European Aviation Safety Agency

Notice of Proposed Amendment 2016-03(E)

Technical review of the theoretical knowledge syllabi, learning objectives, and examination procedures for air transport pilot licence, multi-crew pilot licence, commercial pilot licence, and instrument ratings

Subject 070 — Operational procedures

Subject 081 — Principles of flight (aeroplane)

Subject 082 — Principles of flight (helicopter)

Subject 090 — VFR and IFR communications

RMT.0595 — 9.6.2016

EXECUTIVE SUMMARY

This Notice of Proposed Amendment (NPA) addresses a safety and regulatory coordination issue related to flight crew licensing. It has been developed in response to the European Aviation Safety Plan (EASP) safety actions.

This NPA updates the Learning Objectives (LOs) for the theoretical knowledge (TK) syllabi and ground school examinations, and introduces the threat and error management (TEM) concept and its application. The amendments proposed in this NPA aim to ensure that the LOs correspond to today's operational environment and that commercial pilots are equipped with the knowledge and understanding relevant to modern flight deck and current industry needs. The proposed updated pilot training will contribute to the overall enhancement of the pilots' core competencies and their ability to make informed decisions.

The NPA also introduces new LOs under Area 100 'knowledge, skills and attitudes' (KSA), whose aim is to enhance the pilots' KSA contained in the core competencies. New requirements are proposed for approved training organisations (ATOs) to assess student pilots' KSA. These skills focus on the pilots' ability to apply their knowledge and understanding across subjects and to demonstrate technical and non-technical skills. These LOs will, therefore, not be the subject of examinations organised by the competent authority or its agents, but will be assessed by the ATOs to ensure that trainee pilots have an adequate level of competency before they are allowed to sit their final TK examinations.

The NPA also recommends that EASA develop a process to regularly review and update the LOs so that they are up to date with emerging safety threats as well as with developments in technology and operational practice.

Applicability	
Affected regulations and decisions:	ED Decisions 2011/016/R; 2012/006/R; 2012/007/R; 2014/020/R; 2014/022/R; 2016/008/R
Affected stakeholders:	Competent authorities; ATOs; student pilots; providers of textbooks and training materials; ECQB
Driver/origin:	Safety
Reference:	EASA 4-year Rulemaking Programme; EASA ECQB Project

Process map	
Concept paper:	No
Terms of reference:	11.3.2015
Rulemaking group:	Yes
RIA type:	Light
Technical consultation during NPA drafting:	Yes
Duration of NPA consultation:	3 months
Review group:	Yes
Focused consultation:	No
Publication date of the Opinion:	N/A
Publication date of the Decision:	2016/Q4

Overview of the proposed amendments to Subject 070 'Operational procedures'

The main amendments to this Subject consist of the following: polar navigation has been deleted (as it is covered in 061 and 022), and flight management system (FMS) has been moved to 022.

A significant number of Learning Objectives (LOs) has been updated to include references to new, applicable European Union (EU) regulations.

Many LO levels have been changed from 'state' to 'explain' in order to focus more on understanding than on learning facts by heart.

The older LOs, which included more than one objective under a single LO, have been split and renumbered as separate LOs.

A number of existing LOs, which contained a large amount of information in a single entry, have been split up into several LOs to enable proper examination of the relevant knowledge. These split LOs have been marked as new text (grey-shaded); however, the numbering in the left hand-side column does not indicate that they are new LOs (not existing in the previous syllabi).

The renumbering of the subject from 071 to 070 will be considered for the publication of the related ED Decision with the final version of the acceptable means of compliance (AMC) and guidance material (GM).

Stakeholders are invited to provide feedback on the most appropriate subject area for the LOs on:

- **extended range operations with two-engined aeroplanes (ETOPS) *(currently in 071 01 03 04)*,**
- **selection of alternate aerodromes *(currently in 071 01 03 01)*, and**
- **North Atlantic High Level Airspace (NAT HLA) *(currently in 071 01 03 03)*.**

SUBJECT 070 — OPERATIONAL PROCEDURES

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
070 00 00 00		**OPERATIONAL PROCEDURES**								
071 01 00 00		**GENERAL REQUIREMENTS**								
071 01 01 00		**ICAO Annex 6**								
071 01 01 01		***Definitions***								
(01)		Define the following: a~~A~~lternate aerodrome: take-off alternate, en-route alternate, ETOPS en route alternate, destination alternate (ICAO Annex 6, Part I, Chapter 1).	X	X						
(02)		Define a~~A~~lternate heliport (ICAO Annex 6, Part III, Section 1, Chapter 1).			X	X	X			
(03)		Define f~~F~~light time — aeroplanes (ICAO Annex 6, Part I, Chapter 1).	X	X						
(04)		Define f~~F~~light time — helicopters (ICAO Annex 6, Part III, Section 1, Chapter 1).			X	X	X			
071 01 01 02		***Applicability***								
(01)		~~State~~ Explain that Part I shall be applicable to the operation of aeroplanes by operators authorised to conduct international commercial air transport (CAT) operations (ICAO Annex 6, Part I, Chapter 2).	X	X						Deeper LO level
(02)		~~State~~ Explain that Part III shall be applicable to all			X	X	X			Too detailed LO

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		helicopters engaged in international ~~commercial air transport~~ CAT operations or in international general aviation operations, except ~~it is not applicable to~~ helicopters engaged in aerial work (ICAO Annex 6, Part III, Section 1, Chapter 2).								
071 01 01 03		***General***								
(01)		~~State~~ Explain the compliance with laws, regulations and procedures (ICAO Annex 6, Part I, Chapter 3.1/Part III, Section 2, Chapter 1.1).	X	X	X	X	X			Deeper LO level
(02)		~~State~~ Explain the accident prevention and flight safety programme (ICAO Annex 6, Part I, Chapter 3.2), including the structure and purpose of a safety management system.	X	X						More precise and deeper LO level
(03)		~~State~~ Explain what is a flight safety documents system (ICAO Annex 6, Part I, Chapter 3.3).	X	X						Deeper LO level
(04)		~~State~~ Explain what is maintenance release (ICAO Annex 6, Part I, Chapter 8.8/Part III, Section 2, Chapter 6.7).	X	X	X	X	X			Deeper LO level
(05)		List and describe the lights to be displayed by aircraft (ICAO Annex 6, Part I, Appendix 1).	X	X						
071 01 02 00		**Operational requirements**								
071 01 02 01		***Applicability***								
(01)	X	~~State~~ Explain the operational regulations applicable to ~~commercial air transportation~~ CAT and other activities	X	X	X	X	X			To adapt to EU regulations and deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		(specialised operations (SPO)) (Regulation (EU) No 965/2012 on air operations, and Regulation (EU) No 1178/2011 on aircrew requirements).								
(02)		Describe the n~~N~~ature of CAT operations and exceptions (Regulation (EU) No 965/2012: Article 1, Article 5, ORO.GEN.005 and CAT.GEN.100; Regulation (EC) No 216/ 2008: Article 1).	X	X	X	X	X			To adapt to EU regulations
071 01 02 02		***General***								
(01)	X	~~State~~ Explain why ~~that~~ a ~~commercial air transportation~~ CAT flight must meet the applicable operational requirements (ORO.GEN.105;110 and related AMC/GM).	X	X	X	X	X			To adapt to EU regulations and deeper LO level
(02)		Define f~~F~~light m~~M~~anual limitations — f~~F~~light through the h~~H~~eight v~~V~~elocity (HV) envelope.			X	X	X			
(03)		Define 'h~~H~~elicopter e~~E~~mergency m~~M~~edical s~~S~~ervice (HEMS)'.			X	X	X			
(04)		Define ~~O~~operations over a hostile environment — a~~A~~pplicability.			X	X	X			LO level added
(05)		Define l~~L~~ocal area operations — a~~A~~pproval.			X	X	X			LO level added
(06)		~~State~~ Explain the requirements about language used for crew communication and operations manual (CAT.GEN.MPA.120).	X	X	X	X	X			Deeper LO level
~~LO (07)~~		~~Explain the relation between MMEL and MEL.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Moved to new 071 02 01 03

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(08)		~~State~~ Explain which are the operator's requirements regarding ~~a~~the management system (ORO.GEN.200 and AMC/GM to ORO.GEN.205;220).	X	X	X	X	X			Requirement from the training need analysis (TNA)
(09)		~~State~~ Explain which are the operator's requirements regarding the accident prevention and flight safety programme (ORO.GEN.200 and AMC/GM to ORO.GEN.205;220 and to ORO.AOC.130).	X	X	X	X	X			Requirement from the TNA
~~LO (10)~~		~~State the operator's responsibility regarding the distinction between cabin crew members and additional crew members.~~	~~X~~	~~X~~						Irrelevant
~~LO (11)~~		~~State the operations limitations regarding ditching requirements.~~	~~X~~	~~X~~						Moved to 071 02 10 00 'Emergency and precautionary landings'
(12)		~~State~~ Explain which are the regulations concerning the carriage of persons on an aircraft (CAT.GEN.MPA.115, ORO.AOC.135).	X	X	X	X	X			
~~LO (13)~~		~~State the crew members' responsibilities in the execution of their duties, and define the commander's authority.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Moved to 071 01 02 09
~~LO (14)~~		~~State the operator's and commander's responsibilities regarding admission to the flight deck and carriage of unauthorised persons or cargo.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Moved to 071 01 02 09
(15)		~~State~~ Explain the operator's and commander's responsibility	X	X	X	X	X			Deeper LO level and

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		concerning portable electronic devices (CAT.GEN.MPA.140).								amended responsibility
(16)		~~State~~Explain the operator's and commander's responsibility~~ies~~ regarding admission in an aircraft of a person under the influence of drug or alcohol (CAT.GEN.MPA.170).	X	X	X	X	X			Deeper LO level and amended responsibility
(17)		~~State~~ Explain the regulations concerning the endanger~~ing~~ment of safety (CAT.GEN.MPA.175).	X	X	X	X	X			Deeper LO level
(18)		List the documents to be carried on each flight (CAT.GEN.MPA.180 and related AMC/GM).	X	X	X	X	X			
(19)		~~State~~ Explain the ~~operator's~~ responsibility regarding manuals to be carried on board an aircraft (CAT.GEN.MPA.180 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(20)		List the additional information and forms to be carried on board an aircraft (CAT.GEN.MPA.180 and related AMC/GM).	X	X	X	X	X			
(21)		List the copies of items of information to be retained on the ground by the operator (CAT.GEN.MPA.185).	X	X	X	X	X			More detailed LO
(22)		~~State the operator's responsibility regarding inspections.~~	X	X	X	X	X			Irrelevant
(23)		~~State the~~ Explain what responsibility~~ies~~ ~~of~~ the operator and ~~of~~ the commander have regarding the production of and access to records and documents (CAT.GEN.MPA.190).	X	X	X	X	X			Deeper LO level
~~LO (24)~~		~~State the operator's responsibility regarding the~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Irrelevant

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~preservation of documentation and recordings, including recorders recordings.~~								
~~LO (25)~~		~~Define the terms used in leasing and state the responsibility and requirements of each party in various case.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Irrelevant
071 01 02 03		***Operator certification and supervision***								
(01)		~~State~~ Explain what ~~the~~ requirement has to be satisfied for the issue of an a~~A~~ir o~~O~~perator~~'s~~ c~~C~~ertificate (AOC).	X	X	X	X	X			Deeper LO level
(02)		~~State~~ Explain what the rules applicable to air operator certification are.	X	X	X	X	X			Deeper LO level
(03)		~~State~~ Explain the conditions to be met for the issue or revalidation of an AOC.	X	X	X	X	X			Deeper LO level
(04)		~~State~~ Explain the contents and conditions of the AOC.	X	X	X	X	X			Deeper LO level
071 01 02 04		***Operational procedures (except long-range flight preparation)***								
(01)		Define the terms used for operational procedures (Annex I, CAT.OP.MPA.106; 107).	X	X						
(02)		~~State~~ Explain which are the operator's responsibilities regarding the o~~O~~perations m~~M~~anual (ORO.MLR.100).	X	X	X	X	X			Deeper LO level
~~LO (03)~~		~~State the operator's responsibilities regarding competence of operations personnel.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Irrelevant

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~(04)~~		~~State the operator's responsibilities regarding establishment of procedures.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered by 071 01 02 02 (01)
(05)		State the operator's responsibilities regarding use of air traffic services (ATS) (CAT.OP.MPA.100).	X	X	X	X	X			
(06)		State the operator's responsibilities regarding authorisation of aerodromes/heliports by the operator (CAT.OP.MPA.105).	X	X	X	X	X			
(07)		Explain which elements must be considered by the operator when specifying aerodrome/heliport operating minima (CAT.OP.MPA.110(a)&(c), CAT.OP.115, SPA.LVO.100 and related AMC/GM; SPA.LVO.110).	X	X	X	X	X			Deeper LO level
(08)		~~State~~ Explain what the operator's responsibilities are regarding departure and approach procedures (CAT.OP.MPA.125).	X	X	X	X	X			Deeper LO level
(09)		~~State~~ Explain which ~~the~~ parameters ~~to~~ should be considered in noise-abatement procedures (CAT.OP.MPA.130 and related AMC/GM).	X	X						Deeper LO level
(10)		~~State~~ Explain which ~~the~~ elements ~~to~~ should be considered regarding routes and areas of operation (CAT.OP.MPA.135; 136).	X	X	X	X	X			Deeper LO level
(11)		~~State~~ Explain the additional specific navigation system performance requirements for flights in reduced vertical separation minima (RVSM) airspace (SPA.RVSM.100~~; & 105~~).	X	X	X	X	X			Rephrased for precision

