Notice of Proposed Amendment 2014-29 (D)(1)

Amendments to Commission Regulation (EU) No 1178/2011 (the Aircrew Regulation)

Learning Objectives (LOs)

RMT.0188 (FCL.002(a)) & RMT.0189 (FCL.002(b)) — 17.12.2014

EXECUTIVE SUMMARY

This Notice of Proposed Amendment (NPA) addresses a safety and regulatory coordination issue related to flight crew licensing.

The main objective of this NPA is to introduce the long syllabus and Learning Objectives (LOs) for professional licences and instrument ratings in the EASA regulatory system.

The NPA also aims to resolve any inconsistencies identified after the adoption of the FCL Implementing Rules. This is necessary to ensure that the EASA regulatory system reflects the state of the art, and specifically the best practices developed in the Member States, in the field of pilot training.

The following Safety Recommendations were taken into consideration for the development of this NPA: SR AUST-2012-006, SR BELG-2010-010, SR UNKG-2006-130, SR SWED-2010-008, SR SWED-2012-006, SR FRAN-2013-033, SR FRAN-2013-035 and SR FRAN-2013-017.

The specific objective of this NPA is to maintain a high level of safety for flight crews, to ensure harmonised implementation of the Aircrew Regulation, and to consider at all levels the importance of General Aviation issues.

— **NPA 2014-29 (A)** contains the Explanatory Note and the changes to the rule text of 'Annex I — Part-FCL', 'Annex II — Conditions for the conversion of existing national licences and ratings for aeroplanes and helicopters', and 'Annex III — Conditions for the acceptance of licences issued by or on behalf of third countries'.

  Due to the number of the proposed changes and the complexity of the text that was amended twice after its initial publication, the decision was taken to base the NPA on the amended text and to publish the changes to Annexes I, II and III in a consolidated version.

— **NPA 2014-29 (B)** contains the changes to the existing AMC and GM text.

— **NPAs 2014-29 (C)(1), (C)(2) and (C)(3)** contain the new AMC with the Flight Examiner Manual (FEM).

— **NPAs 2014-29 (D)(1) and (D)(2)** contain the new AMC with the Learning Objectives (LOs).

The proposed changes are expected to increase safety, reduce regulatory burden on Member States, improve harmonisation, ensure compliance with ICAO, and improve proportionality of the rules for General Aviation by applying the principles of the 'General Aviation Road Map'.

As indicated above, NPA 2014-29 (D)(1) contains the first part of the LOs. For the Explanatory Note, please refer to NPA 2014-29 (A).

Applicability		Process map	
Affected regulations and decisions:	Commission Regulation (EU) No 1178/2011, as amended; ED Decision 2011/016/R, as amended.	Concept Paper:	No
		Terms of Reference:	21.7.2011
		Rulemaking group:	Yes
Affected stakeholders:	Pilots; training organisations; instructors; examiners; national competent authorities.	RIA type:	None
		Technical consultation during NPA drafting:	Yes
Driver/origin:	Safety; level playing field; proportionality; RMT FCL.001.	Duration of NPA consultation:	3 months
		Review group:	TBD
Reference:	EASA NPA 2008-17 'Implementing Rules for Pilot Licensing'.	Focussed consultation:	No
		Publication date of the Opinion:	2015/Q4
		Publication date of the Decision:	2015/Q4

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1. Procedural information

1.1. The rule development procedure

Please refer to NPA 2014-29 (A).

1.2. The structure of this NPA and related documents

Please refer to NPA 2014-29 (A).

1.3. How to comment on this NPA

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at **http://hub.easa.europa.eu/crt/**[1].

The deadline for submission of comments is **17 March 2015.**

1.4. The next steps in the procedure

Please refer to NPA 2014-29 (A).

2. Explanatory Note

Please refer to NPA 2014-29 (A).

[1] In case of technical problems, please contact the CRT webmaster (crt@easa.europa.eu).

3. Proposed amendments

The text of the amendment is arranged to show deleted text, new or amended text as shown below:

(a) deleted text is marked with ~~strike through~~;

(b) new or amended text is highlighted in grey.

