Is CM properly documented? (see Section 4)			
Is the CM structured according to the size and complexity of the operator?			
Does the CM include the following as a minimum: a) monitoring of compliance with required technical standards; b) identification of corrective actions and person responsible for rectification; c) a feedback system to accountable manager to ensure corrective action are promptly addressed; d) reporting of significant non-compliances to the competent authority; e) a compliance monitoring		a) b) c) d) e)	

programme to verify continued compliance with applicable requirements, standards and procedures.			

Are the responsibilities of the CM manager defined to include, as a minimum: a) monitoring of corrective action programme; b) ensuring that the corrective actions contain the necessary elements; c) providing management with an independent assessment of corrective action, implementation and completion; d) evaluation of the effectiveness of the corrective action programme.		a) b) c) d)	
Are adequate financial, material and human resources in place to support CM?			
Are management evaluations/reviews of CM held at least quarterly?			
Does the management evaluation ensure that the CMS is working effectively and is it comprehensive and well documented?			
Does the compliance monitoring programme identify the processes necessary and the persons within the organisation who have the training, experience, responsibility and authority to carry out the following: a) schedule and perform quality inspections and		a)	

audits, including unscheduled audits when required; b) identify and record any concerns or findings, and the evidence necessary to substantiate such concerns or findings; c) initiate or recommend solutions to concerns or findings through designated reporting channels; d) verify the implementation of solutions within specific timescales.		b) c) d)	
Is there sufficient auditor resource available and can their required level of independence be demonstrated?			
Do the auditors report directly to the compliance monitoring manager?			
Does the defined audit schedule cover the following areas, within each 12 month period? a) organisation b) plans and objectives c) maintenance procedures d) FSTD qualification level; e) supervision f) FSTD technical status g) manuals, logs and records		a) b) c) d) e) f) g)	

h) defect deferral i) personnel training j) aircraft and simulator configuration management, including Airworthiness Directives		h) i) j)	
How are audit non-compliances recorded?			
Are procedures in place to ensure that corrective actions are taken in response to findings?			

Are records of the compliance monitoring programme: a) accurate b) complete and c) readily accessible?		**a)** b) c)	
Is there an acceptable and effective procedure for providing a briefing on the CM to all personnel?			
Is there an acceptable and effective procedure for ensuring that all those responsible for managing the CM receive training covering: a) an introduction to the concept of the CM; b) compliance management; c) the concept of compliance assurance; d) CM manuals; e) audit techniques; f) reporting and recording; g) how the CM supports continuous improvement within the organisation.		a) b) c) d) e) f) g)	
Are suitable training records maintained?			

Are activities within the CM sub-contracted out to external agencies?			
Do written agreements exist between the organisation and the sub-contractor clearly defining the services and standard to be provided?			
Are the procedures in place to ensure that the necessary authorisations/approval when required are held by a sub-contractor?			
Are the procedures in place to establish that the sub-contractor has the necessary technical competence?			
4. CM MANUAL			
Is there a procedure in place to control copies and the distribution of the CM manual?			
What is the current status of the CM manual – amendment and issue date?			
Is the CM manual signed by the accountable manager and the compliance monitoring manager?			

Does the CM manual include, either directly or by reference to other documents, the following: a) a description of the organisation; b) reference to appropriate FSTD technical standards; c) allocation of duties and responsibilities; d) audit procedures; e) reporting procedures; f) ollow-up and corrective action procedures; g) document retention policy; h) training records		a) b) c) d) e) f) g) h)	
Is there a document retention policy covering: a) audit schedules; b) inspection and audit reports; c) responses to findings; d) corrective action reports; e) follow-up and closure reports; f) management evaluation reports.		a) b) c) d) e) f)	
Does the CM manual include, either directly or by reference to other documents, the following procedures for day to day operation of the FSTD: a) defect reporting systems; b) defect rectification processes; c) tracking mechanisms; d) preventative maintenance programmes; e) spares handling;		a) b) c) d) e) f)	

f) equipment calibration; g) configuration management of the device including visual, IOS and navigation databases; h) configuration control system to ensure the continued integrity of the hardware and software qualified; i) QTG running and function and subjective tests.		g) h) i)	
Does the CM manual include, either directly or by reference to other documents, procedures for notification of the competent authorities of the following: a) any change in the organisation including company name, location, management; b) major changes to a qualified device; c) deactivation or relocation of a qualified device; d) major failures of a qualified device; e) major safety issue associated with the installation.		a) b) c) d) e)	