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (12)~~		~~State the maximum distance from an adequate aerodrome for two-engine aeroplanes without an ETOPS approval.~~	~~X~~	~~X~~						Moved to 071 01 03 04 (08)
~~LO (13)~~		~~State the requirement for alternate airport accessibility check for ETOPS operations.~~	~~X~~	~~X~~						Moved to 071 01 03 04 (09)
(14)		List the factors to be considered when establishing minimum flight altitude (CAT.OP.MPA.145 and related AMC/GM).	X	X	X	X	X			
~~LO (15)~~		~~Describe the components of the fuel policy.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 033 03 02 03
(16)		~~State~~ Explain the requirements for carrying persons with reduced mobility (CAT.OP.MPA.155).	X	X	X	X	X			Deeper LO level
(17)		~~State~~ Explain the operator's responsibilities for the carriage of inadmissible passengers, deportees or persons in custody (CAT.OP.MPA.155).	X	X	X	X	X			Deeper LO level
~~LO (18)~~		~~State the requirements for the stowage of baggage and cargo in the passenger cabin.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Irrelevant
(19)		~~State~~ Explain which are the requirements regarding passenger seating and emergency evacuation (CAT.OP.MPA.165 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(20)		Detail the procedures for a passenger briefing in respect of emergency equipment and exits (CAT.OP.MPA.170 and related AMC).	X	X	X	X	X			
(21)		State the flight preparation forms to be completed before	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		flight (CAT.OP.MPA.175 and related AMC/GM).								
(22)		State the commander responsibilities during flight preparation (CAT.OP.MPA.175 and related AMC/GM).	X	X	X	X	X			
(23)		State the rules for aerodrome~~s~~/heliport~~s~~ selection ~~(including ETOPS configuration)~~ (CAT.OP.MPA.180).	X	X	X	X	X			
(24)		Explain the planning minima for instrument flight rules (IFR) flights (CAT.OP.MPA.185).	X		X					
(25)		~~State~~ Explain the rules for refuelling/defueling with passengers on board (CAT.OP.MPA.195, CAT.OP.MPA.200 and related AMC).	X	X	X	X	X			Deeper LO level and more precise
(26)		~~State~~ Explain the 'crew members at ~~duty~~ station' policy (CAT.OP.MPA.210 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(27)		~~State~~ Explain the use of seats, safety belts and harnesses (CAT.OP.MPA.225).	X	X	X	X	X			Deeper LO level
(28)		~~State~~ Explain the requirements for securing ~~of~~ passenger cabin and galley ~~requirements~~ (CAT.OP.MPA.230).	X	X	X	X	X			
(29)		~~State~~ Explain the commander's responsibility regarding smoking on board (CAT.OP.MPA.240).	X	X	X	X	X			
(30)		State under which conditions a commander can commence or continue a flight regarding meteorological conditions (CAT.OP.MPA.245;246;265).	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(31)		~~State~~ Explain the commander's responsibility regarding ice and other contaminants (CAT.OP.MPA.250, CAT.OP.MPA.255 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(32)		~~State~~ Explain the commander's responsibility regarding fuel to be carried and in-flight fuel management (CAT.OP.MPA.260;280).	X	X	X	X	X			
(33)		~~State the requirements regarding the use of supplemental oxygen.~~ Detail the rules regarding carriage and use of supplemental oxygen for passengers and crew (CAT.OP.MPA.285, CAT.IDE.A.235 and related AMC/GM).	X	X	X	X	X			Extra info in LO
		Flight preparation								
~~LO (34)~~		~~State the ground-proximity detection reactions. (CAT.OP.MPA.290)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 022 12 10 00 (06)
~~LO (35)~~		~~State the requirements for use of ACAS.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 022 12 10 00
(36)		~~State~~ Explain the commander's responsibility regarding approach and landing (CAT.OP.MPA.300;305 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(37)		~~State~~ Explain the circumstances under which a report shall be submitted (ORO.GEN.160 and related AMC).	X	X	X	X	X			Deeper LO level
071 01 02 05		***All-weather operations***								
(01)		~~State~~ Explain the operator's responsibility regarding	X		X					Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		aerodrome/heliport operating minima (CAT.OP.MPA.110; 115, SPA.LVO.100;110 and related AMC/GM).								
~~LO (02)~~		~~List the parameters to be considered in establishing the aerodrome operating minima.~~	~~X~~		~~X~~					Duplication of 071 01 02 04 (07)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (03)~~		~~Define the criteria to be taken into consideration for the classification of aeroplanes.~~	~~X~~							Irrelevant
(04)		Define the following terms: 'circling', 'low-visibility procedures', 'low-visibility take-off', 'visual approach' (Regulation (EU) No 965/2012).	X		X					
(05)		Define the following terms: 'flight control system', 'fail-passive flight control system', 'fail-operational flight control system', 'fail-operational hybrid landing system' (Regulation (EU) No 965/2012).	X							
(06)		Define the following terms: 'final approach and take-off area' (Annex I to Regulation (EU) No 965/2012).			X					
(07)		~~State~~ Explain the general operating rules for low-visibility operations (SPA.LVO.100 and related AMC).	X		X					Deeper LO level
(08)		Define ~~Low visibility operations~~ aAerodrome/heliport considerations regarding low-visibility operations (SPA.LVO.115).	X		X					Clarification
(09)		Explain ~~State~~ the training and qualification requirements for flight crew to conduct low-visibility operations (SPA.LVO.120 and related AMC/GM).	X		X					Deeper LO level
(10)		~~State~~Explain the operating procedures for low-visibility operations (SPA.LVO.125 and related AMC).	X		X					Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(11)		~~State~~Explain the operator's and commander's responsibilities regarding minimum equipment for low-visibility operations (SPA.LVO.130).	X		X					Deeper LO level
(12)		VFR operating minima	X		X					
(13)		Aerodrome operating minima: ~~State~~ explain under which conditions the commander can commence take-off (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level
(14)		Aerodrome operating minima: ~~State~~ explain that take-off minima are expressed as visibility or runway visual range (RVR) (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level
(15)		Aerodrome operating minima: ~~State~~ explain the take-off RVR value depending on the facilities (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level
(16)		Aerodrome operating minima: ~~State~~ explain the system minima for non-precision approach (NPA) (minimum descent altitude/height (MDA/H) and decision altitude/height (DA/H), not RVR) (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level and more detailed
(17)		Aerodrome operating minima: ~~State~~ explain under which conditions a pilot can continue the approach below MDA/H or DA/H (CAT.OP.MPA.110, SPA.LVO.110 and related	X		X					Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		AMC/GM).								
(18)		Aerodrome operating minima: ~~State~~ explain the lowest minima for precision approach category 1 (including single-pilot operations) (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level
(19)		Aerodrome operating minima: ~~State~~ explain the lowest minima for precision approach category 2 operations (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level
(20)		Aerodrome operating minima: ~~State~~ explain the lowest minima for precision approach category 3 operations (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X							Deeper LO level
(21)		Aerodrome operating minima: ~~State~~ explain the lowest minima for circling and visual approach (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).	X		X					Deeper LO level and more precise
(22)		Aerodrome operating minima: ~~State~~ explain the RVR value and cloud ceiling depending on the facilities (class 1, 2 and 3) (CAT.OP.MPA.110 and AMC/GM, SPA.LVO.110 and AMC).			X					Deeper LO level
(23)		Aerodrome operating minima: ~~State~~ explain under which conditions an airborne radar approach can be performed and state the relevant minima (CAT.OP.MPA.110, SPA.LVO.110 and related AMC/GM).			X					Deeper LO level
071 01 02 06		***Instruments and equipment***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		~~State~~ Explain which items do not require an equipment approval (CAT.IDE.A/H.100 and related GM, CAT.IDE.A/H.105).	X	X	X	X	X			Deeper LO level
(02)		~~State~~ Explain the requirements regarding spare fuses availability (CAT.IDE.A.110 and related GM).	X	X	X	X	X			Deeper LO level
~~LO (03)~~		~~State the requirements regarding operating lights. (CAT.IDE.A/H.115)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 010 05 03 00 (02)
(04)		~~State~~ Explain the requirements regarding windshield wipers (CAT.IDE.A.120 and related AMC).	X	X						Deeper LO level
~~LO (05)~~		~~List the equipment for operations requiring a radio communication.~~			~~X~~	~~X~~	~~X~~			Moved to 071 01 02 07
~~LO (06)~~		~~List the equipment for operations requiring a radio-navigation system.~~			~~X~~	~~X~~	~~X~~			Moved to 071 01 02 07
(07)		List the minimum equipment required for day and night VFR flights (CAT.IDE.A/H.125;130 and related AMC/GM).	X	X	X	X	X			
(08)		List the minimum equipment required for IFR flights (CAT.IDE.A/H.130 and related AMC/GM).	X		X					
(09)		~~State~~ Explain the required additional equipment for single-pilot operations under IFR (CAT.IDE.A/H.135).	X		X					Deeper LO level and more precise
(10)		State the requirements for an altitude alert system (CAT.IDE.A.140).	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(11)		State the requirements for radio altimeters (CAT.IDE.H.145).			X	X	X			
(12)		State the requirements for ground proximity warning system (GPWS)/terrain awareness and warning system (TAWS) (CAT.IDE.A.150).	X	X						
(13)		State the requirements for airborne collision avoidance system (ACAS) (CAT.IDE.A.155).	X	X						
(14)		State the conditions under which an aircraft must be fitted with a weather radar (CAT.IDE.A.160).	X	X	X	X	X			
~~LO (15)~~		~~State the requirements for operations in icing conditions.~~	X	X	X	X	X			Moved to 071 02 02 01
~~LO (16)~~		~~State the conditions under which a crew member interphone system and public address system are mandatory.~~	X	X	X	X	X			Moved to 071 01 02 07
(17)		State the circumstances under which a cockpit voice recorder is compulsory (CAT.IDE.A.185 and related AMC/GM).	X	X	X	X	X			
(18)		State the rules regarding the location, construction, installation and operation of cockpit voice recorders (CAT.IDE.A.185 and related AMC/GM).	X	X	X	X	X			
(19)		State the circumstances under which a flight data recorder is compulsory (CAT.IDE.A.190 and related AMC/GM).	X	X	X	X	X			
(20)		State the rules regarding the location, construction, installation and operation of flight data recorders	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		(CAT.IDE.A.190;195;200 and related AMC/GM).								
(21)		~~State~~ Explain the requirements about seats, seat safety belts, harnesses and child-restraint devices (CAT.IDE.A/H.205 and related AMC).	X	X	X	X	X			Deeper LO level
(22)		~~State~~ Explain the requirements about 'Fasten seat belt' and 'No smoking' signs (CAT.IDE.A/H.210).	X	X	X	X	X			Deeper LO level
(23)		~~State~~ Explain the requirements regarding internal doors and curtains (CAT.IDE.A/H.215).	X	X						Deeper LO level
		First-aid and emergency equipment								
(24)		~~State~~ Explain the requirements regarding first-aid kits (CAT.IDE.A/H.220 and related AMC).	X	X	X	X	X			Deeper LO level
(25)		~~State~~ Explain the requirements regarding emergency medical kits and first-aid oxygen (CAT.IDE.A.225, CAT.IDE.A/H.230 and related AMC/GM).	X	X						Deeper LO level
~~LO (26)~~		~~Detail the rules regarding the carriage and use of supplemental oxygen for passengers and crew. CAT.IDE.A.235 + AMC CAT.IDE.A.240 + AMC~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Combined with 071 01 02 04 (33)
(27)		Detail the rules regarding crew protective breathing equipment (CAT.IDE.A.245 and related AMC).	X	X						
(28)		Describe the ~~minimum number,~~ type and location of handheld fire extinguishers (CAT.IDE.A.250 and related	X	X	X	X	X			Number not required to know

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		AMC).								
(29)		Describe the ~~minimum number and~~ location of crash axes and crowbars (CAT.IDE.A.255 and related AMC).	X	X						
(30)		Specify the colours and markings used to indicate break-in points (CAT.IDE.A.260).	X	X	X	X	X			
(31)		~~State~~ Explain the requirements for means of emergency evacuation (CAT.IDE.A.265).	X	X						Deeper LO level
(32)		~~State~~ Explain the requirements for megaphones (CAT.IDE.A.270 and related AMC).	X	X	X	X	X			Deeper LO level
(33)		~~State~~ Explain the requirements for emergency lighting (CAT.IDE.A.275).	X	X	X	X	X			Deeper LO level
(34)		~~State~~ Explain the requirements for an emergency locator transmitter (ELT) (CAT.IDE.A.280 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(35)		~~State~~ Explain the requirements for life jackets, life rafts, survival kits and ELTs (CAT.IDE.A.285 and related AMC, CAT.IDE.H.280;290;300).	X	X	X	X	X			Deeper LO level
(36)		~~State~~ Explain the requirements for crew survival suit (CAT.IDE.H.295).			X	X	X			Deeper LO level
(37)		~~State~~ Explain the requirements for survival equipment (CAT.IDE.A.305).	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(38)		~~State~~ Explain the additional requirements for helicopters operating to or from helidecks located in a hostile sea area (CAT.IDE.H.310).			X	X	X			Deeper LO level
(39)		~~State~~ Explain the requirements for an emergency flotation equipment (CAT.IDE.H.315;320).			X	X	X			Deeper LO level
071 01 02 07		***Communication and navigation equipment***								
(01)		Explain the general requirements for communication and navigation equipment (CAT.IDE.A.325 and related AMC/GM).	X	X	X	X	X			
(02)		~~State~~ Explain ~~that~~ why the radio-communication equipment must ~~provide communications~~ be able to send and receive on 121.5 MHz (CAT.IDE.A.330).	X	X	X	X	X			Deeper LO level
(03)		~~State~~ Explain the requirements regarding the provision of an audio selector panel (CAT.IDE.A.335).	X	X	X	X	X			Deeper LO level
(04)		List the requirements for radio equipment when flying under VFR by reference to visual landmarks (CAT.IDE.A.340).	X	X	X	X	X			
(05)		List the requirements for communications and navigation equipment when operating under IFR or under VFR over routes not navigated by reference to visual landmarks (CAT.IDE.A.345 and related AMC/GM).	X	X	X	X	X			
(06)		~~State~~ Explain what ~~the~~ equipment is required to operate within RVSM airspace (SPA.RVSM.110).	X	X						Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(07)		~~State~~ Explain the conditions under which a crew member interphone system and public address system are mandatory (CAT.IDE.A.170;175;180 and related AMC).	X	X	X	X	X			Moved from 071 01 02 06 and deeper LO level
(08)		List the equipment for operations requiring a radio communication (CAT.IDE.H.325 and related AMC).			X	X	X			Moved from 071 01 02 06
(09)		List the equipment for operations requiring a radio navigation system (CAT.IDE.H.325 and related AMC).			X	X	X			Moved from 071 01 02 06
(10) New		Explain the requirements regarding the provision of a transponder (CAT.IDE.A.350 and related AMC).	X	X	X	X	X			New requirement
(11) New		Explain the requirements regarding the provision of electronic data management products (CAT.IDE.A.355 and related AMC/GM).	X	X						New requirement
071 01 02 08		***Intentionally left blank***								New paragraph
071 01 02 09		***Flight crew***								
(01)		~~State~~ Explain the requirement regarding flight crew composition and in-flight relief (ORO.FC.100;105;110;200; 201;202 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(02)		~~State~~ Explain the requirement for conversion training and checking (ORO.FC.120;145;220 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(03)		~~State~~ Explain the requirement for differences training and familiarisation training (ORO.FC.125 and related AMC).	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(04)		~~State~~ Explain the conditions for upgrade from co-pilot to commander (ORO.FC.205).	X	X	X	X	X			Deeper LO level
(05)		~~State~~ Explain the minimum qualification requirements to operate as a commander (ORO.FC.250).	X	X	X	X	X			Deeper LO level
(06)		~~State~~ Explain the requirement for recurrent training and checking (ORO.FC.230 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(07)		~~State~~ Explain the requirement for a pilot to operate on either pilot's seat (ORO.FC.235 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(08)		~~State~~ Explain which is the minimum recent experience for the commander and the co-pilot (Regulation (EU) No 1178/2011 on aircrew requirements: FCL.060 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(09)		Specify the route and aerodrome/heliport qualification required for a commander or a pilot flying (ORO.FC.105).	X	X	X	X	X			
(10)		~~State~~ Explain the requirement to operate on more than one type or variant (ORO.FC.140;240 and related AMC).	X	X	X	X	X			Deeper LO level
(11)		~~State~~ Explain that when a flight crew member operates both helicopters and aeroplanes, the operations are limited to one type of each (ORO.FC.140;240 and related AMC).	X	X						Deeper LO level
(12)		~~State~~ Explain the training records requirement (ORO.MLR.115 and related AMC).	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(13)		~~State~~ Explain the crew members' responsibilities in the execution of their duties, and define the commander's authority (CAT.GEN.MPA.165).	X	X	X	X	X			Moved from old 071 01 02 02 and amended
(14)		~~State~~ Explain the operator's and commander's responsibilities ~~are~~ regarding admission to the flight deck and carriage of unauthorised persons or cargo (CAT.GEN.MPA.100;105;110;135).	X	X	X	X	X			Moved from old 071 01 02 02 and amended
(15) New		Explain the requirements for initial operator's crew resource management (CRM) training (ORO.FC.215).	X	X	X	X	X			New requirement
071 01 02 10		***Cabin crew/crew members other than flight crew***								
(01)		~~State~~ Explain who is regarded as ~~a~~ cabin crew member (ORO.CC.005, CAT.GEN.MPA.115).	X	X	X	X	X			Deeper LO level
(02)		~~Detail the requirements regarding the numbers required IAW Ops Regulations cabin crew members.~~ Detail the requirements regarding the number and composition of cabin crew (ORO.CC.100;205 and related AMC).	X	X	X	X	X			Update of references
(03)		~~State the acceptability criteria. Minimum age for Cabin Crew State.~~ Explain the conditions and the additional conditions for assignment to duties (ORO.CC.110;210).	X	X	X	X	X			Deeper LO level
(04)		~~State~~ Explain the requirements regarding senior cabin crew members (ORO.CC.200 and related AMC).	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(05)		~~State~~ Explain the conditions ~~to~~ for operate~~ing~~ on more than one type or variant (ORO.CC.250 and related AMC/GM).	X	X	X	X	X			Deeper LO level
		~~State~~ Explain what is the operator's responsibility regarding the distinction between cabin crew members and additional crew members (CAT.GEN.MPA.115).	X	X						Moved from old 071 01 02 02
~~***071 01 02 11***~~		~~***Manuals, logs and records***~~								Moved to 071 02 01 01
~~LO (01)~~		~~State the general rules for the operations manual.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (02)~~		~~State the structure and subject headings of the operations manual.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (03)~~		~~State the requirements for a journey logbook.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (04)~~		~~Describe the requirements regarding the operational flight plan.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (05)~~		~~State the requirements for document storage document storage periods.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
071 01 02 12		***Flight and duty time limitations and rest requirements***								
(01)		~~State~~ Explain the definitions used for the regulation of flight time limitations ~~regulation~~ (ORO.FTL.100;105).	X	X						Deeper LO level
(02)		~~State~~ Explain the flight and duty time limitations (ORO.FTL.210).	X	X						Deeper LO level
(03)		~~State~~ Explain the requirements regarding the maximum	X	X						Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		daily flight duty period (ORO.FTL).								
(04)		~~State~~ Explain the requirements regarding rest periods (ORO.FTL).	X	X						Deeper LO level
(05)		~~State~~ Explain the possible extension of flight duty period due to in-flight rest (ORO.FTL).	X	X						Deeper LO level
(06)		~~State~~ Explain that it is the captain's discretion in case of unforeseen circumstances in actual flight operations (ORO.FTL).	X	X						Deeper LO level
(07)		~~State~~ Explain the regulation regarding standby (ORO.FTL).	X	X						Deeper LO level
(08)		~~State~~ Explain the requirements regarding flight duty, duty and rest period records (ORO.FTL).	X	X						Deeper LO level
		~~***Transport of dangerous goods by air***~~								***Moved to 071 02 12 00***
~~(01)~~		~~State the terminology relevant to dangerous goods.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(02)~~		~~State the scope of the regulation.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(03)~~		~~State the limitations on the transport of dangerous goods.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(04)~~		~~State the requirements for the acceptance of dangerous goods.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(05)~~		~~State the requirements regarding inspection for damage, leakage or contamination.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(06)~~		~~State the loading restrictions.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~(07)~~		~~State the requirement for provision of information to the crew.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~(08)~~		~~State the requirements for dangerous goods incident and accident reports.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
071 01 03 00		**Long-range flights**								
071 01 03 01		***Flight management***								
~~LO (01)~~		~~Navigation planning procedures:~~ ~~— Describe the operator's responsibilities concerning ETOPS routes;~~ ~~— List the factors to be considered by the commander before commencing the flight.~~	~~X~~							Moved to 071 01 03 04 (05) and 071 01 03 03 (46)
~~LO (02)~~		~~Selection of a route:~~ ~~— Describe the meaning of the term 'adequate aerodrome';~~ ~~— Describe the limitations on extended range operations with two-engine aeroplanes with and without ETOPS approval.~~	~~X~~							Covered in 071 01 02 04 ETOPS moved to 071 01 03 04 (06)
~~LO (03)~~		~~Selection of cruising altitude (MNPSA Manual Chapter 4):~~ ~~— Specify the appropriate cruising levels for normal long-range IFR flights and for those operating on the North Atlantic Operational Track Structure.~~	~~X~~							Moved to new 071 01 03 03

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (04)~~		~~Selection of alternate aerodrome:~~ ~~– State the circumstances in which a take-off alternate must be selected;~~ ~~– State the maximum flight distance of a take-off alternate for: two-engine aeroplane, ETOPS-approved aeroplane, three or four-engine aeroplane;~~ ~~– State the factors to be considered in the selection of a take-off alternate;~~ ~~– State when a destination alternate need not be selected;~~ ~~– State when two destination alternates must be selected;~~ ~~– State the factors to be considered in the selection of a destination alternate aerodrome;~~ ~~– State the factors to be considered in the selection of an en route alternate aerodrome.~~	~~X~~							Split up in separate LOs below
(05)		Minimum time routes: Define, ~~construct~~ and interpret minimum time route (route giving the shortest flight time from departure to destination adhering to all ATC and airspace restrictions).	X							Too detailed LO level
(06)		State the circumstances in which a take-off alternate must be selected.	X							Split from old 071 01 03 01 (04) above
(07)		State the maximum flight distance of a take-off alternate for:	X							Split from old