3.1. Draft Acceptable Means of Compliance and Guidance Material (Draft EASA Decision)

SUBPART D — COMMERCIAL PILOT LICENCE — CPL

AMC1 FCL.310; FCL.515(b); FCL.615(b)

~~SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE ATPL, CPL AND IR~~

~~The following tables contain the detailed theoretical knowledge syllabus for the ATPL, CPL and IR.~~

~~Aspects related to non-technical skills shall be included in an integrated manner, taking into account the particular risks associated to the licence and the activity.~~

~~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 sub-divisions are applicable.~~

(a) Aeroplanes and helicopters

		~~**Aeroplane**~~		~~**Helicopter**~~			~~**IR**~~
		~~**ATPL**~~	~~**CPL**~~	~~**ATPL /IR**~~	~~**ATPL**~~	~~**CPL**~~	
~~**010 00 00 00**~~	~~**AIR LAW AND ATC PROCEDURES**~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
~~010 01 00 00~~	~~INTERNATIONAL LAW: CONVENTIONS, AGREEMENTS AND ORGANISATIONS~~						
~~010 02 00 00~~	~~AIRWORTHINESS OF AIRCRAFT~~						
~~010 03 00 00~~	~~AIRCRAFT NATIONALITY AND REGISTRATION MARKS~~						
~~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~~						
~~010 07 00 00~~	~~AIR TRAFFIC SERVICES AND AIR TRAFFIC MANAGEMENT~~						
~~010 08 00 00~~	~~AERONAUTICAL INFORMATION SERVICE~~						
~~010 09 00 00~~	~~AERODROMES OR HELIPORTS~~						
~~010 10 00 00~~	~~FACILITATION~~						
~~010 11 00 00~~	~~SEARCH AND RESCUE~~						
~~010 12 00 00~~	~~SECURITY~~						
~~010 13 00 00~~	~~AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION~~						
~~**021 00 00 00**~~	~~**AIRCRAFT GENERAL KNOWLEDGE: AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT**~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
~~021 01 00 00~~	~~SYSTEM DESIGN, LOADS, STRESSES AND MAINTENANCE~~						

		~~**Aeroplane**~~		~~**Helicopter**~~			~~**IR**~~
		~~**ATPL**~~	~~**CPL**~~	~~**ATPL /IR**~~	~~**ATPL**~~	~~**CPL**~~	
~~021 02 00 00~~	~~AIRFRAME~~						
~~021 03 00 00~~	~~HYDRAULICS~~						
~~021 04 00 00~~	~~LANDING GEAR, WHEELS, TYRES AND BRAKES~~						
~~021 05 00 00~~	~~FLIGHT CONTROLS~~						
~~021 06 00 00~~	~~PNEUMATICS: PRESSURISATION AND AIR CONDITIONING~~						
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~~021 08 00 00~~	~~FUEL SYSTEM~~						
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~~021 15 00 00~~	~~HELICOPTER: ROTOR HEADS~~						
~~021 16 00 00~~	~~HELICOPTER: TRANSMISSION~~						
~~021 17 00 00~~	~~HELICOPTER: BLADES~~						
~~**022 00 00 00**~~	~~**AIRCRAFT GENERAL KNOWLEDGE: INSTRUMENTATION**~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
~~022 01 00 00~~	~~SENSORS AND INSTRUMENTS~~						
~~022 02 00 00~~	~~MEASUREMENT OF AIR DATA PARAMETERS~~						
~~022 03 00 00~~	~~MAGNETISM: DIRECT READING COMPASS AND FLUX VALVE~~						
~~022 04 00 00~~	~~GYROSCOPIC INSTRUMENTS~~						
~~022 05 00 00~~	~~INERTIAL NAVIGATION AND REFERENCE SYSTEMS~~						
~~022 06 00 00~~	~~AEROPLANE: AUTOMATIC FLIGHT CONTROL SYSTEMS~~						
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~~022 09 00 00~~	~~AUTOTHROTTLE: AUTOMATIC THRUST CONTROL SYSTEM~~						
~~022 10 00 00~~	~~COMMUNICATION SYSTEMS~~						

		~~Aeroplane~~		~~Helicopter~~			~~IR~~
		~~ATPL~~	~~CPL~~	~~ATPL /IR~~	~~ATPL~~	~~CPL~~	
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~~033 01 00 00~~	~~FLIGHT PLANNING FOR VFR FLIGHTS~~						
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		~~**Aeroplane**~~		~~**Helicopter**~~			~~**IR**~~
		~~**ATPL**~~	~~**CPL**~~	~~**ATPL /IR**~~	~~**ATPL**~~	~~**CPL**~~	
~~033 05 00 00~~	~~ATS FLIGHT PLAN~~						
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~~034 01 00 00~~	~~GENERAL~~						
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~~040 01 00 00~~	~~HUMAN FACTORS: BASIC CONCEPTS~~						
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~~**050 00 00 00**~~	~~**METEOROLOGY**~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
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~~**061 00 00 00**~~	~~**GENERAL NAVIGATION**~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
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~~061 03 00 00~~	~~CHARTS~~						
~~061 04 00 00~~	~~DEAD RECKONING NAVIGATION~~						
~~061 05 00 00~~	~~IN-FLIGHT NAVIGATION~~						