Does the CM manual define acceptable and effective procedures to ensure compliance with applicable health and safety regulations, including: a) safety briefings; b) fire/smoke detection and suppression; c) protection against electrical, mechanical, hydraulic and pneumatic hazards; d) other items as defined in AMC1 ORA.FSTD.115		a) b) c) d)	
Does the CM manual include acceptable and effective procedures for regularly checking FSTD safety features such as emergency stops and emergency lighting, and are such tests recorded?			
5. COMPLIANCE MEASURES			
Have compliance monitoring objectives been developed from the policy statement, and included either directly or by reference in the CMS manual?			
Does the CMS include processes to produce and review appropriate metrics data?			
Do these compliance measures track the following: a) FSTD availability; b) numbers of defects; c) open defects; d) defect closure rates; e) training session interrupt rates; f) training session compliance rating.		a) b) c) d) e) f)	
Do the compliance measures support the compliance objectives?			
<u>**Required actions/Comments**</u>			

Signature:……………………………………………………
Date:…………………………………….

GM3 ORA.FSTD.100 General

COMPLIANCE MONITORING SYSTEM – GUIDANCE FOR ORGANISATIONS OPERATING FSTDs TO PREPARE FOR A COMPETENT AUTHORITY EVALUATION

(a) Introduction

The following material provides guidance on what is expected by the competent authorities to support the discussion during the preliminary briefing, which is a first step of any initial or recurrent evaluation of an FSTD carried out by a competent authority.

This document has been developed as well to standardise working methods throughout Member States and to develop effective CM spot checks to satisfy the applicable requirements and therefore to ensure the highest standards of training are attained.

(b) Document form

Different document forms can be considered. Nevertheless, it appears that the best solution is a dossier, which includes all the information required by the competent authority to perform an evaluation.

(c) Contents of the dossier for an initial evaluation:

(1) type of FSTD and qualification level requested;

(2) evaluation agenda: including date of evaluation, name of people involved for the competent authority, contact details for the FSTD operator, schedules for the subjective flight profile, QTG rerun;

(3) FSTD identification and detailed technical specification including, type of FSTD, manufacturer, registration number, date of entry into service, host computer, visual system, motion system, type of IOS, simulated version(s), standards of all the aircraft computers, if applicable. Manuals needed for an evaluation (e.g. flight manuals, system manuals, acceptance test manual, IOS user manual etc. – if applicable) could already be provided as part of the dossier in an electronic format;

(4) planned modifications;

(5) subjective open defect(s);

(6) airport visual databases including for each visual scene, name of the airport, IATA and ICAO codes, type of visual scene (specific or generic), additional capabilities (e.g. snow model, WGS 84 compliance, enhanced ground proximity warning system (EGPWS)); and

(7) QTG status: the list should include for each QTG test available the status of the tests following the FSTD operator and competent authority reviews.

(d) Contents of the dossier for a recurrent evaluation:

(1) type of FSTD and qualification level requested;

(2) evaluation agenda, including date of evaluation, name of people involved for the competent authority, contact details for the operator, schedules for the subjective flight profile, QTG rerun and QTG review;

(3) FSTD identification, including type of FSTD, manufacturer, registration number, date of entry into service, host computer, visual system, motion

system, type of IOS, simulated version(s), standards of all the aircraft computers, if applicable;

(4) status of items raised during the last evaluation and date of closure;

(5) reliability data: training hours month by month during the past year, numbers of complaints mentioned in the technical log, training hours lost, availability rate;

(6) operational data: a list of FSTD users over the previous 12 months should be provided, with number of training hours;

(7) failure tabulation including categorisation of failures (by ATA chapter and Pareto diagram, ARINC classification);

(8) details of main failures leading to training interruption or multiple occurrences of some failures;

(9) hardware and/or software updates or changes since last evaluation and planned hardware and/or software updates or changes;

(10) subjective open defect(s);

(11) airport visual databases including for each visual scene, name of the airport, ATA and ICAO codes, type of visual scene (specific or generic), additional capabilities (snow model, WGS 84 compliance, EGPWS);

(12) QTG status: the list should include for each QTG test available, the date of run during the past year, any comment, and the status of the tests; and

(13) results of scheduled internal audits and additional quality inspections (if any) since last evaluation and a summary of actions taken.