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		two-engine aeroplane, ETOPS-approved aeroplane, three- or four-engine aeroplane.								071 01 03 01 (04) above
(08)		State the factors to be considered in the selection of a take-off alternate.	X							Split from old 071 01 03 01 (04) above
(09)		State when a destination alternate need not be selected.	X							Split from old 071 01 03 01 (04) above
(10)		State when two destination alternates must be selected.	X							Split from old 071 01 03 01 (04) above
(11)		State the factors to be considered in the selection of a destination alternate aerodrome.	X							Split from old 071 01 03 01 (04) above
(12)		State the factors to be considered in the selection of an en-route alternate aerodrome.	X							Split from old 071 01 03 01 (04) above
071 01 03 02		***Transoceanic and polar flight***								
(01)		(ICAO Doc 7030 Regional Supplementary P~~p~~rocedures) According to ICAO Doc 7030, explain that special rules apply to the North Atlantic (NAT) Region, and crews need to be specifically trained before flying in this area. ~~— Describe the possible indications of navigation system degradation.~~ ~~— Describe by what emergency means course and INS can be cross-checked in the case of: three navigation~~	X							Deeper LO level This larger LO is split into several specific LOs below

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~systems, two navigation systems.~~ ~~— Interpret VOR, NDB, VOR/DME information to calculate aircraft position and aircraft course.~~ ~~— Describe the general ICAO procedures applicable in North Atlantic airspace (NAT) if the aircraft is unable to continue the flight in accordance with its air traffic control clearance.~~ ~~— Describe the ICAO procedures applicable in North Atlantic Airspace (NAT) in case of radio-communication failure.~~ ~~— Describe the recommended initial action if an aircraft is unable to obtain a revised air traffic control clearance.~~ ~~— Describe the subsequent action for: aircraft able to maintain assigned flight level, and aircraft unable to maintain assigned flight level.~~ ~~— Describe determination of tracks and courses for random routes in NAT.~~ ~~— Specify the method by which planned tracks are defined (by latitude and longitude) in the NAT region: when operating predominately in an east–west direction south of 70°N, when operating predominately in an east–west direction north of~~								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~70°N.~~ ~~– State the maximum flight time recommended between significant points.~~ ~~– Specify the method by which planned tracks are defined for flights operating predominantly in a north–south direction.~~ ~~– Describe how the desired route must be specified in the air traffic control flight plan.~~								
(02)		Describe the possible indications of navigation system degradation.	X							Split from (01)
(02)		Describe by what emergency means course and inertial navigation system (INS) can be cross-checked in the case of three navigation systems and two navigation systems.	X							Split from (01)
~~(03)~~		~~Interpret VOR, NDB, VOR/DME information to calculate aircraft position and aircraft course.~~	~~X~~							Covered in 062 02 03 02, 062 02 02 02 and 062 02 04 02
(04)		Describe the general ICAO procedures applicable in NAT airspace if the aircraft is unable to continue the flight in accordance with its air traffic control (ATC) clearance.	X							Split from (01)
(05)		Describe the ICAO procedures applicable in NAT airspace in case of radio communication failure.	X							Split from (01)
(06)		Describe the recommended initial action if an aircraft is	X							Split from (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		unable to obtain a revised ATC clearance.								
(07)		Describe the subsequent action for aircraft able to maintain assigned flight level and aircraft unable to maintain assigned flight level.	X							Split from (01)
(08)		Describe determination of tracks and courses for random routes in NAT airspace.	X							Split from (01)
(09)		Specify the method by which planned tracks are defined (by latitude and longitude) in the NAT airspace: when operating predominately in an east–west direction south of 70°N, and when operating predominately in an east–west direction north of 70°N.	X							Split from (01)
(10)		State the maximum flight time recommended between significant points on random routes.	X							Clarification: It is meant for random routes only Split from (01)
(11)		Specify the method by which planned tracks for random routes are defined for flights operating predominantly in a north–south direction.	X							Split from (01)
(12)		Describe how the desired random route must be specified in the ATC flight plan.	X							Split from (01)
(13)		~~**Polar navigation**~~	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~*Terrestrial magnetism characteristics in polar zones*~~ ~~— State why magnetic compasses become unreliable or useless in polar zones.~~ ~~— State in which area VORs are referenced to the true north.~~ *Specific problems of polar navigation* — Describe the general problems of polar navigation. ~~— Describe what precautions can be taken when operating in the area of compass unreliability as a contingency against INS failure.~~ ~~— Describe how grid navigation can be used in conjunction with a Directional Gyro (DG) in polar areas.~~ ~~— Use polar stereographic chart and grid coordinates to solve polar navigation problems.~~ ~~— Use polar stereographic chart and grid coordinates to calculate navigation data.~~ ~~— Use INS information to solve polar navigation problems.~~ ~~— Define, calculate: transport precession, Earth rate~~								Covered in 061 01 04 02 and moved to 022 03 02 00 and 022 03 03 00 Covered in 061 04 02 02 Grid navigation is outdated Covered in 061 06 01 00

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~(astronomic) precession, convergence factor.~~								
		— ~~Describe the effect of using a free gyro to follow a given course.~~								No practical use
		— ~~Describe the effect of using a gyro compass with hourly rate corrector unit to follow a given course.~~								No practical use
		— ~~Convert grid navigation data into true navigation data, into magnetic navigation data, and into compass navigation data.~~								Outdated
		— ~~Justify the selection of a different 'north' reference at a given position.~~								Covered in 061 01 03 00
		— ~~Calculate the effects of gyro drift due to the Earth's rotation (15 degrees / h × sin Lm).~~								Covered in 022 04 01 00
(14)		Describe what precautions can be taken when operating in the area of compass unreliability as a contingency against INS failure.	X							Split from (02)
071 01 03 03		***~~MNPS airspace~~ North Atlantic High Level Airspace (NAT HLA)***								Title updated
		NAT Region North Atlantic Operations and Airspace Manual (NAT Doc 007 and NAT Doc 7030)								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Geographical limits: ~~— state the lateral dimensions (in general terms) and vertical limits of MNPS airspace (ICAO Doc 7030 NAT/RAC-2 3.2.1);~~ ~~— state that operators must ensure that crew follow NAT MNPSA Operations Manual procedures (ICAO Doc 7030 NAT/RAC-2 3.2.3).~~ State the lateral dimensions (in general terms) and vertical limits of the NAT HLA.	X							Reworded for clarity and adjusted to the actual terminology
(02)		Define the following acronyms: MNPS, ~~MNPSA,~~ OCA, OTS, PRM~~, PTS~~, RVSM, LRNS, MASPS, SLOP, WATRS (~~MNPSA Manual~~ NAT Doc 007, Glossary of T~~t~~erms).	X							Updated to NAT Doc 007
(03)		~~Aircraft System Requirements (MNPSA Manual Chap 1):~~ ~~— navigation requirements for unrestricted MNPS airspace operations;~~ ~~— routes for use by aircraft not equipped with two LRNSs: routes for aircraft with only one LRNS, routes for aircraft with short-range navigation equipment only;~~ ~~— performance monitoring.~~ State the navigation requirements for unrestricted minimum navigation performance specifications (MNPS) airspace operations.	X							For clarity split up into separate LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(04)		Describe the routes for aircraft with only one long-range navigation system (LRNS).	X							Split from (03)
(05)		Describe the routes for aircraft with short-range navigation equipment only.	X							Split from (03)
(06)		State that horizontal (i.e. latitudinal and longitudinal) and vertical navigation performance of operators within NAT MNPS airspace is monitored on a continual basis.	X							Split from (03)
(07)		~~Organised Track System (MNPSA Manual Chap 2):~~ ~~Construction of the organised track system (OTS);~~ ~~— NAT track message;~~ ~~— OTS changeover periods.~~ Describe the organised track system (OTS).	X							Reworded for clarity
(08)		State the OTS changeover periods.	X							Split from (07)
(09)		Describe the NAT track message.	X							Split from (07)
(10)		~~Other routes and route structures within or adjacent to NAT MNPS airspace (MNPSA Manual Chap 3):~~ ~~— other routes within NAT MNPS airspace;~~ ~~— route structures adjacent to NAT MNPS airspace: North American routes (NARs), Canadian domestic track systems, Routes between north America and the Caribbean area.~~	X							Rephrased and more practical oriented to the job of pilot Split into two LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		Illustrate routes between northern Europe and the Spain/Canaries/Lisbon flight information region (FIR) (T9, T13 and T16) within NAT MNPS airspace.								
(11)		Describe the function of the North American Routes (NARs) and Shannon Oceanic Transition Area (SOTA) and Northern Oceanic Transition Area (NOTA).	X							Split from (10)
(12)		Flight planning (NAT Doc 007, Chapter 4) State that a~~A~~ll flights should plan to operate on great circle tracks joining successive significant waypoints. ~~— during the hours of validity of the OTS, operators are encouraged to flight plan in accordance with the OTS or along a route to join or leave an outer track of the OTS or on a random route to remain clear of the OTS~~ ~~— flight levels available on OTS tracks during OTS periods~~ ~~— flight levels on random tracks or outside OTS periods (appropriate direction Levels).~~	X							LO level added and split into four LOs
(13)		State that during the hours of validity of the OTS, operators are encouraged to plan flights in accordance with the OTS or along a route to join or leave an outer track of the OTS or on a random route to remain clear of the OTS.	X							Split from (12)
(14)		State which flight levels are available on OTS tracks during OTS periods.	X							Split from (12)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(15)		State which flight levels are to be planned on random tracks or outside OTS periods.	X							Split from (12)
(16)		Selection of cruising altitude ~~(MNPSA Manual Chapter 4)~~: Specify the appropriate cruising levels for normal long-range IFR flights and for those operating on the North Atlantic OTS.	X							Moved from old 071 01 03 01 (03) and updated
(17)		**Oceanic ATC c~~C~~learances ~~(MNPSA Manual Chap 5):~~** State that it is recommended that pilots should request their o~~O~~ceanic c~~C~~learance at least 40 minutes prior to the o~~O~~ceanic entry point estimated time of arrival (ETA). ~~– the pilot should notify the Oceanic Area control Centre (OAC) of the maximum acceptable flight level possible at the boundary.~~ ~~– at some airports, which are situated close to oceanic boundaries, the Oceanic Clearance must be obtained before departure.~~ ~~– if an aircraft, which would normally be RVSM and/or MNPS approved, encounters, whilst en route to the NAT Oceanic Airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the MEL requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting Oceanic Clearance.~~	X							LO levels added and split up in separate LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~– after obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by 3 minutes or more, should pass a revised estimate to ATC.~~ ~~– pilots should pay particular attention when the issued clearance differs from the flight plan as a significant proportion of navigation errors investigated in the NAT involve an aircraft which has followed its flight plan rather than its differing clearance.~~ ~~– if the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic re-clearance.~~ ~~– there are three elements to an Oceanic Clearance: route, Mach number and flight level. These elements serve to provide for the three basic elements of separation: lateral, longitudinal and vertical.~~								
(18)		State that the pilot should notify the oceanic area control centre (OAC) of the maximum acceptable flight level possible at the boundary.	X							Split up from (07)
(19)		State that at some airports, which are situated close to oceanic boundaries, the oceanic clearance must be obtained	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		before departure.								
(20)		State that if an aircraft, which would normally be RVSM- and/or MNPS-approved, encounters, whilst en route to the NAT oceanic airspace, a critical in-flight equipment failure, or at dispatch is unable to meet the minimum equipment list (MEL) requirements for RVSM or MNPS approval on the flight, then the pilot must advise ATC at initial contact when requesting oceanic clearance.	X							
(21)		State that after obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry, and if this changes by 3 minutes or more, should pass a revised estimate on to ATC.	X							
(22)		State that pilots should pay particular attention when the issued clearance differs from the flight plan as a significant proportion of navigation errors investigated in the NAT Region involve aircraft which have followed their flight plan rather than the differing clearance.	X							
(23)		State that if the entry point of the oceanic route on which the flight is cleared differs from that originally requested and/or the oceanic flight level differs from the current flight level, the pilot is responsible for requesting and obtaining the necessary domestic re-clearance.	X							
(24)		State that there are three elements to an oceanic clearance:	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		route, Mach number, and flight level, and that these elements serve to provide for the three basic elements of separation: lateral, longitudinal, and vertical.								
(25)		***Communications and position reporting procedures ~~(MNPSA Manual Chap 6)~~*** State that p~~P~~ilots communicate with OACs via aeradio stations staffed by communicators who have no executive ATC authority. ~~Messages are relayed, from the ground station to the air traffic controllers in the relevant OAC for action.~~ ~~– Frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during day-time.~~ ~~– When initiating contact with an aeradio station the pilot should state the HF frequency in use.~~ ~~*SATCOM voice communications*~~ ~~Since oceanic traffic typically communicate with ATC through aeradio facilities, a SATCOM call made due to unforeseen inability to communicate by other means should be made to such a facility rather than the ATC Centre, unless the urgency of the communication dictates otherwise.~~ ~~An air-to-air VHF frequency has been established for world-wide use when aircraft are out of range of VHF ground~~	X							LO levels added and rephrased for clarity and updated Split up in separate LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~stations which utilise the same or adjacent frequencies. This frequency, 123.45 MHz, is intended for pilot-to-pilot exchanges of operationally significant information.~~ ~~Standard position report message type.~~ ~~Some aircraft flying in the NAT are required to report MET observations of wind speed and direction plus outside air temperature. Any turbulence encountered should be included in these reports.~~ ~~General guidance for aircraft operating in, or proposing to operate in, the NAT Region, which experience a communications failure: General Provisions, On-board HF Equipment Failure, Poor HF Propagation Conditions, Loss of HF Communications Prior to Entry into the NAT, Loss of HF Communications after Entering the NAT.~~ ~~All turbine-engine aeroplanes having a maximum certificated take-off mass exceeding 5,700 kg or authorized to carry more than 19 passengers are required to carry and operate ACAS II in the NAT Region.~~								
(26)		State that messages are relayed from the ground station to the air traffic controllers of the relevant OAC for action.	X							Split up from (25)
(27)		State that frequencies from the lower HF bands tend to be used for communications during night-time and those from the higher bands during daytime. Generally, in NAT	X							Split up from (25)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		frequencies of less than 7 MHz are utilised at night and frequencies greater than 8 MHz during the day. When initiating contact with an aeradio station, the pilot should state the HF frequency in use.								
(28)		State that since oceanic traffic typically communicates with ATC through aeradio facilities, a satellite communication (SATCOM) call, made due to unforeseen inability to communicate by other means, should be made to such a facility rather than the ATC centre, unless the urgency of the communication dictates otherwise.	X							Split up from (25)
		State that an air-to-air VHF frequency has been established for worldwide use when aircraft are out of range of VHF ground stations which utilise the same or adjacent frequencies. This frequency, 123.45 MHz, is intended for pilot-to-pilot exchanges of operationally significant information.	X							Split up from (25)
(29) New		State that any pilot, who provides position reports via data link, encounters significant meteorological phenomena (such as moderate/severe turbulence or icing, volcanic ash or thunderstorms) should report this information.	X							
(30)		State that all turbine-engine aeroplanes having a maximum certified take-off mass exceeding 5 700 kg or authorised to carry more than 19 passengers are required to carry and	X							Split up from (25)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		operate airborne collision avoidance system (ACAS) II in the NAT Region.								
(31) New		State that the majority of NAT air–ground voice communications is conducted on single sideband (SSB) HF frequencies. To support air–ground ATC communications in the NAT Region, 24 HF frequencies have been allocated in bands ranging from 2.8 to 18 MHz.	X							
(32)		**Application of Mach number technique (NAT HLA): ~~MNPSA Manual Chap 7~~):** State that p~~P~~ractical experience has shown that when two or more turbojet aircraft, operating along the same route at the same flight level, maintain the same Mach number, they are more likely to maintain a constant time interval between each other than when using other methods~~;~~. ~~– pilots must ensure that any required corrections to indicated Mach are taken into account when complying with the true Mach number specified in the ATC clearance;~~ ~~– after leaving oceanic airspace pilots must maintain their assigned Mach number in domestic controlled airspace unless and until the appropriate ATC unit authorises a change.~~	X							LO levels added Split up in separate LOs Outdated