		~~Aeroplane~~		~~Helicopter~~			~~IR~~
		~~ATPL~~	~~CPL~~	~~ATPL /IR~~	~~ATPL~~	~~CPL~~	
~~062 00 00 00~~	**~~RADIO NAVIGATION~~**	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~
~~062 01 00 00~~	~~BASIC RADIO PROPAGATION THEORY~~						
~~062 02 00 00~~	~~RADIO AIDS~~						
~~062 03 00 00~~	~~RADAR~~						
~~062 04 00 00~~	*~~INTENTIONALLY LEFT BLANK~~*						
~~062 05 00 00~~	~~AREA NAVIGATION SYSTEMS AND RNAV OR FMS~~						
~~062 06 00 00~~	~~GNSS~~						
~~070 00 00 00~~	**~~OPERATIONAL PROCEDURES~~**	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	
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~~081 01 00 00~~	~~SUBSONIC AERODYNAMICS~~						
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~~081 03 00 00~~	*~~INTENTIONALLY LEFT BLANK~~*						
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		~~Aeroplane~~		~~Helicopter~~			~~IR~~
		~~ATPL~~	~~CPL~~	~~ATPL /IR~~	~~ATPL~~	~~CPL~~	
~~082 08 00 00~~	~~HELICOPTER FLIGHT MECHANICS~~						
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~~091 00 00 00~~	**~~VFR COMMUNICATIONS~~**						
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~~091 04 00 00~~	~~ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE~~						
~~091 05 00 00~~	~~DISTRESS AND URGENCY PROCEDURES~~						
~~091 06 00 00~~	~~GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES~~						
~~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 TERMS (IFR)~~						
~~092 06 00 00~~	~~GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES~~						
~~092 07 00 00~~	~~MORSE CODE~~						

DETAILED THEORETICAL KNOWLEDGE SYLLABUS AND LEARNING OBJECTIVES FOR THE ATPL, CPL AND IR

General note

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 Learning Objectives 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 & monitoring*	F.
034	*Performance (Helicopter)*	G.
040	***Human performance & 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 Learning Objectives for each licence or the instrument rating are marked with an 'x'.

The Learning Objectives define the theoretical knowledge that a student should have assimilated on 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 Learning Objectives are intended to be used by an ATO when developing Part-FCL theoretical-knowledge elements of the appropriate course. It should be noted, however, that the Learning Objectives 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.

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 'Abbreviations and Codes' or those listed in GM1 FCL.010.

Where a Learning Objective 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.

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;	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— territory, high seas, according to the UN Convention on the High Seas.						
LO	Define the following terms and explain how they apply to ~~I~~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;	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— documents.						
010 01 02 00	**Other conventions and agreements**						
010 01 02 01	**The International Air Services Transit Agreement (ICAO Doc 7500)**						
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	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	Suppression of Unlawful Acts against the Safety of Civil Aviation, Montreal, 23 September 1971)						
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 Aviation, done at Montreal on 23.9.1971, and signed at Montreal on 24 February 1988).	x	x	x	x	x	
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,	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	Warsaw, 2 October 1929.						
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 of the Montreal Convention of 28 May 1999.	x	x	x	x	x	
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.**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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)**						
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	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	(ECAC).						
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	
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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**						
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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)**						
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	instrument ratings, their validity and privileges.						
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**						
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
LO	Describe how omnidirectional departures are expressed in the	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	appropriate publication.						
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
LO	State that a pilot shall apply wind	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	corrections when carrying out an instrument-approach procedure.						
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	may lie.						
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	the MAPt at an altitude/height greater than that required by the procedure.						
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
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)**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	associated with the holding pattern.						
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
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	holding area, the buffer area (general only) and over high terrain or in mountainous areas.						
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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 shall be expressed in terms of altitude and when in terms of flight levels.	x	x	x	x	x	x
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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;	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— a communication failure; — unlawful interference.						
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
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	Advisory situation is resolved.						
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	RNP type is considered an integral part of the ATS route designator.						
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)**						