AMC1 ORA.FSTD.110 Modifications

GENERAL

(a) The FSTD, where applicable, should be maintained in a configuration that accurately represents the aircraft being simulated. This may be a specific aircraft tail number or may be a representation of a common standard.

(b) Users of the device should always establish a differences list for any device they intend to use, and to identify how any differences should be covered in training. In order to ensure each device is maintained in the appropriate configuration, the organisation operating an FSTD should have a system that ensures that all relevant airworthiness directives (ADs) are introduced where applicable on affected FSTDs.

(c) ADs from both the State of Design of the aircraft and the State where the FSTD is located should be monitored. ADs from the State of Design of an aircraft are usually automatically applicable, unless specifically varied by the aircraft's State of Registry.

(d) Where appropriate, ADs issued by States where users of the device have aircraft registered should also be monitored. In addition to ADs, the FSTD operator should also put in place processes that ensure all aircraft modifications are reviewed for any effect on training, testing and checking. This can be achieved by reviewing the aircraft manufacturer's service bulletins and may require a specific link to the aircraft manufacturer to be developed. In practice this link is often established through aircraft operators who use the device.

(e) Organisations operating FSTDs should notify the competent authority of major changes.

(f) This does not imply that the competent authority will always wish to directly evaluate the change. The competent authority should be mindful of the potential burden placed on the organisation by a special evaluation and should always consider that burden when deciding if such an evaluation is necessary.

(g) The organisation operating FSTDs should have an internal acceptance process for modifications, to be used when implementing all modifications, even if the competent authority has made a decision to carry out an evaluation.

GM1 ORA.FSTD.110 Modifications

EXAMPLES OF MAJOR MODIFICATIONS

The following are examples of modifications that should be considered as major. This list is not exhaustive and modifications need to be classified on a case-by-case basis:

(a) any change that affects the QTG;

(b) introduction of new standards of equipment such as flight management and guidance computer (FMGC) and updated aerodynamic data packages;

(c) re-hosting of the FSTD software;

(d) introduction of features that model new training scenarios; e.g. airborne collision avoidance system (ACAS), EGPWS;

(e) aircraft modifications that could affect the FSTD qualification; and

(f) FSTD hardware or software modifications that could affect the handling qualities, performance or system representation.

AMC1 ORA.FSTD.115 Installations

MINIMUM ELEMENTS FOR SAFE OPERATION

(a) Introduction

(1) This AMC identifies those elements that are expected to be addressed, as a minimum, to ensure that the FSTD installation provides a safe environment for the users and operators of the FSTD under all circumstances.

(b) Expected elements

(1) Adequate fire/smoke detection, warning and suppression arrangements should be provided to ensure safe passage of personnel from the FSTD.

(2) Adequate protection should be provided against electrical, mechanical, hydraulic and pneumatic hazards, including those arising from the control loading and motion systems, to ensure maximum safety of all persons in the vicinity of the FSTD.

(3) Other areas that should be addressed include the following:

(i) a two-way communication system that remains operational in the event of a total power failure;
(ii) emergency lighting;
(iii) escape exits and escape routes;
(iv) occupant restraints (seats, seat belts etc.);
(v) external warning of motion and access ramp or stairs activity;
(vi) danger area markings;
(vii) guard rails and gates;
(viii) motion and control loading emergency stop controls accessible from either pilot or instructor seats;
(ix) a manual or automatic electrical power isolation switch.

GM1 ORA.FSTD.115 Installations

GENERAL

(a) The intent of ORA.FSTD.115 is to establish that the organisation operating an FSTD has all the necessary procedures in place to ensure that the FSTD installation remains in compliance with all requirements affecting the safety of the device and its users.