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(33)		State that after leaving oceanic airspace, pilots must maintain their assigned Mach number in domestic controlled airspace unless and until the appropriate ATC unit authorises a change.	X							Split up from (32)
		~~***MNPS***~~***North Atlantic High Level Airspace (NAT HLA) flight operation and navigation procedures ~~(MNPSA Manual Chap 8)~~***								
(34)		~~**MNPS**~~ **NAT HLA flight operation and~~&~~ navigation procedures ~~(MNPSA Manual Chap 8):~~** State that t~~T~~he pre-flight procedures for any NAT MNPS flight must include a Universal Time Coordinated (UTC) time check~~. and resynchronisation of the aircraft master clock;~~ ~~– State the use of the Master Document;~~ ~~– State the requirements for position plotting;~~ ~~– PRE-FLIGHT PROCEDURES: alignment of IRS, Satellite Navigation Availability Prediction Programme for flights using GNSS LRNS, loading of initial waypoints, flight plan check;~~ ~~– IN FLIGHT PROCEDURES: ATC Oceanic Clearance, entering the MNPS airspace and reaching an oceanic waypoint, routine monitoring;~~ ~~– strategic Lateral Offset Procedure (SLOP) state that along a route or track there will be three positions that~~	X							Deeper LO level Split up in separate LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~an aircraft may fly: centreline or one or two miles right.~~								
(35)		Describe the function of the master document.	X							Split up from (34)
(36)		State the requirements for position plotting.	X							Split up from (34)
(37)		Describe the pre-flight procedures for the alignment of IRS, for the satellite navigation availability prediction programme for flights using global navigation satellite long-range navigation system (GNSS LRNS), for loading of initial waypoints, and for flight plan check.	X							Split up from (34)
(38)		Describe the strategic lateral offset procedure (SLOP) and state that along a route or track there will be three positions that an aircraft may fly: centre line, or 1 or 2 miles right.	X							Split up from (34)
(39) New		State that RNAV 10 retains the RNP 10 designation, as specified in the Performance-based Navigation Manual (ICAO Doc 9613), 1.2.3.5. (ICAO Doc 7030, NAT Chapter 4).	X							
(40) New		State that aircraft and operator must be approved RNP 10 or RNP 4 by the State of the operator or the State of registry, as appropriate. RNP 10 is the minimum navigation specification for the application of 93 km (50 NM) lateral separation (ICAO Doc 7030, NAT Chapter 4).	X							
(41) New		State that RNP 10 is the minimum navigation specification for the application of 93 km (50 NM) lateral	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		separation (ICAO Doc 7030, NAT Chapter 4).								
(42)		**Reduced vertical separation minima (RVSM) flight in ~~MNPS~~NAT HLA airspace ~~(MNPSA Manual Chap 9):~~** State the altimeter cross-check to be performed before entry to NAT HLA ~~MNPS~~ airspace ~~entry~~. ~~– State the altimeter cross-check to be performed into the MNPS airspace;~~ ~~– in NAT MNPS Airspace pilots always have to report to ATC immediately on reaching any new cruising level;~~ ~~– crews should report when a 300 ft or more deviation occurs.~~	X							Split up in separate LOs
(43)		State the altimeter cross-check to be performed into the MNPS airspace.	X							Split from (42)
(44)		State that in NAT MNPS airspace pilots always have to report to ATC immediately when reaching any new cruising level.	X							Split from (42)
(45)		State that crews should report when a 300 ft deviation or more occurs.	X							Split from (42)
(46)		Navigation planning procedures List the factors to be considered by the commander before commencing the flight (SPA.RVSM.100).	X							Moved from 071 01 03 01 (01)
(47)		**Navigation system degradation or failure ~~*(MNPSA Manual*~~**								Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~*Chap 10)*~~ **(NAT Doc 007, Chapter 12)**								
		For this part consider aircraft equipped with only two operational LRNSs~~;~~ and state the requirements for the following situations: — one system fails before take-off; — one system fails before the OCA boundary is reached; — one system fails after the OCA boundary is crossed; and — the remaining system fails after entering MNPS airspace.	X							Deeper LO level
(48)		**Special procedures for in-flight contingencies** ~~(MNPSA Manual Chap 11~~ **(NAT Doc 007, Chapter 13)** *General* ~~— Until a revised clearance is obtained the specified NAT in-flight contingency procedures should be carefully followed;~~ State that t~~T~~he general concept of these NAT in-flight contingency procedures is, whenever operationally feasible, to offset from the assigned route by 15 NM and climb or descend to a level which differs from those normally used by 500 ft if below FL410 or by 1 000 ft if above FL410. ~~— State the factors which may affect the direction of turn: direction to an alternate airport, terrain clearance, levels~~	X							Reworded for clarification and LO levels added Split up in separate LOs

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~allocated on adjacent routes or tracks and any known SLOP off sets adopted by other nearby traffic.~~ ~~*Deviations around severe weather*~~ ~~— State that if the deviation is to be greater than 10NM the assigned flight level must be changed by +/- 300 ft depending on the followed track and the direction of the deviation (table 1).~~								
(49)		State the factors which may affect the direction of turn: — direction to an alternate airport; — terrain clearance; — levels allocated on adjacent routes or tracks and any known SLOP offsets adopted by other nearby traffic.	X							Split up from (48)
(50)		State that if the deviation is to be greater than 10 NM, the assigned flight level must be changed by ± 300 ft depending on the followed track and the direction of the deviation (Table 1).	X							Split up from (48)
071 01 03 04		***ETOPS***								
(01)		State that ETOPS approval is part of an AOC.	X							
(02)		State that prior to conducting an ETOPS flight, an operator shall ensure that a suitable ETOPS en-route alternate is available, within either the approved diversion time or a diversion time based on the MEL-generated serviceability	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		status of the aeroplane, whichever is shorter.								
(03)		State the requirements for take-off alternate.	X							
(04)		State the planning minima for ETOPS en-route alternate.	X							
(05)		Navigation-planning procedures: – Describe the operator's responsibilities concerning ETOPS routes.	X							Moved from 071 01 03 01 (01) and amended
(06)		Selection of a route: – Describe the limitations on extended-range operations with two-engine aeroplanes with and without ETOPS approval.	X							Moved from 071 01 03 01 (02) and amended
(07)		Selection of alternate aerodrome: – State the maximum flight distance of a take-off alternate for: two-engine aeroplane, ETOPS-approved aeroplane, three or four-engine aeroplane;	X							Moved from 071 01 03 01 (03)
(08)		State the maximum distance from an adequate aerodrome for two-engine aeroplanes without an ETOPS approval.	X							Moved from 071 01 02 04 (12)
(09)		State the requirement for alternate-airport accessibility check for ETOPS operations.	X							Moved from 071 01 02 04 (13)
071 02 00 00		**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS — ~~(~~GENERAL ASPECTS~~)~~**								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
071 02 01 00		**Operations ~~M~~manual (ORO.MLR.100, ORO.MLR.101 and related AMC/GM)**								
071 02 01 01		***Operating procedures***								
(01)		~~State~~ Explain the general rules for the operations manual.	X	X	X	X	X			Moved from 071 01 02 11
(02)		~~State~~ Explain the structure and subject headings of the operations manual (ORO.MLR.101).	X	X	X	X	X			Moved from 071 01 02 11
(03)		~~State~~ Explain the requirements for a journey ~~logbook~~ log or equivalent.	X	X	X	X	X			Moved from 071 01 02 11
(04)		Describe the requirements regarding the operational flight plan.	X	X	X	X	X			Moved from 071 01 02 11
(05)		~~State~~ Explain the requirements for document storage periods.	X	X	X	X	X			Moved from 071 01 02 11 and more precise
(06)		~~State~~ Explain that all non-type-related operational policies, instructions and procedures needed for a safe operation are included in Part A of the o~~O~~perations m~~M~~anual (ORO.MLR.100 and related AMC/GM).	X	X	X	X	X			
(07)		State that the following items are included into Part A: de-icing and anti-icing on the ground, adverse and potentially hazardous atmospheric conditions, wake turbulence, incapacitation of crew members, use of the minimum equipment and configuration deviation list(s), security,	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		handling of accidents and occurrences (ORO.MLR.100 and related AMC/GM).								
(08)		State that the following items are included into Part A: altitude alerting system procedures, ground proximity warning system procedures, policy and procedures for the use of traffic alert and collision avoidance system (TCAS)/airborne collision avoidance system (ACAS) (ORO.MLR.100 and related AMC/GM).	X	X						Deeper LO level
(09)		State that the rotor downwash ~~following items are~~ is included into Part A~~: rotor downwash~~ (ORO.MLR.100 and related AMC/GM).			X	X	X			
~~LO (10)~~		~~Define the following terms: 'commencement of flight', 'inoperative', 'MEL', 'MMEL', rectification interval.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Moved to new paragraph 071 02 01 03 below
~~LO (11)~~		~~Define the 'limits of MEL applicability'.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (12)~~		~~Identify the responsibilities of the operator and the authority with regard to MEL and MMEL.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (13)~~		~~State the responsibilities of the crew members with regard to MEL.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (14)~~		State the responsibilities of the commander with regard to MEL.	X	X	X	X	X			
071 02 01 02		***Aeroplane/helicopter operating matters — type-related***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		State that all type-related instructions and procedures needed for a safe operation are included in Part B of the o~~O~~perations m~~M~~anual. They will take account of any differences between types, variants or individual aircraft used by the operator (ORO.MLR.100 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(02)		State that the following items are included into Part B: abnormal and emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures (ORO.MLR.100 and related AMC/GM).	X	X						Deeper LO level
(03)		State that the following items are included into Part B: emergency procedures, configuration deviation list, minimum equipment list, emergency evacuation procedures.			X	X	X			Deeper LO level
071 02 01 03		***Minimum equipment list (MEL) and master minimum equipment list (MMEL)***								New paragraph created with related LOs from 071 02 01 01 above
(01)		Define the following terms: 'commencement of flight', 'inoperative', 'MEL', 'MMEL', 'rectification interval' (ORO.MLR.100, ORO.MLR.105 and related AMC/GM).	X	X	X	X	X			Moved from 071 02 01 01
(02)		~~State~~ Explain the relation between MMEL and MEL (ORO.MLR.100 , ORO.MLR.105 and related AMC/GM).								Moved from 071 01 02 02 (07)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
										Deeper LO level
(03)		Define the 'limits of MEL applicability' (ORO.MLR.100, ORO.MLR.105 and related AMC/GM).	X	X	X	X	X			Moved from 071 02 01 01
(04)		Identify the responsibilities of the operator and the authority with regard to MEL and MMEL (ORO.MLR.100, ORO.MLR.105 and related AMC/GM).	X	X	X	X	X			
(05)		~~State~~ Explain the responsibilities of the crew members with regard to MEL (ORO.MLR.100, ORO.MLR.105 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(06)		~~State~~ Explain the responsibilities of the commander with regard to MEL (CAT.OP.MPA.175).	X	X	X	X	X			Deeper LO level
071 02 02 00		**Icing conditions**								
071 02 02 01		***On-ground de-icing/anti-icing procedures, types of de-icing/anti-icing fluids***								
(01)		Define the following terms: 'anti-icing', 'de-icing', 'one-step de-icing/anti-icing', 'two-step de-icing/anti-icing', 'holdover time' (ICAO Doc 9640 Glossary).	X	X						
~~LO (02)~~		~~Define the following weather conditions: 'drizzle', 'fog', 'freezing fog', 'freezing drizzle', 'freezing rain', 'frost', 'rain', 'rime', 'slush', 'snow', 'dry snow', 'wet snow'. (ICAO Doc 9640 Glossary)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered by 050 05 02 01

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(03)		Describe 't~~T~~he clean aircraft concept' as presented in the relevant chapter of ICAO Doc 9640~~.~~ (ICAO Doc 9640, Chapter 2).	X	X						
(04)		List the types of de-icing/anti-icing fluids available~~.~~ (ICAO Doc 9640, Chapter 4).	X	X	X	X	X			
(05)		~~State~~ Explain the procedure to be followed when an aeroplane has exceeded the holdover time~~.~~ (ICAO Doc 9640, Chapter 4).	X	X						Deeper LO level
(06)		Interpret the fluid holdover time tables and list the factors which can reduce the fluid protection time~~.~~ (ICAO Doc 9640, Chapter 5 ~~+~~and a~~A~~ttachment tables).	X	X						
(07)		~~State that~~ Explain how the pre-take-off check, which is the responsibility of the pilot-in-command, ensures that the critical surfaces of the aircraft ~~aeroplane~~ are free of ice, snow, slush or frost just prior to take-off. This check shall be accomplished as close to the time of take-off as possible and is normally made from within the aeroplane by visually checking the wings~~.~~ (ICAO Doc 9640, Chapter 6).	X	X						Deeper LO level
(08)		~~State that~~ Explain why an aircraft has to be treated symmetrically~~.~~ (ICAO Doc 9640, Chapter 11).	X	X						Increased skill level
(09)		~~State that~~ Explain why an operator shall establish procedures to be followed when ground de-icing and anti-	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		icing and related inspections of the ~~aeroplane(s)~~ aircraft are necessary.								
(10)		~~State that~~ Explain why a commander shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect the performance and/or controllability of the aircraft except as permitted in the f~~F~~light m~~M~~anual.	X	X	X	X	X			Deeper LO level
(11)		~~State~~ Explain the requirements for operations in icing conditions.	X	X	X	X	X			Moved from 071 01 02 06 (15)
(12) New		Explain why safety must come before commercial pressures.	X	X	X	X	X			Extra example of the application of TEM
071 02 02 02		***Procedure to apply in case of performance deterioration, on ground/in flight***								
(01)		~~State that~~ Explain how the effects of icing are wide-ranging, unpredictable and dependent upon individual aeroplane design. The magnitude of these effects is dependent upon many variables, but the effects can be both significant and dangerous~~.~~ (ICAO Doc 9640, Chapter 1).	X	X	X	X	X			Deeper LO level
(02)		~~State that~~ Explain how in icing conditions, for a given speed and a given angle of attack, wing lift can be reduced by as much as 30 % and drag increased by up to 40 %. State that these changes in lift and drag will significantly increase stall	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		speed, reduce controllability and alter flight characteristics~~.~~ (ICAO Doc 9640, Chapter 1).								
(03)		~~State that~~ Explain how ice on critical surfaces and on the airframe may also break away during take-off and be ingested into engines, possibly damaging fan and compressor blades~~.~~ (ICAO Doc 9640, Chapter 1).	X	X	X	X	X			Deeper LO level
(04)		~~State that~~ Explain how ice forming on pitot tubes and static ports or on angle-of-attack vanes may give false altitude, airspeed, angle-of-attack and engine-power information for air-data systems~~.~~ (ICAO Doc 9640, Chapter 1).	X	X	X	X	X			Deeper LO level
(05)		~~State that~~ Explain how ice, frost and snow formed on the critical surfaces on the ground can have a totally different effect on aircraft flight characteristics than ice formed in flight~~.~~ (ICAO Doc 9640, Chapter 1).	X	X	X	X	X			Deeper LO level
(06)		~~State that~~ Explain how flight in known icing conditions is subject to limitations found in Part B of the o~~O~~perations m~~M~~anual.	X	X	X	X	X			Deeper LO level
(07)		~~State~~ Explain where procedures and performances regarding flight in expected or actual icing conditions can be found~~are located~~.	X	X	X	X	X			Deeper LO level
071 02 03 00		***Bird-strike risk and avoidance***								
(01)		~~State that~~ Explain how presence of birds constituting a	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		potential hazard to aircraft operations is part of the pre-flight information (ICAO Annex 15, Chapter 8).								
(02)		~~State that~~ Explain how information concerning the presence of birds observed by aircrews is made available to the a~~A~~eronautical i~~I~~nformation s~~S~~ervice (AIS) for ~~such~~ distribution as the circumstances dictate~~necessitate~~ (ICAO Annex 15, Chapter 8).	X	X	X	X	X			Deeper LO level
(03)		~~State that~~ Explain that the Aeronautical Information Publication (AIP) Section En-route (ENR) 5.6 contains information regarding bird migrations (ICAO Annex 15, Appendix 1).	X	X	X	X	X			Deeper LO level
(04)		~~State~~ Explain significant data regarding bird strikes contained in ICAO Doc 9137 (ICAO Doc 9137, Part 3, 1.1.6).	X	X	X	X	X			Deeper LO level
(05)		~~List incompatible land use around airports (ICAO Doc 9137, Part 3, 10.4).~~ Explain why birds constitute a hazard to aircraft (damage to probes, sensors, engines, windscreens, airframes, degradation in vision, etc.).	X	X	X	X	X			Reworded for clarification
(06)		Define the commander's responsibilities regarding the reporting of bird hazards and bird strikes.	X	X	X	X	X			
071 02 04 00		**Noise abatement**								
071 02 04 01		***Noise-abatement procedures***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Define the operator responsibilities regarding establishment of noise-abatement procedures.	X	X	X	X	X			
(02)		State the main purpose of noise-abatement departure procedure (NADP) 1 and NADP 2 (ICAO Doc 8168, Volume 1, Part V, 3.1.1).	X	X	X	X	X			
(03)		State that the pilot-in-command has the authority to decide not to execute an ~~noise-abatement departure procedure~~NADP if conditions preclude the safe execution of the procedure (ICAO Doc 8168, Volume 1, Part V, 3.2.1.3).	X	X	X	X	X			
071 02 04 02		***Influence of the flight procedure (departure, cruise, approach)***								
(01)		List the main parameters for NADP 1 and NADP 2 (i.e. speeds, heights, etc.) (ICAO Doc 8168, Volume 1, Part V, Appendix to Chapter 3).	X	X						
(02)		State that a runway lead-in lighting system should be provided where it is desired to provide visual guidance along a specific approach path for purposes of noise abatement (ICAO Annex 14, – Volume 1, 5.3.7.1/Volume 2, 5.3.4.1).	X	X	X	X	X			
(03)		State that detailed information about noise-abatement procedures is to be found in Part 'Aerodromes' (AD) Sections 2 and 3 of the AIP (ICAO Annex 15, Appendix 1).	X	X	X	X	X			
071 02 04 03		***Influence by the pilot (power setting, low drag)***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required (ICAO Doc 8168, Volume 1, Part V, 3.2.2).	X	X						
(02)		List the adverse operating conditions under which noise-abatement procedures during approach should not be required (ICAO Doc 8168, Volume 1, Part V, 3.4.4).	X	X						
(03)		State the rule regarding the use of reverse thrust on landing (ICAO Doc 8168, Volume 1, Part V, 3.5).	X	X						
071 02 04 04		***Influence by the pilot (power setting, track of helicopter)***								
(01)		List the adverse operating conditions under which noise-abatement procedures in the form of reduced-power take-off should not be required~~.~~ (ICAO Doc 8168, Volume 1, Part V, 3.2.2).			X	X	X			
071 02 05 00		**Fire and smoke**								
071 02 05 01		***Carburettor fire***								
(01)		~~List the~~ Explain that actions to be taken in the event of a carburettor fire may be type-specific and should be known by the pilot.	X	X						More precise and hint for the importance of memory items
071 02 05 02		***Engine fire***								
(01)		~~List the~~ Explain that actions to be taken in the event of an	X	X						More precise and hint for

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		engine fire may be type-specific and should be known by the pilot.								the importance of memory items
071 02 05 03		***Fire in the cabin, ~~cockpit~~flight deck, and cargo compartment***								
(01)		Identify the different types of extinguishants used in handheld extinguishers and the type of fire on which each one may be used.	X	X						Required knowledge for the use of handheld fire extinguishers
(02)		Describe the precautions to be considered in the application of fire extinguishant.	X	X						
(03)		Identify the appropriate handheld extinguishers to be used in the ~~cockpit~~flight deck, the passenger cabin and toilets, and in the cargo compartments.	X	X						
071 02 05 04		***Smoke in the ~~cockpit~~flight deck and in the cabin***								
(01)		~~List the~~ State Explain which actions should ~~to~~ be taken in the event of smoke in the ~~cockpit~~flight deck or in the cabin, and why these may be type-specific and should be known by the pilot.	X	X						More precise and hint for the importance of memory items
071 02 05 05		***Actions in case of overheated brakes***								
(01)		Describe the problems and safety precautions following overheated brakes after a heavy-weight landing or a rejected take-off.	X	X						More precise