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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	by ATC.						
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
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	provided to aircraft shall be rounded up or down.						
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
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	a new frequency.						
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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 maintain a specified vertical separation between them during climb or descent.	x		x			x
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-	x					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	number technique.						
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
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	x	x	x	x	x	x

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	sequence indicates their intention to hold for weather improvements.						
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
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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 have previously been directed by ATC to operate the transponder on a specific code.	x	x	x	x	x	x
010 07 02 18	**Air traffic advisory service**						
LO	Describe the objective and basic principles of the air traffic advisory	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	service.						
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 two-way COM failure, shall be sent by ATS.	x	x	x	x	x	x
LO	Describe the expected actions of an ATS unit after having been informed	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	that an aircraft is being intercepted in or outside its area of responsibility.						
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
010 08 03 00	**General**						
LO	State during which period of time	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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.						
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 procedure,	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	NOTAM.						
LO	State to whom NOTAMs shall be distributed.	x	x	x	x	x	x
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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	x	x	x	x	x	x

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	normally be located.						
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	and characteristics. *Remark: This includes the 'Calvert' system with additional crossbars.*						
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; — stop bars; — intermediate holding position lights; — RWY-guard lights; — road holding position lights.	x	x	x	x	x	x
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	intermediate holding-position sign on a taxiway.						
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
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,	x	x	x	x	x	x

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	cables, etc.						
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 apron shall be warned that the shoulders of these surfaces are 'non-load-bearing'.	x	x	x	x	x	x
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,**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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 fire-fighting 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**						
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	x	x	x	x	x	x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	distances' on a runway and also the appropriate abbreviations.						
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
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
LO	Understand the required activities expected at each airport serving international civil aviation.	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
LO	Describe the assistance each Contracting State shall provide to an aircraft subjected to an act of	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	unlawful seizure.						
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**						
LO	Describe the special considerations referring to flight crew compartment	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	doors with regard to aviation security.						
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	
LO	Define the difference between	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	'serious incident' and 'accident'.						
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	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	Annex 13.						
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

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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL/IR	Helicopter ATPL	Helicopter CPL	IR
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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 aero-elastic 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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

<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>LO</td><td>List the main advantages and disadvantages of system actuation by hydraulic or purely mechanical means with respect to:
— weight,
— size,
— force.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>List the main users of hydraulic systems.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>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).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>State that the normal hydraulic pressure of most large transport aircraft is 3 000 psi.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>Explain the working principle of a low-pressure (0–2000 psi) open centred system using an off loading valve and an RPM dependent pump.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>Explain the advantages and disadvantages of a high pressure system over a low -pressure system.</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>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).</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr>
<tr><td>LO</td><td>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.</td><td>x</td><td>x</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	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	_Aeroplane_		_Helicopter_			_IR_
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL /IR	Helicopter ATPL	Helicopter CPL	IR
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	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

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 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**						
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane* ATPL	CPL	*Helicopter* ATPL /IR	ATPL	CPL	*IR*
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)**						
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL/IR	Helicopter ATPL	Helicopter CPL	IR
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
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
022 03 01 00	**Earth's magnetic field**						
LO	Describe the magnetic field of the Earth.	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 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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain how to use and interpret the direct-reading compass indications during a turn.	x	x	x	x	x	x
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL /IR	Helicopter ATPL	Helicopter CPL	IR
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**						
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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					

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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane* ATPL	*Aeroplane* CPL	*Helicopter* ATPL /IR	*Helicopter* ATPL	*Helicopter* CPL	*IR*
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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.*						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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				

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL/IR	Helicopter ATPL	Helicopter CPL	IR
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

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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)**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane ATPL	Aeroplane CPL	Helicopter ATPL /IR	Helicopter ATPL	Helicopter CPL	IR
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		

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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.

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		

Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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)**						

Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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	

Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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)**						

Syllabus reference	Syllabus details details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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**						

Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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**						

Syllabus reference	Syllabus details details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

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**						

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).