(b) Based on experience, the competent authority should pay particular attention to the quality of safety briefings on the FSTD provided to users and instructors, and to the execution of regular checks on the FSTD safety features.

(c) It is recognised that certain checks, such as that of the emergency stop, can have adverse impact on the FSTD if carried out in full.

(d) It is acceptable to develop a procedure that protects elements of the device by shutting them down in advance, in a more controlled manner, provided it can be shown that the procedure still demonstrates the whole device can be shut down by the operation of a single emergency stop button, when required.

SECTION II – REQUIREMENTS FOR THE QUALIFICATION OF FSTDs

AMC1 ORA.FSTD.200 Application for FSTD qualification

LETTER OF APPLICATION FOR INITIAL QUALIFICATION OF AN FSTD; EXCEPT BASIC INSTRUMENT TRAINING DEVICE (BITD)

A sample of letter of application is provided overleaf.

Part A

To be submitted not less than 3 months prior to requested qualification date

(Date)
(Office – Competent Authority)
(Address)…………………………………………….
(City)…………………………………………………..
(Country)…………………………………………….

Type of FSTD	Aircraft Type/class	Qualification Level Sought				
Full Flight Simulator FFS		A	B	C	D	Sp./Cat
Flight Training Device FTD		1	2	3		
Flight and Navigation Procedures Trainer FNPT		I	II	III	II MCC	III MCC

Interim Qualification Level requested: YES/NO
Dear,
<*Name of Applicant*> requests the evaluation of its flight simulation training device<*operator's identification of the FSTD*> for qualification. The <*FSTD manufacturer's name*> FSTD with its <*visual system and manufacturer's name, if applicable*>visual system.
Evaluation is requested for the following configurations and engine fits as applicable:
e.g. 767 PW/GE and 757RR
1...........
2...........
3...........
Dates requested are: <*date(s)*> and the FSTD will be located at <*place*>.

The objective tests of the QTG will be submitted by <*date*> and in any event not less than 30 days before the requested evaluation date unless otherwise agreed with the competent authority.

Comments:
……
……
…………………………………………………………………….

Signed
…………………………………………………………

Print name: ……………..
Position/appointment held: ……………..
Email address: ……………..
Telephone number: ……………..

Part B
To be completed with attached QTG results

(Date) ……………………….
We have completed tests of the FSTD and declare that it meets all applicable requirements except as noted below.
The following QTG tests still have to be provided:

Tests	Comments

(Add boxes as required)

It is expected that they will be completed and submitted 3 weeks prior to the evaluation date.

Signed
……………………………………………………

Print name: ……………..
Position/appointment held: ……………..
E-mail address: ……………..
Telephone number: ……………..

Part C
To be completed not less than 7 days prior to initial evaluation

(Date) ……………………….

The FSTD has been assessed by the following evaluation team:

(Name) …………………. Qualification …………………………………………..

(Name) …………………. Qualification …………………………………………..

(Name) …………………. Qualification …………………………………………..

(Name) …………………. Pilot's Licence Nr …………………………………..

(Name) …................ Flight Engineer's Licence Nr (if applicable) …….

- ☐ FFS/FTD: This team attests that the <*type of FSTD*> conforms to the aeroplane flight deck/helicopter cockpit configuration of <*name of aircraft operator (if applicable)*, *type of aeroplane/helicopter*> aeroplane/helicopter within the requirements for <*type of FSTD and level*> and that the simulated systems and subsystems function equivalently to those in that aeroplane/helicopter. The pilot of this evaluation team has also assessed the performance and the flying qualities of the FSTD and finds that it represents the designated aeroplane/helicopter.

- ☐ FNPT: This team attest(s) that the <type of FSTD> represents the flight deck or cockpit environment of a <*aeroplane/helicopter or class of aeroplane/type of helicopter*> within the requirements for <*type of FSTD and level*> and that the simulated systems appear to function as in the class of aeroplane/type of helicopter. The pilot of this evaluation team has also assessed the performance and the flying qualities of the FSTD and finds that it represents the designated class of aeroplane/type of helicopter.