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02) New		Explain the difference in the way steel and carbon brakes react to energy absorption and the operational consequences.	X	X						New LO
071 02 06 00		**Decompression of pressurised cabin**								
071 02 06 01		***Slow decompression***								
(01)		~~Indicate~~ Explain what can cause, and how to detect, a slow decompression or an automatic pressurisation system failure.	X	X						Clarification
(02)		Describe the actions required following a slow decompression.	X	X						
071 02 06 02		***Rapid and explosive decompression***								
(01)		~~Indicate~~ Explain what can cause, and how to detect, a rapid or an explosive decompression.	X	X						Clarification
071 02 06 03		***Dangers and action to be taken***								
(01)		Describe the actions required following a rapid or explosive decompression.	X	X						
(02)		Describe the effects on aircraft occupants of a slow decompression and of a rapid or explosive decompression.	X	X						
071 02 07 00		**Wind shear and microburst**								
071 02 07 01		***Effects and recognition during departure and approach***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (01)~~		~~Define the meaning of the term 'low-level windshear'. (ICAO Circular 186, Chapter 1)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Duplication of 050 09 03 01
~~LO (02)~~		~~Define: vertical wind shear, horizontal wind shear, updraft and downdraft wind shear. (ICAO Circular 186, Chapter 2)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Duplication of 050 09 03 01
~~LO (03)~~		~~Identify the meteorological phenomena associated with wind shear. (ICAO Circular 186, Chapter 3)~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Duplication of 050 09 03 01
(04)		~~State recognition of~~ Explain how to identify low-level wind shear~~.~~ (ICAO Circular 186, Chapter 4).	X	X	X	X	X			
071 02 07 02		***Actions to avoid and actions to take during encounter***								
(01)		Describe the effects of wind shear and the actions required when wind shear is encountered~~ing wind shear,~~ at take-off and approach~~.~~ (ICAO Circular 186, Chapter 4).	X	X	X	X	X			
(02)		Describe the precautions to be taken when wind shear is suspected~~,~~ at take-off and approach~~.~~ (ICAO Circular 186, Chapter 4).	X	X	X	X	X			
(03)		Describe the effects of wind shear and the actions required following entry into a strong downdraft wind shear~~.~~ (ICAO Circular 186, Chapter 4).	X	X	X	X	X			
(04)		Describe a microburst and its effects~~.~~ (ICAO Circular 186, Chapter 4).	X	X	X	X	X			
071 02 08 00		**Wake turbulence**								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
071 02 08 01		***Cause***								
(01)		Define the term 'wake turbulence'~~.~~ (ICAO Doc 4444, 4.9).	X	X	X	X	X			
(02)		Describe tip vortices circulation~~.~~ (ICAO Doc 9426, Part II).	X	X	X	X	X			
(03)		State when vortex generation begins and ends~~.~~ (ICAO Doc 9426, Part II).	X	X	X	X	X			
(04)		Describe vortex circulation on the ground with and without crosswind~~.~~ (ICAO Doc 9426, Part II).	X	X	X	X	X			
071 02 08 02		***List of relevant parameters***								
(01)		List the three main factors which, when combined, give the strongest vortices (heavy, clean, slow)~~.~~ (ICAO Doc 9426, Part II).	X	X	X	X	X			
(02)		Describe the wind conditions which are worst for wake turbulence near the ground~~.~~ (ICAO Doc 9426, Part II).	X	X	X	X	X			
071 02 08 03		***Actions to be taken when crossing traffic, during take-off and landing***								
(01)		Describe the actions to be taken to avoid wake turbulence, ~~specially~~ specifically separations~~.~~ (ICAO Doc 4444, 5).	X	X	X	X	X			
071 02 09 00		**Security (unlawful events)**								
071 02 09 01		***ICAO Annex 17 and Regulation (EC) No 300/2008***								More precise

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		~~Give~~ Define the following terms ~~definitions~~: 'aircraft security check', 'screening', 'security', 'security-restricted area', 'unidentified baggage'. ~~(ICAO Annex 17, 1)~~	X	X	X	X	X			
(02)		Give the objectives of security. ~~(ICAO Annex 17, 2.1)~~	X	X	X	X	X			
071 02 09 02		***Use of s~~S~~econdary s~~S~~urveillance r~~R~~adar (SSR)***								
(01)		Describe the commander's responsibilities concerning notifying the appropriate ATS unit (ICAO Annex 17, Attachment).	X	X	X	X	X			
(02)		Describe the commander's responsibilities concerning operation of SSR (ICAO Annex 17, Attachment).	X	X	X	X	X			
(03)		Describe the commander's responsibilities concerning departing from assigned track and/or cruising level (ICAO Annex 17, Attachment).	X	X	X	X	X			
(04)		Describe the commander's responsibilities concerning the action required or being requested by an ATS unit to confirm SSR code and ATS interpretation response (ICAO Annex 17, Attachment).	X	X	X	X	X			
071 02 09 03		***Security***								
(01)		~~State~~ Explain the requirements regarding training programmes (Regulation (EC) No 300/2008).	X	X	X	X	X			Deeper LO level
(02)		~~State~~ Explain the requirements regarding reporting acts of	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		unlawful interference (Regulation (EC) No 300/2008).								
(03)		~~State~~ Explain the requirements regarding aircraft search procedures (Regulation (EC) No 300/2008).	X	X	X	X	X			Deeper LO level
071 02 10 00		**Emergency and precautionary landings**								
071 02 10 01		***Definition***								
(01)		Define 'ditching', 'precautionary landing', 'emergency landing'.	X	X	X	X	X			
(02)		Describe a ditching procedure.	X	X	X	X	X			
(03)		Describe a precautionary landing.	X	X	X	X	X			
(04)		Explain the factors to be considered when deciding to make a precautionary/emergency landing or ditching.	X	X	X	X	X			
		~~State~~ Explain the operations limitations regarding ditching requirements.	X	X						Moved from 071 01 02 02 (11) and deeper LO level
071 02 10 02		***Cause***								
(01)		List some ~~reasons~~ circumstances that may require a ditching, a precautionary landing or an emergency landing.	X	X	X	X	X			
071 02 10 03		***Passenger information***								
(01)		Describe the passenger briefing to be given before conducting a precautionary/emergency landing or ditching	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		(including evacuation).								
071 02 10 04		***Action after landing***								
(01)		Describe the actions and responsibilities of crew members after landing.	X	X	X	X	X			
071 02 10 05		***Evacuation***								
(01)		~~State that~~ Explain why the aircraft must be stopped and the engine shut down before launching an emergency evacuation.	X	X	X	X	X			Deeper LO level
~~LO (02)~~		~~State that evacuation procedures are to be found in Part B of the Operations Manual.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 071 02 01 01 ORO.MLR.100;105
(03)		~~State~~ Explain the CS-25 requirements regarding evacuation procedures~~.~~ (CS 25.803 ~~+~~and Appendix J).	X	X						Deeper LO level
071 02 11 00		**Fuel jettisoning**								
071 02 11 01		***Safety aspects***								
(01)		~~State that~~ Explain why an aircraft may need to jettison fuel so as to reduce its landing mass in order to ~~effect~~ make a safe landing~~.~~ (ICAO Doc 4444, 15.5.3).	X	X						Deeper LO level
(02)		~~State~~ Explain that when an aircraft operating within controlled airspace needs to jettison fuel, the flight crew shall coordinate with ATC the following: route to be flown which, if possible, should be clear of cities and towns,	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		preferably over water and away from areas where thunderstorms have been reported or are expected; the level to be used, which should be not less than 1 800 m (6 000 ft); and the duration of fuel jettisoning~~.~~ (ICAO Doc 4444, 15.5.3).								
(03)		~~State that~~ Explain how flaps and slats may adversely affect fuel jettisoning~~.~~ (CS 25.1001).	X	X						Deeper LO level
071 02 11 02		***Requirements***								
~~LO (01)~~		~~State that a fuel-jettisoning system must be installed on each aeroplane unless it is shown that the aeroplane meets some the CS-25 climb requirements. (CS 25.1001)~~	~~X~~	~~X~~						Covered in 021 08 02 02
(02)		~~State that~~ Explain why a fuel-jettisoning system must be capable of jettisoning enough fuel within 15 minutes~~.~~ (CS-25.1001).	X	X						Deeper LO level
071 02 12 00		**Transport of dangerous goods by air**								
071 02 12 01		***ICAO Annex 18***								
(01)		Define ~~Give~~ the following terms~~definitions~~: 'dangerous goods', 'dangerous goods accident', 'dangerous goods incident', 'exemption', 'incompatible', 'packaging', 'UN number' (ICAO Annex 18, Chapter 1).	X	X	X	X	X			
(02)		~~State that~~ Explain that detailed provisions for dangerous goods transportation are contained in the Technical	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Doc 9284~~;~~) ~~(~~ ICAO Annex 18, Chapter 2, 2.2.1).								
(03)		~~State that~~ Explain why, in case of an in-flight emergency, the pilot-in-command must inform the ATC of dangerous goods transportation (ICAO Annex 18, Chapter 9, 9.5).	X	X	X	X	X			Deeper LO level
071 02 12 02		***Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Doc 9284)***								
(01)		Explain the principle of compatibility and segregation (ICAO Doc 9284).	X	X	X	X	X			
(02)		Explain the special requirements for the loading of radioactive materials (ICAO Doc 9284).	X	X	X	X	X			
(03)		Explain the use of the dangerous goods list (ICAO Doc 9284).	X	X	X	X	X			
(04)		Identify the labels (ICAO Doc 9284).	X	X	X	X	X			
071 02 12 03		***~~Transport of dangerous goods by air~~ Regulation (EU) No 965/2012 — Annex IV (Part-CAT) and Annex V (Part-SPA)***								
(01)		~~State~~ Explain the terminology relevant to dangerous goods (Annex I, Annex V: SPA.DG.100;105;110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(02)		~~State~~ Explain the scope of the R~~r~~egulation (SPA.DG.100; 105;110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(03)		~~State that~~ Explain why dangerous goods transportation is	X	X	X	X	X			Deeper LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		subject to operator approval (SPA.DG.100, AMC1 ARO.OPS.200).								
(04)		~~State~~ Explain the limitations on the transport of dangerous goods (SPA.DG.100;105;110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(05)		~~State~~ Explain the requirements for the acceptance of dangerous goods (SPA.DG.110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(06)		~~State~~ Explain the requirements regarding inspection for damage, leakage or contamination (SPA.DG.105).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
~~LO (07)~~		~~State the loading restrictions.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Moved from 071 01 02 13 The reference in the EU regulation is to ICAO Doc 9284 Covered in 071 02 12 02 (01)
(08)		~~State~~ Explain the requirement for provision of information to the flight crew (SPA.DG.110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(09)		~~State~~ Explain the requirements for dangerous goods incident and accident reports (CAT.GEN.MPA.200 and related AMC/GM, SPA.DG.105;110).	X	X	X	X	X			Moved from 071 01 02 13 Deeper LO level
(10)		~~Identify~~ State that some articles and substances, which would otherwise be classed as dangerous goods, ~~that are~~	X	X	X	X	X			More precise description

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~excluded~~ can be exempted from the provisions if they are part of the aircraft equipment, or required for use during aeromedical flights (CAT.GEN.MPA.200 and related AMC/GM).								
(11)		~~State that~~ Explain why some articles and substances may be forbidden for air transportation (CAT.GEN.MPA.200 and related AMC/GM).	X	X	X	X	X			Deeper LO level
(12)		~~State that~~ Explain why packing must comply with the specifications of the Technical Instructions ~~specifications~~.	X	X	X	X	X			Deeper LO level
~~LO (13)~~		~~List the labelling and marking requirements.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Duplication of 071 02 12 02
~~LO (14)~~		~~List the Dangerous Goods Transport Document requirements.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Not required knowledge
~~LO (15)~~		~~List the Acceptance of Dangerous Goods requirements.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Training is required before clearance for carriage
(16)		~~State~~ Explain the need for an inspection prior to loading on an aircraft (SPA.DG.110).	X	X	X	X	X			Deeper LO level
(17)		~~State that~~ Explain why some dangerous goods are designated for carriage only on cargo aircraft (SPA.DG.110).	X	X	X	X	X			Deeper LO level
~~LO (18)~~		~~State that accidents or incidents involving dangerous goods are to be reported~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Covered in 071 02 12 03 (09)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(19)		~~State that~~ Explain how misdeclared or undeclared dangerous goods found in baggage are to be reported (CAT.GEN.MPA.200 and related AMC/GM).	X	X	X	X	X			Deeper LO level
071 02 13 00		**Contaminated runways**								
071 02 13 01		***~~Kinds of contamination~~ Intentionally left blank***								Moved to 032 04 01 10
~~LO (01)~~		~~Define a 'contaminated runway', a 'damp runway', a 'wet runway', and a 'dry runway'.~~	~~X~~	~~X~~						
~~LO (02)~~		~~List the different types of contamination: damp, wet or water patches, rime or frost-covered, dry snow, wet snow, slush, ice, compacted or rolled snow, frozen ruts or ridges. (ICAO Annex 15, Appendix 2)~~	~~X~~	~~X~~						
~~LO (03)~~		~~Give the definitions of the various types of snow. (ICAO Annex 15, Appendix 2)~~	~~X~~	~~X~~						Covered in 050 05 02 01
071 02 13 02		***~~Estimated surface friction, friction coefficient~~ Intentionally left blank***								
~~LO (01)~~		~~Identify the difference between friction coefficient and estimated surface friction. (ICAO Annex 15, Appendix 2)~~	~~X~~	~~X~~						
~~LO (02)~~		~~State that when friction coefficient is 0.40 or higher, the expected braking action is good. (ICAO Annex 15, Appendix 2)~~	~~X~~	~~X~~						
071 02 13 03		***~~Hydroplaning principles and effects~~ Intentionally left blank***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (01)~~		~~Define the different types of hydroplaning.~~ ~~(NASA TM-85652/Tire friction performance/pp. 6 to 9)~~	~~X~~	~~X~~						
~~LO (02)~~		~~Compute the two dynamic hydroplaning speeds using the following formulas:~~ ~~Spin-down speed (rotating tire) (kt) = 9 square root (pressure in PSI)~~ ~~Spin-up speed (non-rotating tire) (kt) = 7.7 square root (pressure in PSI).~~ ~~(NASA TM-85652/Tire friction performance /p. 8)~~	~~X~~	~~X~~						
~~LO (03)~~		~~State that it is the spin-up speed rather than the spin-down speed which represents the actual tire situation for aircraft touchdown on flooded runways.~~ ~~(NASA TM-85652/Tire friction performance/p. 8)~~	~~X~~	~~X~~						
071 02 13 04		~~***Procedures***~~ ***Intentionally left blank***								
~~LO (01)~~		~~State that some wind limitations may apply in case of contaminated runways. Those limitations are to be found in Part B of the Operations Manual — Limitations.~~	~~X~~	~~X~~						
~~LO (02)~~		~~State that the procedures associated with take-off and landing on contaminated runways are to be found in Part B of the Operations Manual — Normal procedures.~~	~~X~~	~~X~~						
~~LO (03)~~		~~State that the performances associated with contaminated~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~runways are to be found in Part B of the Operations Manual — Performance.~~								
071 02 13 05		***SNOWTAM and contamination on the aerodrome***								
(01)		Interpret from a SNOWTAM the contamination and braking action on a runway, taxiways and apron.	X	X						More precise
(02) New		Explain which hazards can be identified from the SNOWTAM/METAR and how to mitigate them.	X	X	X	X	X			Operational TEM aspect added
071 02 14 00		**Rotor downwash**								
071 02 14 01		***Describe downwash***								
(01)		Describe the downwash.			X	X	X			
071 02 14 02		***Effects***								
(01)		~~State~~ Explain the effectss on: soil erosion, water dispersal and spray, recirculation, damage to property, loose articles.			X	X	X			Deeper LO level
071 02 15 00		**Operation influence by meteorological conditions (Helicopter)**								
071 02 15 01		***White-out/sand/dust***								
(01)		Give the definition of ‘white-out’.			X	X	X			
(02)		Describe loss of spatial orientation.			X	X	X			
(03)		Describe take-off and landing techniques.			X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
071 02 15 02		***Strong winds***								
(01)		Describe blade sailing.			X	X	X			
(02)		Describe wind operating envelopes.			X	X	X			
(03)		Describe vertical speed problems.			X	X	X			
071 02 15 03		***Mountain environment***								
(01)		Describe constraints associated with mountain environment.			X	X	X			
071 03 00 00		**EMERGENCY PROCEDURES (HELICOPTER)**								
071 03 01 00		**Influence of technical problems**								
071 03 01 01		***Engine failure***								
(01)		Describe techniques for failure in: hover, climb, cruise, approach.			X	X	X			
071 03 01 02		***Fire in the cabin~~/~~, the flight deck~~cockpit/~~ and the engine***								
(01)		Describe the basic actions when encountering fire in the cabin, ~~cockpit~~flight deck or engine.			X	X	X			
071 03 01 03		***Tail~~/~~ rotor~~/~~directional control failure***								
(01)		Describe the basic actions following loss of tail rotor.			X	X	X			
(02)		Describe the basic actions following loss of directional control.			X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
071 03 01 04		***Ground resonance***								
(01)		Describe recovery actions.			X	X	X			
071 03 01 05		***Blade stall***								
(01)		Describe cause and recovery actions when encountering retreating blade stall.			X	X	X			
071 03 01 06		***Settling with power (vortex ring)***								
(01)		Describe prerequisite conditions and recovery actions.			X	X	X			
071 03 01 07		***Overpitch***								
(01)		Describe recovery actions.			X	X	X			
071 03 01 08		***Overspeed: rotor/engine***								
(01)		Describe overspeed control.			X	X	X			
071 03 01 09		***Dynamic rollover***								
(01)		Describe potential conditions and recovery action.			X	X	X			
071 03 01 10		***Mast bumping***								
(01)		Describe conditions of the 'conducive to' and the 'avoidance of' effect.			X	X	X			
071 04 01 00		**SPECIALISED OPERATIONS** **(Commission Regulation (EU) No 379/2014 amending**								This subtopic will be further developed when Part-SPO becomes

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		Regulation (EU) No 965/2012 on air operations)								applicable (April 2017) and to be examined at a later date
071 04 01 01		***Additional requirements for commercial specialised operations and CAT operations (Subpart SPO, Section 3)***								
(01)		Explain the requirements related to flight crew recurrent training and checking and operator proficiency check.	X	X	X	X	X			
071 04 01 02		***Specific requirements (Part-SPO, Subpart E, Section 1)***								
(01)		Explain how specific requirements are to be met by a pilot-in-command conducting non-commercial specialised operations with other-than complex motor-powered aircraft.	X	X	X	X	X			
071 04 01 03		***Helicopter external sling load operations (HESLO)***			X	X	X			
071 04 01 04		***Human external cargo operations (HEC)***			X	X	X			
071 04 02 00		**SPECIALISED OPERATIONS (ANNEX VIII (PART-SPO))**								
(01)		**General requirements (Subpart A)**								
(02)		Explain the task specialist's responsibilities.	X	X	X	X	X			

Overview of the proposed amendments to Subject 081 'Principles of flight (aeroplane)'

The wording of some Learning Objectives (LOs) has been changed for clarification and to increase understanding. Some LOs have been moved or split in order to be placed and examined in a single appropriate section(s).