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				

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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**						
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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				
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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				
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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				
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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**						
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				

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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				
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				

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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**						
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption.	x	x				
LO	Calculate range and endurance data.	x	x				

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					

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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
LO	Define the term 'Aeroplane-Specific Fuel Consumption (ASFC)'. *Remark: Engine-specific fuel consumption is covered in subject 021.*	x					
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					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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**						
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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')**						
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					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
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					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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**						
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					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
LO	Explain the effect of a descent at constant Mach number on the margin to low and high-speed buffet.	x					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
032 04 06 03	**Influence of variables on landing performance**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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					
LO	Find the structural-limited landing mass from the aeroplane performance data sheets.	x					

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL/ IR	ATPL	CPL	
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 & MONITORING

(1) For mass definitions, please refer to Chapter D.

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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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	
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;	x	x	x	x	x	

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— Flight Information Services (FIS); — weather information stations; — Automatic Terminal Information Service (ATIS).						
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**						
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	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	route(s) considering: — altitudes and flight levels; — standard routes; — ATC restrictions; — shortest distance; — obstacles; — any other relevant data.						
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**						
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);	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— Minimum Holding Altitude (MHA).						
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**						
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;	x		x			x

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	— 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.						
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
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 emperature (OAT).	x		x			x

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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			

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			x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	with the applicable operational requirements and 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	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
033 03 03 00	**Specific fuel-calculation procedures**						
033 03 03 01	**Decision-point procedure**						
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					

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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 the fuel-price ratio between departure and destination airports and air distance to fly).	x					
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**						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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.*						
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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); — destination aerodrome, total estimated elapsed time and alternate aerodrome (Item 16); — other information (Item 18); — supplementary information (Item 19).	x	x	x	x	x	x
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	x		x	x		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	its use.						
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**						
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	x	x	x	x	x	x

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	chart.						
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; — adjusting flight parameters and power settings.	x	x	x	x	x	
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	x	x	x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	aerodrome; — the aircraft must be able to land with the prescribed final reserve fuel.						
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.

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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Interpret the charts showing minimum clearances associated with Category A & B procedures.			x	x		
034 01 02 00	**General performance theory**						
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 (V_Y); — never exceed speed (V_{NE}); — velocity landing gear extended (V_{LE}); — velocity landing gear operation (V_{LO}); — cruising speed and maximum cruising speed.			x	x	x	

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane* ATPL	*Aeroplane* CPL	*Helicopter* ATPL/IR	*Helicopter* ATPL	*Helicopter* CPL	*IR*
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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	
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	

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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)**						
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 Learning Objectives for Performance Class 2 are principally identical with those of Performance Class 1. (See 034 04 00 00) Additional Learning Objectives 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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
034 04 04 01	**Requirements for en route flights for OEI**						

Syllabus reference	Syllabus details and associated Learning Objectives	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

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

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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain and give examples of organisational threats.	x	x	x	x	x	x
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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		

Syllabus reference	**Syllabus details and associated Learning Objectives**	_Aeroplane_		_Helicopter_			_IR_
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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

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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
040 02 02 03	**Hearing**						
	Descriptive and functional anatomy						
LO	State the audible range of the human ear.	x	x	x	x	x	x
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						
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		

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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
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						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		

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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Besides coffee, indicate other beverages containing caffeine.	x	x	x	x	x	x
	Alcohol						
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						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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**						

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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						

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
	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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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		

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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		
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		

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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**						

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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*			*Helicopter*		*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	Syllabus details and associated Learning Objectives	Aeroplane			Helicopter		IR
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

Syllabus reference	**Syllabus details and associated Learning Objectives**	*Aeroplane*		*Helicopter*			*IR*
		ATPL	CPL	ATPL /IR	ATPL	CPL	
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
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

4. References

4.1. Affected regulations

Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 311, 25.11.2011, p. 1), as amended by Commission Regulation (EU) No 290/2012 of 30 March 2012 (OJ L 100, 5.4.2012, p. 1), Commission Regulation (EU) No 70/2014 of 27 January 2014 (OJ L 23, 28.1.2014, p. 25), and Commission Regulation (EU) No 245/2014 of 13 March 2014 (OJ L 74, 14.3.2014, p. 33)

4.2. Affected CS, AMC and GM

Annex to ED Decision 2011/016/R of 15 December 2011 on 'Acceptable Means of Compliance and Guidance Material to Part-FCL' (Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council)

Annex to ED Decision 2014/022/R of 1 April 2014 on 'AMC and GM to Part-FCL – Amendment 1' (amending the Acceptable Means of Compliance and Guidance Material to Part-FCL of Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council)

4.3. Reference documents

Not applicable.

5. Appendices

Not applicable.