(Additional comments as required)
……………………………………………………………….
……………………………………………………………….
……………………………………………………………….

Signed
……………………………………………………….

Print name: …………….
Position/appointment held: …………….
E-mail address: …………….
Telephone number: …………….

GM1 ORA.FSTD.200 Application for FSTD qualification

USE OF FOOTPRINT TESTS IN QUALIFICATION TEST SUBMISSION

(a) Introduction

(1) Recent experience during initial qualification of some FFSs has required acceptance of increasing numbers of footprint tests. This is particularly true for FFSs of smaller or older aircraft types, where there may be a lack of aircraft flight test data. However, the large number of footprint tests offered in some QTGs has given rise to concern.

(2) This guidance is applicable to FFS aeroplane, FTD aeroplane, FFS helicopter and FTD helicopter qualifications.

(b) Terminology

(1) Footprint test - footprint test data are derived from a subjective assessment carried out on the actual FSTD requiring qualification. The assessment and validation of these data are carried out by a pilot appointed by the competent authority. The resulting data are the footprint validation data for the FSTD concerned.

(c) Recommendation

(1) It is permitted to use footprint data where flight test data is not available. Only when all other alternative possible sources of data have been thoroughly reviewed without success may a footprint test be acceptable, subject to a case-by-case review with the competent authorities concerned, and taking into consideration the level of qualification sought for the FSTD.

(2) Footprint test data should be:

(i) constructed with initial conditions and FFS set up in the appropriate configuration (e.g. correct engine rating) for the required validation data;
(ii) a manoeuvre representative of the particular aircraft being simulated;
(iii) manually flown out by a type rated pilot who has current experience on type* and is deemed acceptable by the competent authority**;
(iv) constructed from validation data obtained from the footprint test manoeuvre and transformed into an automatic test;
(v) an automatic test run as a fully integrated test with pilot control inputs; and
(vi) automatically run for the initial qualification and recurrent evaluations.

* In this context, 'current' refers to the pilot experience on the aircraft and not to the Part-FCL standards.

** The same pilot should sign off the complete test as being fully representative.

(3) A clear rationale should be included in the QTG for each footprint test. These rationales should be added to and clearly recorded within the validation data roadmap (VDR) in accordance with and as defined in Appendix 2 to AMC1-CS-FSTD(A).300.

(4) Where the number of footprint tests is deemed by the competent authority to be excessive, the maximum level of qualification may be affected. The competent authority should review each area of validation test data where the use of footprint tests as the basis for the validation data is proposed. Consideration should be given to the extent to which footprint tests are used in any given area.

For example, it would be unacceptable if all or the vast majority of take-off tests were proposed as footprint tests, with little or no flight test data being presented. It should be recognised, therefore, that it may be necessary for new flight test data to be gathered if the use of footprint tests becomes excessive, not just overall, but also in specific areas.

(5) For recurrent evaluation purposes an essential match is to be expected. Validation tests using footprint data which do not provide an essential match should be justified to the satisfaction of the competent authority.

(6) The competent authority should be consulted at the point of definition of the aircraft data for qualification prior to the procurement of the device if footprint tests need to be used.

AMC1 ORA.FSTD.225(b)(4) Duration and continued validity

The assigned person should have experience in FSTDs and training. The person may have FSTD experience or training experience with an education in FSTD evaluation procedures only, provided the other element of expertise is available within the organisation and a procedure for undertaking the annual review and reporting to the competent authority is documented within the compliance monitoring function.

AMC1 ORA.FSTD.230(b) Changes to the qualified FSTD

UPDATING AND UPGRADING EXISTING FSTDs

(a) An update is a result of a change to the existing device where it retains its existing qualification level. The change may be certified through a recurrent inspection or an extra inspection if deemed necessary by the competent authority according to the applicable requirements in effect at the time of initial qualification.

(b) If such a change to an existing device would imply that the performance of the device could no longer meet the requirements at the time of initial qualification, but that the result of the change would, in the opinion of the competent authority, clearly mean an improvement to the performance and training capabilities of the device altogether, then the competent authority might accept the proposed change as an update while allowing the device to retain its original qualification level.