Some LOs have been deleted to prevent repletion.

The LOs referring to the boundary layer, stall and shock stall have been moved to the more appropriate new section 081 03 00 00 titled 'Stall, shock stall, and upset prevention and recovery'.

In the LOs referring to the stall, the relation is laid in the Notice of Proposed Amendment (NPA) 2015-13[1] on upset prevention and recovery training (UPRT) and on threat and error management (TEM).

The LOs on the aerodynamic moment and moment coefficients have been deleted, and the LOs referring to the neutral point and stick force have been adjusted to reflect the essential knowledge required by a line pilot.

The LOs on the phenomenon of flutter have been simplified to essential facts.

The LOs related to TEM have been added.

[1] https://www.easa.europa.eu/system/files/dfu/NPA%202015-13.pdf

SUBJECT 081 — PRINCIPLES OF FLIGHT (AEROPLANE)

(1) The following standard conventions are used for certain mathematical symbols:

*	multiplication
≥	greater than or equal to
≤	less than or equal to
SQRT(…)	square root of the function, symbol or number in round brackets

(2) Normally, it should be assumed that the effect of a variable under review is the only variation that needs to be addressed, unless specifically stated otherwise.

(3) Candidates are expected in simple calculations to be able to convert knots (kt) into metres/second (m/s), and know the appropriate conversion factors by heart.

(4) In the subsonic range, as covered under Subject 081 01, compressibility effects normally are not considered, unless specifically mentioned.

(5) For those questions related to propellers (Subject 081 07), as a simplification of the physical reality, the inflow speed into the propeller plane is taken as the aeroplane's true airspeed (TAS).

In addition, when discussing propeller rotational direction, it will always be specified as seen from behind the propeller plane.

(6) Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe 'mass'. The professional pilot should always note the units to determine if the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
080 00 00 00		**PRINCIPLES OF FLIGHT**								
081 00 00 00		**PRINCIPLES OF FLIGHT — AEROPLANE**								
081 01 00 00		**SUBSONIC AERODYNAMICS**								
081 01 01 00		**Basics, laws and definitions**								
081 01 01 01		***Laws and definitions***								
(01)		List the international system ~~(SI)~~ of units of measurement (SI) for mass, acceleration, weight, velocity, energy, density, temperature, pressure, force, wing loading and power.	X	X						Completeness
(02)	X	Define 'mass', 'force', 'acceleration' and 'weight'.	X	X						Split from old (01)
(03)		State and interpret Newton's three laws of motion.	X	X						Split from old (01) Clarity
~~LO (04)~~		~~State and interpret Newton's first law.~~	~~X~~	~~X~~						Covered in (03) above
~~LO (05)~~		~~State and interpret Newton's second law~~	~~X~~	~~X~~						Covered in (03) above
~~LO (06)~~		~~State and interpret Newton's third law.~~	~~X~~	~~X~~						Covered in (03) above
(07)	X	Explain air density.	X	X						Split from old (01)
(08)	X	List the atmospheric properties that effect air density.	X	X						
(09)		Explain how temperature and pressure changes affect air density.	X	X						
(10)	X	Define 'static pressure'.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(11)	X	Define 'dynamic pressure'.	X	X						
(12)	X	State the 'formula for dynamic pressure'.	X	X						
(13)		Describe dynamic pressure in terms of an indication of the energy in the system, and how it is related to indicated airspeed (IAS) and air density for a given altitude and speed.	X	X						Clarity
(14)		State Bernoulli's equation for incompressible flow.	X	X						Clarity
(15)		Define 'total pressure' and explain that the total pressure differs in different systems.	X	X						Increased understanding
(16)		Apply Bernoulli's equation to flow through a venturi stream tube for incompressible flow.	X	X						Clarity
(17)		Describe how IAS is acquired from the pitot static system.	X	X						
(18)		Describe the relationship between density, temperature and pressure for air.	X	X						
(19)		Explain the equation of continuity and its application to the flow through a stream tube.	X	X						Clarity
(20)	X	Define 'IAS', 'CAS', 'EAS', 'TAS'.	X	X						Basic knowledge (BK) in 081 and examined in 022 02 06 00
081 01 01 02		***Basics about airflow***								
(01)	X	Describe steady and unsteady airflow.	X	X						
(02)	X	Explain the concept of a streamline and a stream tube.	X	X						Split from old (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
										Required for completeness
(03)	X	Describe and explain airflow through a stream tube.	X	X						
(04)	X	Explain the difference between two- and three-dimensional airflow.	X	X						
081 01 01 03		***Aerodynamic forces ~~and moments~~ on aerofoils***								
(01)		Describe the originating point and direction of the resultant force caused by ~~resulting from~~ the pressure distribution around an aerofoil.	X	X						Clarity
(02)	X	Resolve the resultant force into the components 'lift' and 'drag'.	X	X						Split from old (01)
(03)		Describe the direction of lift and drag.	X	X						Split from old (01)
~~LO (04)~~		~~Define the 'aerodynamic moment'.~~	~~X~~	~~X~~						Not essential knowledge
~~LO (05)~~		~~List the factors that affect the aerodynamic moment.~~	~~X~~	~~X~~						Not essential knowledge
~~LO (06)~~		~~Describe the aerodynamic moment for a symmetrical aerofoil.~~	~~X~~	~~X~~						Not essential knowledge
~~LO (07)~~		~~Describe the aerodynamic moment for a positively and negatively cambered aerofoil.~~	~~X~~	~~X~~						Not essential knowledge
~~LO (08)~~		~~Forces and equilibrium of forces (refer to 081 08 00 00).~~	~~X~~	~~X~~						Moved to 081 08 00 00
(09)	X	Define 'angle of attack' (α).	X	X						Split from old (01)
081 01 01 04		***Shape of an aerofoil section***								
		~~Describe the following parameter of an aerofoil section:~~								Split from old (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)	X	Describe the following parameter of an aerofoil section: leading edge.	X	X						Split from old (01)
(02)	X	Describe the following parameter of an aerofoil section: trailing edge.	X	X						Split from old (01)
(03)	X	Describe the following parameter of an aerofoil section: chord line.	X	X						Split from old (01)
(04)	X	Describe the following parameter of an aerofoil section: thickness-to-chord ratio or relative thickness.	X	X						Split from old (01)
(05)	X	Describe the following parameter of an aerofoil section: location of maximum thickness.	X	X						Split from old (01)
(06)	X	Describe the following parameter of an aerofoil section: camber line.	X	X						Split from old (01)
(07)	X	Describe the following parameter of an aerofoil section: camber.	X	X						Split from old (01)
(08)	X	Describe the following parameter of an aerofoil section: nose radius.	X	X						Split from old (01)
(09)	X	Describe a symmetrical and an asymmetrical aerofoil section.	X	X						Split from old (01)
081 01 01 05		***Wing shape***								
		~~Describe the following parameters of a wing:~~								
(01)	X	Describe the following parameter of a wing: span.	X	X						Split from old (01)
(02)	X	Describe the following parameter of a wing: tip and root chord.	X	X						Split from old (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(03)		Describe the following parameter of a wing: taper ratio.	X	X						Split from old (01)
(04)	X	Describe the following parameter of a wing: wing area.	X	X						Split from old (01)
(05)	X	Describe the following parameter of a wing: wing planform.	X	X						Split from old (01)
(06)	X	Describe the following parameter of a wing: mean geometric chord.	X	X						Split from old (01)
(07)		Describe the following parameter of a wing: mean aerodynamic chord (MAC).	X	X						Split from old (01)
(08)		Describe the following parameter of a wing: aspect ratio.	X	X						Split from old (01)
(09)	X	Describe the following parameter of a wing: dihedral angle.	X	X						Split from old (01)
(10)	X	Describe the following parameter of a wing: sweep angle.	X	X						Split from old (01)
~~LO (11)~~	~~X~~	~~Describe the following parameter of a wing: wing twist; geometric and aerodynamic .~~	~~X~~	~~X~~						Not essential knowledge
(12)		Describe the following parameter of a wing: angle of incidence. *Remark: In certain textbooks, angle of incidence is used as angle of attack. For Part-FCL theoretical knowledge examination purposes this use is discontinued, and the angle of incidence is defined as the angle between the aeroplane longitudinal axis and the wing-root chord line.*	X	X						Split from old (01)
081 01 02 00		**Two-dimensional airflow around an aerofoil**								
081 01 02 01		***Streamline pattern***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)	X	Describe the streamline pattern around an aerofoil.	X	X						
(02)		Describe converging and diverging streamlines and their effect on static pressure and velocity.	X	X						Split from old (01)
(03)	X	Describe upwash and downwash.	X	X						Split from old (01)
081 01 02 02		***Stagnation point***								
(01)		Describe the stagnation point.	X	X						
(02)		Describe the movement of the stagnation point as the angle of attack changes.	X	X						Split from old (01) Clarity
~~LO (03)~~		~~Explain local pressure changes.~~	~~X~~	~~X~~						Duplication of 081 01 02 03 (01)
081 01 02 03		***Pressure distribution***								
(01)		Describe pressure distribution and local speeds around an aerofoil including effects of camber and angle of attack.	X	X						
(02)		Describe where the minimum local static pressure is typically situated on an aerofoil.	X	X						Split from old (01)
081 01 02 04		***Centre of pressure (CP) and aerodynamic centre (AC)***								
(01)		Explain ~~centre of pressure~~CP and ~~aerodynamic centre~~AC.	X	X						
081 01 02 05		***~~Lift and downwash~~ Intentionally left blank***								
~~LO (01)~~		~~Explain the association between lift and downwash.~~	~~X~~	~~X~~						Moved to 081 01 03 01 01 where all factors affecting lift

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
										are described
081 01 02 06		***Drag and wake***								
(01)	X	List two physical phenomena that cause drag.	X	X						
(02)		Describe skin friction drag.	X	X						Split from old (01)
(03)		Describe form (pressure) drag.	X	X						Split from old (01)
(04)	X	Explain why drag and wake cause loss of energy (momentum).	X	X						Split from old (01)
081 01 02 07		***Influence of angle of attack***								
(01)		Explain the influence of angle of attack on lift.	X	X						
~~***081 01 02 08***~~		~~***Flow separation at high angles of attack***~~ ***Intentionally left blank***								
~~LO (01)~~		~~Refer to 081 01 08 01.~~	~~X~~	~~X~~						Included in new 081 03 00 00
081 01 02 09		***The coefficient of lift — angle of attack (α) graph***								Correctness
(01)		Describe the coefficient of lift and the angle of attack (α) graph.	X	X						Completeness
(02)		Explain the significant points on the graph.	X	X						Split from old (01)
~~LO (03)~~		~~Describe the coefficient of lift against α graph for a symmetrical aerofoil.~~	~~X~~	~~X~~						Covered in 081 01 03 01 (02)
081 01 03 00		***Coefficients***								
(01)	X	Explain why coefficients are used in general.	X	X						
081 01 03 01		***The lift coefficient (C_L)***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Explain ~~Describe~~ the lift formula, the factors that affect lift, and perform simple calculations.	X	X						Increased understanding
(02)		Describe the C_L–α graph (symmetrical and positively/ negatively cambered aerofoils).	X	X						Split from old (01)
(03)		Describe the typical difference in the C_L–α graph for fast and slow aerofoil design.	X	X						Split from old (01)
(04)	X	Define 'C_{LMAX}' and 'α_{stall}' on the graph.	X	X						Split from old (01)
(05) New		Describe C_L and explain the variables that affect it in low subsonic flight.	X	X						Required understanding
081 01 03 02		***~~The~~ Drag ~~coefficient~~ C_{dp}***								
(01)		Describe the two-dimensional drag formula and perform simple calculations.	X	X						Clarity
(02)		Discuss the effect of the shape of a body, cross-sectional area and surface roughness on the drag coefficient.	X	X						Split from old (01) Completeness
~~LO (03)~~		~~Describe the Coefficient of lift – Coefficient of drag graph (aerofoil polar).~~	~~X~~	~~X~~						Moved to 081 01 04 02 (14) (3D flow)
~~LO (04)~~		~~Indicate minimum drag on the graph.~~	~~X~~	~~X~~						Moved to 081 01 04 02 (15) (3D flow)
~~LO (05)~~		~~Explain why the C_l–C_d ratio is important as a measure of performance.~~	~~X~~	~~X~~						Moved to 081 01 04 02 (16) (3D flow)
~~LO (06)~~	~~X~~	~~State the normal values of C_l–C_d.~~	~~X~~	~~X~~						Moved to 081 01 04 02 (17)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
										(3D flow)
081 01 04 00		**Three-dimensional airflow about an aeroplane**								
(01)	X	Define 'angle of attack.' *Remark: For theoretical knowledge examination purposes, the angle-of-attack definition requires a reference line. This reference line for 3D has been chosen to be the longitudinal axis and for 2D the chord line*.	X	X						
(02)		Explain the difference between the angle of attack and the attitude of an aeroplane.	X	X						Split from old (01)
081 01 04 01		***Streamline pattern***								
(01)		Describe the general streamline pattern around the wing, tail section and fuselage.	X	X						
(02)		Explain and describe the causes of spanwise flow over top and bottom surfaces.	X	X						Split from old (01)
(03)	X	Describe tip vortices and the contribution to downwash behind the wing.	X	X						Split from old (01) Clarity
(04)		Explain why tip vortices vary with angle of attack.	X	X						Split from old (01)
~~LO (05)~~		~~Explain upwash and downwash due to tip vortices.~~	~~X~~	~~X~~						Merged into 081 01 04 01 03
(06)		Describe spanwise lift distribution including the effect of wing planform.	X	X						Split from old (01)
(07)		Describe the causes, distribution and duration of the wake	X	X						Split from old (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		turbulence behind an aeroplane.								
(08)		Describe the influence of flap deflection on the tip vortex.	X	X						Split from old (01)
(09)		Describe the parameters that influence wake turbulence.	X	X						Split from old (01) Increased skill level
081 01 04 02		***Induced drag***								
(01)		Explain the factors that ~~what~~ cause ~~the~~ induced drag.	X	X						Clarity
(02)		Describe the approximate formula for the induced drag coefficient (including variables but excluding constants).	X	X						Split from old (01)
~~LO (03)~~		~~State the factors that affect induced drag.~~	~~X~~	~~X~~						Covered in 081 01 04 02 (01)
(04)		Describe the relationship between induced drag and total drag in straight and level flight with variable speed.	X	X						Split from old (01) Clarity
(05)		Describe the effect of mass on induced drag at a given IAS.	X	X						Split from old (01)
(06)		Describe the means to reduce induced drag: — aspect ratio; — winglets; — tip tanks; — wing twist; — camber change.	X	X						Split from old (01)
(07)		Describe the influence of lift distribution on induced drag.	X	X						Split from old (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(08)		Describe the influence of downwash on the effective airflow.	X	X						Split from old (01) Clarity
(09)		Explain induced and effective local angle of attack.	X	X						Split from old (01)
(10)		Explain the influence of the induced angle of attack on the direction of the lift vector.	X	X						Split from old (01)
(11)		Explain the relationship between induced drag and: — speed; — aspect ratio; — wing planform; — bank angle in a horizontal coordinated turn.	X	X						Split from old (01)
~~LO (12)~~		~~Explain the induced drag coefficient.~~	~~X~~	~~X~~						Included in below LO
(13)		Explain the induced drag coefficient and its relationship with the lift coefficient and aspect ratio.	X	X						Split from old (01) Clarity
(14)		Explain the influence of induced drag on: — the C_L–α graph, and show the effect on the graph when comparing high- and low-aspect ratio wings; — the C_L–C_D (aeroplane polar), and show the effect on the graph when comparing high- and low-aspect ratio wings; — the parabolic aeroplane polar in a graph and as a formula [$C_D = C_{PD} + kC_L^2$], where C_{PD} = coefficient of parasite drag.	X	X						Split from old (01)
(15)		Describe the C_L–C_D graph (polar).	X	X						Moved from 2D to 3D flow