(c) An upgrade is defined as the raising of the qualification level of a device, or an increase in training credits, which can only be achieved by undergoing an initial qualification according to the latest applicable requirements.

(d) As long as the qualification level of the device does not change, all changes made to the device should be considered to be updates pending approval by the competent authority.

(e) An upgrade, and consequent initial qualification according to the latest applicable requirements, is only applicable when the organisation requests another qualification level (recategorisation) for the FSTD.

AMC1 ORA.FSTD.240 Record-keeping

FSTD RECORDS

(a) FSTD records to be kept should include the following:

(1) for the lifetime of the device:

(i) the master QTG (MQTG) of the initial evaluation;

(ii) the qualification certificate of the initial evaluation; and

(iii) the initial evaluation report;

(2) for a period of at least 5 years (in paper or electronic format):
  (i) recurrent QTG runs;
  (ii) recurrent evaluation reports;
  (iii) reports of internal functions and subjective testing;
  (iv) technical log;
  (v) CMS report;
  (vi) audit schedule;
  (vii) evaluation programme;
  (viii) management evaluation reports;
  (ix) obsolete procedures and forms.

Subpart AeMC – Aero-medical Centres

SECTION I – GENERAL

AMC1 ORA.AeMC.115 Application

GENERAL

(a) The documentation for the approval of an AeMC should include the names and qualifications of all medical staff, a list of medical and technical facilities for initial class 1 aero-medical examinations and of supporting specialist consultants.

(b) The AeMC should provide details of clinical attachments to hospitals, medical institutions and/or specialists.

AMC1 ORA.AeMC.135 Continued validity

EXPERIENCE

(a) At least 200 class 1 aero-medical examinations and assessments should be performed at the AeMC every year.

(b) In Member States where the number of aero-medical examinations and assessments mentioned in (a) cannot be reached due a low number of professional pilots, a proportionate number of class 1 aero-medical examinations and assessments should be performed.

(c) In these cases, the continuing experience of the head of the AeMC and aero-medical examiners on staff should also be ensured by them performing aero-medical examinations and assessments for:
  (1) class 2 medical certificates as established in Part-MED; and/or
  (2) third country class 1 medical certificates.

(d) Aero-medical research including publication in peer reviewed journals may also be accepted as contributing to the continued experience of the head of, and aero-medical examiners at, an AeMC.

SECTION II – MANAGEMENT

GM1 ORA.AeMC.200 Management system

RESEARCH

If aero-medical research is conducted at an AeMC, its management system should include processes to conduct that research and publish the results.

AMC1 ORA.AeMC.210 Personnel requirements

GENERAL

(a) The aero-medical examiner (AME) should have held class 1 privileges for at least 5 years and have performed at least 200 aero-medical examinations for a class 1 medical certificate before being nominated as head of an AeMC.

(b) The AeMC may provide practical AME training for persons fully qualified and licensed in medicine.

AMC1 ORA.AeMC.215 Facility requirements

MEDICAL-TECHNICAL FACILITIES

The medical-technical facilities of an AeMC should consist of the equipment of a general medical practice and, in addition, of:

(a) Cardiology

Facilities to perform:

(1) 12-lead resting ECG;

(2) stress ECG;

(3) 24-hour blood pressure monitoring; and

(4) 24-hour heart rhythm monitoring.

(b) Ophthalmology

Facilities for the examination of:

(1) near, intermediate and distant vision;

(2) external eye, anatomy, media and fundoscopy;

(3) ocular motility;

(4) binocular vision;

(5) colour vision (anomaloscopy or equivalent);

(6) visual fields;

(7) refraction; and

(8) heterophoria.

(c) Hearing

(1) pure-tone audiometer

(d) Otorhinolaryngology

Facilities for the clinical examination of mouth and throat and:

(1) otoscopy;

(2) rhinoscopy;

(3) tympanometry or equivalent; and

(4) clinical assessment of vestibular system.

(e) Examination of pulmonary function

(1) spirometry

(f) The following facilities should be available at the AeMC or arranged with a service provider:

(1) clinical laboratory facilities; and

(2) ultrasound of the abdomen.