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
										for clarity and relevance
(16)		Indicate minimum drag on the graph.	X	X						Moved from 2D to 3D flow for clarity and relevance
(17)		Explain why the C_L–C_D ratio is important as a measure of performance.	X	X						Moved from 2D to 3D flow for clarity and relevance
(18)	X	State the normal values of C_L–C_D.	X	X						Moved from 2D to 3D flow for clarity and relevance
081 01 05 00		**Total drag**								
(01)	X	State that total drag consists of parasite drag and induced drag.	X	X						
081 01 05 01		***Parasite drag***								
(01)		Describe ~~List~~ the types of drag that are included in parasite drag.	X	X						Increased skill level
(02)		Describe form (pressure) drag and the factors which affect its magnitude.	X	X						Split from old (01) Increased understanding
(03)		Describe interference drag and the factors which affect its magnitude.	X	X						Split from old (01) Increased understanding
(04)		Describe friction drag and the factors which affect its magnitude.	X	X						Split from old (01) Increased understanding
081 01 05 02		***Parasite drag and speed***								
(01)		Describe the relationship between parasite drag and speed.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 01 05 03		***Induced drag and speed*** *(Refer to 081 01 04 02)*								Covered in 081 01 04 02
081 01 05 04		***Intentionally left blank***								
081 01 05 05		***Total drag ~~and speed~~***								
(01)		Explain the total drag–speed graph and the constituent drag components.	X	X						
(02)		Indicate the speed for minimum drag.	X	X						Split from old (01)
081 01 05 06		***Intentionally left blank***								
081 01 05 07		***Variables affecting t~~T~~he total drag–speed graph***								
(01)		Describe the effect of aeroplane gross mass on the graph.	X	X						
(02)		Describe the effect of pressure altitude on: — drag–IAS graph; — drag–TAS graph.	X	X						
(03)		Describe speed stability from the graph.	X	X						
(04)		Describe non-stable, neutral and stable IAS regions.	X	X						
(05)		Explain what happens to the IAS and drag in the non-stable region if speed suddenly decreases and why this could occur.	X	X						
081 01 06 00		**Ground effect**								
(01)		Explain the influence of ground effect on ~~what happens to the~~ tip vortices, downwash, airflow pattern, lift and drag ~~in ground~~	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~effect~~.								
081 01 06 01		***Influence of ground effect ~~Effect on C_{Di}~~***								
(01)		Describe the influence of ground effect on ~~C_{Di} and~~ induced α ~~angle of attack~~ and the coefficient of induced drag (C_{Di}).	X	X						
(02)		Explain the effects of~~n~~ entering and leaving ground effect.	X	X						
081 01 06 02		***Effect on α_{stall}***								
(01)		Describe the influence of ground effect on α_{stall}.	X	X						
081 01 06 03		***Effect on C_L***								
(01)		Describe the influence of ground effect on the effective α and C_L.	X	X						
081 01 06 04		***Effect on take-off and landing characteristics of an aeroplane***								
(01)		Describe the influence of ground effect on take-off and landing characteristics and performance of an aeroplane.	X	X						
(02)		Describe the difference in take-off and landing characteristics of high- and low-wing aeroplanes.~~between:~~ — ~~high and low wing characteristics;~~ — ~~high and low tail characteristics.~~	X	X						Clarity and removal of non-essential knowledge
~~LO (03)~~		~~Explain the effects on static pressure measurements at the static ports when entering and leaving ground effect.~~	~~X~~	~~X~~						Not relevant
081 01 07 00		**The relationship between lift coefficient and speed in steady,**								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		straight and level flight								
081 01 07 01		***Represented by an equation***								
(01)		Explain the effect on C_L during speed increase/decrease in steady, straight and level flight, and perform simple calculations.	X	X						
081 01 07 02		***Represented by a graph***								
(01)		Explain, by using a graph, the effect on speed of C_L changes at a given weight.	X	X						
~~**081 01 08 00**~~		~~**The stall**~~								Moved to 081 03
~~***081 01 08 01***~~		~~***Flow separation at increasing angles of attack***~~								
~~LO (01)~~		~~Define the 'boundary layer'.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Describe the thickness of a typical laminar and turbulent boundary layer.~~	~~X~~	~~X~~						
~~LO (03)~~		~~List the factors that affect thickness.~~	~~X~~	~~X~~						
~~LO (04)~~		~~Describe the properties, advantages and disadvantages of the laminar boundary layer.~~	~~X~~	~~X~~						
~~LO (05)~~		~~Describe the properties, advantages and disadvantages of the turbulent layer.~~	~~X~~	~~X~~						
~~LO (06)~~		~~Define the 'transition point'.~~	~~X~~	~~X~~						
~~LO (07)~~		~~List the differences between laminar and turbulent boundary~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~layers.~~								
~~LO (08)~~		~~Explain why the laminar boundary layer separates easier than the turbulent one.~~	~~X~~	~~X~~						
~~LO (09)~~		~~Describe why List the factors that slow down the airflow over the aft part of an wing aerofoil slows down , as the angle of attack increases.~~	~~X~~	~~X~~						
~~LO (10)~~		~~Define the 'separation point' and describe its location as a function of angle of attack.~~	~~X~~	~~X~~						
~~LO (11)~~		~~Define the 'critical stall angle of attack'.~~	~~X~~	~~X~~						
~~LO (12)~~		~~Describe in straight and level flight the influence of increasing the angle of attack on:~~ ~~— the forward stagnation point;~~ ~~— the pressure distribution;~~ ~~— the location of the centre of pressure (straight and swept back wing);~~ ~~— CL and L;~~ ~~— CD and D;~~ ~~— the pitching moment (straight and swept back wing);~~ ~~— the downwash at the horizon stabiliser.~~	~~X~~	~~X~~						
~~LO (13)~~		~~Explain what causes the possible natural buffet on the controls in a pre-stall condition.~~	~~X~~	~~X~~						
~~LO (14)~~		~~Describe the effectiveness of the flight controls in a pre-stall~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~condition.~~								
~~LO (15)~~		~~Describe and explain the normal post stall behaviour of a straight wing/ aeroplane;~~	~~X~~	~~X~~						
~~LO (16)~~		~~Describe the effect and dangers of using the controls close to the stall.~~	~~X~~	~~X~~						
~~***081 01 08 02***~~		~~***The stall speed***~~								Moved to 081 03
~~LO (01)~~		~~Explain V_{S0}, V_{S1}, V_{SR}, V_{S1g}.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Solve the 1gG stall speed from the lift formula, given varying:~~ — ~~airspeed;~~ — ~~coefficient of lift.~~	~~X~~	~~X~~						
~~LO (03)~~		~~Describe and explain the influence of the following parameters on stall speed:~~ — ~~centre of gravity;~~ — ~~thrust component;~~ — ~~slipstream;~~ — ~~wing loading;~~ — ~~mass;~~ — ~~wing contamination;~~ — ~~angle of sweep;~~ — ~~altitude (for compressibility effects, see 081 02 03 02).~~	~~X~~	~~X~~						
~~LO (04)~~		~~Define the 'load factor n'.~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (05)~~		~~Explain why the load factor increases in a turn.~~	~~X~~	~~X~~						
~~LO (06)~~		~~Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre.~~	~~X~~	~~X~~						
~~LO (07)~~		~~Describe and explain the influence of the 'load factor n' on stall speed.~~	~~X~~	~~X~~						
~~LO (08)~~		~~Explain the expression 'accelerated stall'.~~ ~~*Remark: Sometimes accelerated stall is also erroneously referred to as high-speed stall. This latter expression will not be used for subject 081.*~~	~~X~~	~~X~~						
~~LO (09)~~		~~Calculate the change of stall speed as a function of the load factor.~~	~~X~~	~~X~~						
~~LO (10)~~		~~Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle.~~	~~X~~	~~X~~						
~~LO (11)~~		~~Calculate the change of stall speed as a function of the gross mass.~~	~~X~~	~~X~~						
~~***081 01 08 03***~~		~~***The initial stall in span-wise direction***~~								Moved to 081 03
~~LO (01)~~		~~Explain the initial stall sequence on the following planforms:~~ — ~~elliptical;~~ — ~~rectangular;~~ — ~~moderate and high taper;~~ — ~~sweepback or delta.~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (02)~~		~~Explain the influence of geometric twist (wash out.) and aerodynamic twist.~~	~~X~~	~~X~~						
~~LO (03)~~		~~Explain the influence of deflected ailerons.~~	~~X~~	~~X~~						
~~LO (04)~~		~~Explain the influence of fences, vortilons, saw teeth, vortex generators (on engine nacelles).~~	~~X~~	~~X~~						
~~***081 01 08 04***~~		~~***Stall warning***~~								Moved to 081 03
~~LO (01)~~		~~Explain why stall warning is necessary.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Explain when aerodynamic and artificial stall warnings are used.~~	~~X~~	~~X~~						
~~LO (03)~~		~~Explain why CS-23 and CS-25 require a margin to stall speed~~	~~X~~	~~X~~						
~~LO (04)~~		~~Describe:~~ ~~— buffet;~~ ~~— stall strip;~~ ~~— flapper switch (leading-edge stall-warning vane);~~ ~~— angle-of-attack vane;~~ ~~— angle-of-attack probe;~~ ~~— stick shaker.~~	~~X~~	~~X~~						
~~LO (05)~~		~~Describe the recovery after:~~ ~~— stall warning;~~ ~~— stall;~~ ~~— stick-pusher actuation.~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~***081 01 08 05***~~		~~***Special phenomena of stall***~~								Moved to 081 03
~~LO (01)~~		~~Describe the basic stall requirements for transport category aeroplanes.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Explain the difference between power-off and power-on stalls and recovery.~~	~~X~~	~~X~~						
~~LO (03)~~		~~Describe stall and recovery in a climbing and descending turn.~~	~~X~~	~~X~~						
~~LO (04)~~		~~Describe the effect on stall and recovery characteristics of:~~ ~~— wing sweep (consider both forward and backward sweep);~~ ~~— T-tailed aeroplane;~~ ~~— canards.~~	~~X~~	~~X~~						
~~LO (05)~~		~~Describe super-stall or deep-stall.~~	~~X~~	~~X~~						
~~LO (06)~~		~~Describe the philosophy behind the stick-pusher system.~~	~~X~~	~~X~~						
~~LO (07)~~		~~Explain the effect of ice, frost or snow on the :~~ ~~— stagnation point.~~	~~X~~	~~X~~						
~~LO (08)~~		~~— danger and reason for the absence of stall warning.~~	~~X~~	~~X~~						
~~LO (09)~~		~~— abnormal behaviour of the stall.~~	~~X~~	~~X~~						
~~LO (10)~~		~~Describe and explain the cause and effects of the stabiliser stall caused by ice (negative tail stall).~~	~~X~~	~~X~~						
~~LO (11)~~		~~Describe when to expect in-flight icing.~~	~~X~~	~~X~~						
~~LO (12)~~		~~Explain how the effect is changed when retracting/ extending~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~lift augmentation devices.~~								
~~LO (13)~~		~~Describe how to recover from a stall after a configuration change caused by in-flight icing.~~	~~X~~	~~X~~						
~~LO (14)~~		~~Explain the effect of a contaminated wing on the stall speed and critical angle of attack.~~	~~X~~	~~X~~						
~~LO (15)~~		~~Explain what 'on-ground' icing is.~~	~~X~~	~~X~~						
~~LO (16)~~		~~Describe the aerodynamic effects and hazards of de-icing/anti-ice fluid after the holdover time has been reached.~~	~~X~~	~~X~~						
~~LO (17)~~		~~Describe the aerodynamic effects of heavy tropical rain on stall speed and drag, and appropriate mitigation in such conditions.~~	~~X~~	~~X~~						
~~LO (18)~~		~~Explain how to avoid spins.~~	~~X~~	~~X~~						
~~LO (19)~~		~~List the factors that cause a spin to develop.~~	~~X~~	~~X~~						
~~LO (20)~~		~~Describe spin development, recognition and recovery.~~	~~X~~	~~X~~						
~~LO (21)~~		~~Describe the differences in spin attitude with forward and aft centre of gravity. Recovery techniques for aeroplanes that have different mass distributions between the wings and the fuselage.~~	~~X~~	~~X~~						
081 01 09 00		**C_{LMAX} augmentation**								
081 01 09 01		***Trailing-edge flaps and the reasons for use in take-off and landing***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (01)~~		~~Describe trailing-edge flaps and the reasons for their use during take-off and landing.~~	~~X~~	~~X~~						Covered in (02)
(02)		From the given relevant diagrams describe and/or ~~i~~identify the following types of trailing-edge flaps ~~given a relevant diagram~~: — split flaps; — plain flaps; — slotted flaps; — Fowler flaps.	X	X						Clarity
~~LO (03)~~		~~Describe their effect on wing geometry.~~	~~X~~	~~X~~						Covered in (04)
(04)		Describe how the wing's effective camber increases the C_L and C_D, and the reasons why this can be beneficial.	X	X						Increased clarity and application
~~LO (05)~~		~~Describe how the effective chord line differs from the normal chord line.~~	X	X						Covered in (04)
(06)		Describe their effect on: — the location of CP~~centre of pressure~~; — pitching moments (due to wing CP movement); — stall speed.	X	X						Clarity
(07)		Compare their influence on the C_L–α graph: — indicate the variation in C_L at any given α~~angle of attack~~; — indicate the variation in C_D at any given α~~angle of~~	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~attack~~; — indicate their effect on C_{LMAX}; — indicate their effect on the stall or critical α~~angle of attack~~; — indicate their effect on the α~~angle of attack~~ at a given C_L.								
(08)		Compare their influence on the C_L–C_D graph: — indicate how the $(C_L/C_D)_{MAX}$ differs from that of a clean wing.	X	X						
(09)		Explain the influence of trailing-edge flap deflection on the glide angle.	X	X						
(10)		Describe flap asymmetry: — explain the effect on aeroplane controllability.	X	X						
(11)		Describe trailing-edge flap effect on take-off and landing: — explain the advantages of lower-nose attitudes; — explain why take-off and landing speeds/distances are reduced.	X	X						
(12)		Explain the effects of flap-setting errors.	X	X						TEM
081 01 09 02		***Leading-edge devices and the reasons for their use in take-off and landing***								
~~LO (01)~~		~~Describe leading-edge high-lift devices.~~	~~X~~	~~X~~						Covered in (02)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02)		From the given relevant diagrams describe and/or ~~i~~identify the different types of leading-edge high-lift devices ~~given a relevant diagram~~: — Krueger flaps; — variable camber flaps; — slats.	X	X						Clarity
~~LO (03)~~		~~State their effect on wing geometry.~~	~~X~~	~~X~~						Covered in (02)
(04)		Describe the function of the slot.	X	X						
(05)		Describe how the wing's effective camber increases with a leading-edge flap.	X	X						Clarity
~~LO (06)~~		~~Describe how the effective chord line differs from the normal chord line.~~	~~X~~	~~X~~						Covered in (07)
(07)		Explain ~~State~~ the~~ir~~ effect of leading-edge flaps on the stall speed, also in comparison with trailing-edge flaps.	X	X						Clarity
(08)		Compare their influence on the C_L–α graph, compared with trailing-edge flaps and a clean wing: — indicate the effect of leading-edge devices on C_{LMAX}; — explain how the C_L curve differs from that of a clean wing; — indicate the effect of leading-edge devices on the stall or critical α~~angle of attack~~.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(09)		Compare their influence on the C_L–C_D graph.	X	X						
(10)		Describe slat asymmetry: — describe the effect on aeroplane controllability.	X	X						
(11)		Explain the reasons for using leading-edge high-lift devices on take-off and landing: — explain the disadvantage of increased nose-up attitudes; — explain why take-off and landing speeds/distances are reduced~~.~~; — explain the reduced likelihood of leading-edge separation due to the increased leading-edge radius.	X	X						
081 01 09 03		***Vortex generators***								
(01)		Explain the purpose of vortex generators.	X	X						
(02)		Describe the basic operating principle of vortex generators.	X	X						
(03)		State their advantages and disadvantages.	X	X						
081 01 10 00		**Means to reduce the C_L–C_D ratio**								
081 01 10 01		***Spoilers and the reasons for their use in the different phases of flight***								
(01)		Describe the aerodynamic functioning of spoilers: — roll spoilers; — flight spoilers (speed brakes);	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— ground spoilers (lift dumpers).								
(02)		Describe the effect of spoilers on the C_L–α graph and stall speed.	X	X						
(03)		Describe the influence of spoilers on the C_L–C_D graph and lift–drag ratio.	X	X						
081 01 10 02		***Speed brakes and the reasons for their use in the different phases of flight***								
(01)		Describe speed brakes and the reasons for use in the different phases of flight.	X	X						
(02)		State their influence on the C_L–C_D graph and lift–drag ratio.	X	X						
(03)		Explain how speed brakes increase parasite drag.	X	X						
(04)		Describe how speed brakes affect the minimum drag speed.	X	X						
(05)		Describe their effect on rate and angle of descent.	X	X						
081 01 11 00		**The boundary layer**								
081 01 11 01		***Different types***								
(01)		Refer to 081 01 08 01.	X	X						
081 01 11 02		***Their advantages and disadvantages on form (pressure) drag and friction drag***								
081 01 12 00		**Aerodynamic degradation**								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 01 12 01		***Ice and other contaminants***								
(01)		Describe the locations on an aeroplane where ice build-up will occur during flight.	X	X						
(02)		Explain the aerodynamic effects of ice and other contaminants on: — lift (maximum C_L ~~lift coefficient~~); — drag; — stall speed; — stalling α~~angle of attack~~; — stability and controllability.	X	X						
(03)		Explain the aerodynamic effects of icing ~~on the various phases~~ during take-off.	X	X						
081 01 12 02		***Deformation and modification of airframe, ageing aeroplanes***								
(01)		Describe the effect of airframe deformation and modification of an ageing aeroplane on aeroplane performance.	X	X						
(02)		Explain the effect on boundary layer condition of an ageing aeroplane.	X	X						
081 02 00 00		**HIGH-SPEED AERODYNAMICS**								
081 02 01 00		**Speeds**								
081 02 01 01		***Speed of sound***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)	X	Define 'speed of sound'.	X							
(02)		Explain the variation of the speed of sound with altitude.	X							
(03)		Explain ~~Describe~~ the influence of temperature on the speed of sound.	X							Increased skill level
081 02 01 02		***Mach number***								
(01)		Define 'Mach number as a function of TAS and speed of sound'.	X							
081 02 01 03		***Influence of temperature and altitude on Mach number***								
(01)		Explain the absence of change of Mach number with varying temperature at constant flight level and calibrated airspeed.	X							
(02)		~~Referring to 081 08 01 02 and 081 08 01 03,~~ Explain the relationship ~~of~~ between Mach number, TAS and IAS during climb and descent at constant Mach number and IAS, and explain variation of lift coefficient, angle of attack, pitch and flight-path angle.	X							
(03)		~~Referring to 081 06 01 04 and 081 06 01 05,~~ Explain that maximum operating airspeed (V_{MO}) could be exceeded during a descent at constant Mach number, and that the maximum operating Mach number (M_{MO}) could be exceeded during a climb at constant IAS, if climb or descent is not managed.	X							
081 02 01 04		***Compressibility***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		State that compressibility means that density can change along a streamline, and that this occurs in the high subsonic, transonic and supersonic flow~~above~~.	X							Clarity
(02)		Describe how the streamline pattern changes due to compressibility.	X							
(03)	X	State that Mach number is a measure of compressibility.	X							
081 02 01 05		***Subdivision of aerodynamic flow***								
(01)	X	List the subdivision of aerodynamic flow: — subsonic flow; — transonic flow; — supersonic flow.	X							
(02)		Describe the characteristics of the flow regimes listed above.	X							
(03)		Explain why ~~State that~~ some transport aeroplanes normally cruise at Mach numbers above the critical Mach number (M_{CRIT}), but below the divergence Mach number ($M_{DRAG\ DIVERGENCE}$).	X							Clarity
081 02 02 00		**Shock waves**								
(01)	X	Define a 'shock wave'.	X							
081 02 02 01		***Normal shock waves***								
(01)		Describe a normal shock wave with respect to changes in:	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— static temperature; — static and total pressure; — velocity; — local speed of sound; — Mach number; — density.								
(02)		Describe a normal shock wave with respect to orientation relative to the wing surface.	X							
(03)		Explain the influence of increasing Mach number on a normal shock wave, at positive lift, with respect to: — strength; — length; — position relative to the wing; — second shock wave at the lower surface.	X							
(04)		Explain the influence of ~~angle of attack~~ α on shock-wave intensity and shock-wave location at constant Mach number.	X							Increased understanding
~~LO (05)~~		~~Discuss the bow wave.~~	~~X~~							Irrelevant for CAT aeroplanes today
~~***081 02 02 02***~~		~~***Oblique shock waves***~~								Irrelevant
~~LO (01)~~		~~Describe an oblique shock wave with respect to changes in:~~	X							Irrelevant

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~— static temperature;~~ ~~— static and total pressure;~~ ~~— velocity;~~ ~~— local speed of sound;~~ ~~— Mach number;~~ ~~— density.~~								
~~LO (02)~~		~~Compare the characteristics of normal and oblique shock waves.~~	~~X~~							Irrelevant
~~***081 02 02 03***~~		~~***Mach cone***~~								
~~LO (01)~~		~~Define 'Mach angle μ' with a formula and perform simple calculations.~~	~~X~~							Irrelevant
~~LO (02)~~		~~Identify the Mach-cone zone of influence of a pressure disturbance due to the presence of the aeroplane.~~	~~X~~							Irrelevant
~~LO (03)~~		~~Explain 'sonic boom'.~~	~~X~~							Irrelevant
081 02 03 00		**Effects of exceeding the critical Mach number (M_{CRIT})**								
081 02 03 01		***M_{CRIT}***								
(01)		Define 'M_{CRIT}'.	X							
(02)		Explain how a change in angle of attack, aeroplane weight, manoeuvres and centre-of-gravity (CG) position influences M_{CRIT}.	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 02 03 02		***Effect on lift***								
(01)		Describe the behaviour of ~~lift coefficient~~ C_L versus Mach number at constant α~~angle of attack~~.	X							
~~LO (02)~~		~~Explain shock-induced separation, shock stall, and describe its relationship with Mach buffet.~~	~~X~~							Moved to 081 03 06 00
~~LO (03)~~	~~X~~	~~Define 'shock stall'.~~ ~~*Remark: For theoretical-knowledge examination purposes, the following description is used for shock stall: Shock stall occurs when the lift coefficient, as a function of Mach number, reaches its maximum value (for a given angle of attack).*~~	~~X~~							Moved to 081 03 06 00
(04)		Explain ~~Describe~~ the advantage of ~~consequences~~ slightly exceeding M_{CRIT} with respect to the C_L and C_{LMAX}. — ~~gradient of the C_L – α graph;~~ — ~~C_{LMAX} (stall speed).~~	X							Increased skill level and clarity
(05)		Explain the change in stall indicated airspeed (IAS) with altitude.	X							
(06)		Discuss the effect on critical or stalling angle of attack.	X							
081 02 03 03		***Effect on drag***								
(01)		Describe wave drag.	X							
(02)		Describe the behaviour of ~~drag coefficient~~ C_D versus Mach	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		number at constant α~~angle of attack~~.								
(03)		Explain the effect of Mach number on the C_L–C_D graph.	X							
(04)		Describe the effects and hazards of exceeding the ~~Define~~ 'drag divergence Mach number' and explain its speed in ~~the~~ relation to ~~with~~ M_{CRIT}.	X							TEM
081 02 03 04		***Effect on pitching moment***								
(01)		Discuss the effect of Mach number on the location of CP~~centre of pressure and aerodynamic centre~~.	X							
(02)		Describe ~~Explain~~ the overall change in pitching moment from M_{CRIT} to $M_{DRAG\ DIVERGENCE}$ and explain the 'tuck under' or 'Mach tuck' effect.	X							Clarity
(03)	X	State ~~List~~ the requirement for a Mach trim system ~~methods of compensating~~ to compensate for the effect of the CP movement and tuck under effect.	X							Clarity
~~LO (04)~~		~~Discuss the aerodynamic functioning of the Mach trim system.~~	~~X~~							No practical use
(05)		Discuss the corrective measures if the Mach trim fails.	X							
081 02 03 05		***Effect on control effectiveness***								
(01)		Discuss the effects on the functioning of control surfaces.	X							
~~***081 02 04 00***~~		~~***Buffet onset***~~								Moved to 081 03 01
~~LO (01)~~		~~Explain the concept of buffet margin and describe the influence~~	~~X~~							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~of the following parameters:~~ — ~~angle of attack;~~ — ~~Mach number;~~ — ~~pressure altitude;~~ — ~~mass;~~ — ~~load factor;~~ — ~~angle of bank;~~ — ~~CG location.~~								
~~LO (02)~~		~~Explain how the buffet onset boundary chart can be used to determine manoeuvre capability.~~	~~X~~							
~~LO (03)~~		~~Describe the effect of exceeding the speed for buffet onset.~~	~~X~~							
~~LO (04)~~		~~Explain aerodynamic ceiling and 'coffin corner'.~~	~~X~~							
~~LO (05)~~		~~Explain the concept of the '1.3G' altitude.~~	~~X~~							
LO (06)		~~Find (using an example graph):~~ — ~~buffet free range;~~ — ~~aerodynamic ceiling at a given mass;~~ — ~~load factor and bank angle at which buffet occurs at a given mass, Mach number and pressure altitude.~~	~~X~~							
081 02 05 00		**Means to influence M_{CRIT}**								
081 02 05 01		***Wing sweep***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Explain the influence of the angle of sweep on: — M_{CRIT}; — effective thickness/chord change or velocity component perpendicular to the quarter chord line.	X							
(02)		Describe the influence of the angle of sweepback at subsonic speed on: — C_{LMAX}; — efficiency of and requirement for high-lift devices; — pitch-up stall behaviour.	X							Clarity
(03)		Discuss the effect of wing sweepback on drag.	X							
081 02 05 02		***Aerofoil shape***								
(01)		Explain the use of thin aerofoils with reduced camber.	X							
(02)		Explain the main purpose of supercritical aerofoils.	X							
(03)	X	Identify the shape characteristics of a supercritical aerofoil shape.	X							
(04)		Explain the advantages and disadvantages of supercritical aerofoils for wing design.	X							
081 02 05 03		***Vortex generators***								
(01)		Explain the use of vortex generators as a means to avoid or restrict flow separation caused by the presence of a normal	X							Clarity

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		shock wave.								
~~***081 02 05 04***~~		~~***Area ruling***~~								Not relevant for CAT
~~LO (01)~~		~~Explain area ruling in aeroplane design.~~	~~X~~							
081 03 00 00		**Stall, shock stall, and upset prevention and recovery**								LOs amendment recorded in relation to old text in 081 08
081 03 01 00		**The stall**								Was 081 08 00 00
081 03 01 01		***Flow separation at increasing angles of attack***								From 081 01 08 01
(01)	X	Define the 'boundary layer'.	X	X						
(02)	X	Describe the thickness of a typical laminar and turbulent boundary layer.	X	X						
~~LO (03)~~		~~List the factors that affect thickness.~~	~~X~~	~~X~~						Irrelevant
(04)		Describe the properties, advantages and disadvantages of the laminar boundary layer.	X	X						Clarity
(05)		Describe the properties, advantages and disadvantages of the turbulent layer.	X	X						Clarity
(06)		Define the 'transition point'.	X	X						
~~LO (07)~~		~~List the differences between laminar and turbulent boundary layers.~~	~~X~~	~~X~~						Covered in (04) and (05)
(08)		Explain why the laminar boundary layer separates easier than	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		the turbulent one.								
(09)		Describe why ~~List the factors that slow down~~ the airflow over the aft part of a wing ~~aerofoil~~ slows down~~ ,~~ as the angle of attack increases.	X	X						Clarity
(10)		Define the 'separation point' and describe its location as a function of angle of attack.	X	X						
(11)	X	Define the 'critical stall angle of attack'.	X	X						
(12)		Describe in straight and level flight the influence of increasing the angle of attack on: — the forward stagnation point; — the pressure distribution; — the location of the CP~~centre of pressure~~ (straight and swept back wing); — C_L ~~and L~~; — C_D and D~~;~~. — ~~the pitching moment (straight and swept back wing);~~ — ~~the downwash at the horizon stabiliser.~~	X	X						Most relevant
(13)		Explain what causes the possible natural buffet on the controls and the aeroplane in a pre-stall condition.	X	X						Clarity
(14)		Describe the effectiveness of the flight controls in a pre-stall condition.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(15)		Describe and explain the normal post-stall behaviour of a straight-wing~~/~~ aeroplane.	X	X						Clarity
(16)		Describe the effect and dangers of using the controls close to the stall.	X	X						
081 03 01 02		***The stall speed***								From old 081 08 02 00
(01)		Explain V_{S0}, V_{S1}, V_{SR}, V_{S1g}.	X	X						
(02)		Solve the 1g~~G~~ stall speed from the lift formula~~,~~ given varying: — airspeed; — C_L.	X	X						
(03)		Describe and explain the influence of the following parameters on stall speed: — CG~~centre of gravity~~; — thrust component; — slipstream; — wing loading; — mass; — wing contamination; — angle of sweep; — altitude (for compressibility effects, see 081 02 03 02).	X	X						
(04)	X	Define the ‘load factor n’.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(05)		Explain why the load factor increases in a turn.	X	X						
(06)		Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre.	X	X						
(07)		Describe and explain the influence of the 'load factor n' on stall speed.	X	X						
(08)	X	Explain the expression 'accelerated stall'. *Remark: Sometimes accelerated stall is also erroneously referred to as high-speed stall. This latter expression will not be used for S~~s~~ubject 081.*	X	X						
(09)		Calculate the change of stall speed as a function of the load factor.	X	X						
(10)		Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle.	X	X						
(11)		Calculate the change of stall speed as a function of the gross mass.	X	X						
081 03 01 03		***The initial stall in span-wise direction***								
(01)		Explain the initial stall sequence on the following planforms~~plan forms~~: — elliptical; — rectangular; — moderate and high taper;	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— sweepback or delta.								
(02)		Explain the purpose of ~~influence~~ of ~~geometric twist (~~washout.~~)~~ ~~and aerodynamic twist.~~	X	X						
(03)		Explain the effect ~~influence~~ of ~~deflected~~ ailerons~~ deflection.	X	X						Clarity
(04)		Explain the influence of fences, vortilons, saw teeth, vortex generators and chines on engine nacelles.	X	X						Updating
081 03 01 04		***Stall warning***								
(01)	X	Explain why stall warning is necessary.	X	X						
(02)	X	Explain when aerodynamic and artificial stall warnings are used.	X	X						
(03)		Explain why CS-23 and CS-25 require a margin to stall speed for take-off and landing speeds.	X	X						Clarity
(04)		Describe: — buffet; — stall strip; — flapper switch (leading-edge stall-warning vane); — angle-of-attack vane; — angle-of-attack probe; — stick shaker.	X	X						
(05)		Describe the recovery after:	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— stall warning; — stall; — stick-pusher actuation.								
081 03 01 05		***Special phenomena of stall***								From 081 01 08 05
(01)		Describe the basic stall requirements for commercial air transport (CAT) ~~category~~ aeroplanes.	X	X						
(02)		Explain the difference between power-off and power-on stalls and recovery.	X	X						
(03)		Describe stall and recovery in a climbing and descending turn.	X	X						
(04)		Describe the effect on stall and recovery characteristics of: — wing sweep (~~consider both forward and~~ backward sweep); — T-tailed aeroplane~~;~~. ~~— canards.~~	X	X						Forward seep and canards irrelevant for CAT aeroplanes today
(05)		Describe super-stall or deep stall.	X	X						
(06)		Describe the philosophy behind the stick-pusher system.	X	X						
(07)		Explain the effect of ice, frost or snow on the stagnation point.	X	X						
(08)		Danger of and reason for the a~~A~~bsence of stall warning.	X	X						TEM
(09)		Abnormal behaviour of the stall.	X	X						
(10)		Describe and explain the cause and effects of the stabiliser stall	X	X						TEM

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		caused by ice (negative tail stall).								
(11)		Describe when to expect in-flight icing.	X	X						
(12)		Explain how the effect is changed when retracting/extending lift augmentation devices.	X	X						
(13)		Describe how to recover from a stall after a configuration change caused by in-flight icing.	X	X						
(14)		Explain the effect of a contaminated wing on the stall speed and critical angle of attack.	X	X						Clarity
(15)		Explain what 'on-ground' icing is.	X	X						
(16)		Describe the aerodynamic effects and hazards of de-icing/anti-iceing fluid after the holdover time has been reached.	X	X						TEM
(17)		Describe the aerodynamic effects of heavy tropical rain on stall speed and drag, and the appropriate mitigation in such conditions.	X	X						TEM
081 03 01 06		***The spin***								
(01)		Explain how to avoid spins.	X	X						From 081 01 08 05 (18)
(02)		List the factors that cause a spin to develop.	X	X						From 081 01 08 05 (19)
(03)		Describe an 'incipient', 'developing' and 'developed' spin, recognition and recovery.	X	X						From 081 01 08 05 (20), with additional wording relating to UPRT

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(04)		Describe the differences in spin attitude with forward and aft CG. ~~Recovery techniques for aeroplanes that have different mass distributions between the wings and the fuselage.~~	X	X						From 081 01 08 05 (21) Later section irrelevant for CAT aeroplanes
081 03 02 00		**Shock s~~s~~tall**								From 081 02 03
(01)		Explain shock-induced separation, shock stall, and describe its relationship with Mach buffet.	X							
(02)	**X**	Define 'shock stall'. *Remark: For theoretical knowledge examination purposes, the following description is used for shock stall: Shock stall occurs when the lift coefficient, as a function of Mach number, reaches its maximum value (for a given angle of attack).*	X							
081 03 02 01		***Buffet onset***								From 081 02 04 00
(01)		Explain the concept of buffet margin and describe the influence of the following parameters: — α~~Angle of attack~~; — Mach number; — pressure altitude; — mass; — load factor; — angle of bank; — CG location.	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02)		Explain how the buffet onset boundary chart can be used to determine if buffet may occur in turbulence, which causes the load factor to increase by a specific margin (normally 0.3)~~manoeuvre capability~~.	X							Increased understanding
(03)		Describe the effect of exceeding the speed for buffet onset.	X							
(04)		Explain 'aerodynamic ceiling' and 'coffin corner'.	X							
(05)		Explain the concept of the '1.3g~~G~~' altitude.	X							
(06)		Find (using an example graph): — buffet free range; — aerodynamic ceiling at a given mass; — load factor and bank angle at which buffet occurs at a given mass, Mach number and pressure altitude.	X							
(07) New		Explain why descent increases the buffet free range.	X							Required understanding
081 03 03 00		**Situations in which buffet or stall could occur**								New subtopic
(01)		Explain why buffet or stall could occur in the following pilot-induced situations, and the methods to mitigate them: — take-off with or without error in extension of leading-edge devices; — steep turns; — go-around using take-off/go-around (TOGA) setting	X	X						Required understanding and TEM

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		(underslung engines).								
(02)		Explain why buffet or stall could occur in the following environmental conditions at low altitude, and how to mitigate them: — thunderstorms; — wind shear and microburst; — turbulence; — wake turbulence; — icing conditions.	X	X						Required understanding and TEM
(03)		Explain why buffet or stall could occur in the following environmental conditions at high altitude, and how to mitigate them: — thunderstorms in the intertropical convergence zone (ITCZ); — jet streams; — clear air turbulence.	X							Required understanding and TEM
(04)		Explain why buffet or stall could occur in the following situations, and how to mitigate them: — inappropriate climb mode at higher altitude; — loss of or unreliable airspeed indication.	X	X						Required understanding and TEM
081 03 04 00		**Recognition of stalled condition**								New subtopic

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Explain why a stalled condition can occur at any airspeed, or attitude or altitude.								Required understanding
(02)		Explain that a stall may be recognised by continuous stall-warning activation accompanied by at least one of the following: — buffet, that can be heavy; — lack of pitch authority; — inability to arrest the descent rate.								Required understanding
(03)		Explain that 'stall warning' means a natural or synthetic indication provided when approaching the stall that may include one or more of the following indications: — aerodynamic buffeting; — reduced roll stability and aileron effectiveness; — visual or aural clues and warnings; — reduced elevator (pitch) authority; — inability to maintain altitude or arrest a rate of descent; — stick-shaker activation.								Required understanding
081 04 00 00		**STABILITY**								
081 04 01 00		**Static and dynamic stability**								
081 04 01 01		***Basics and definitions***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Define 'static stability': — describe/identify a statically stable, neutral and unstable condition (positive, neutral and negative static stability).	X	X						
(02)		Explain manoeuvrability.	X	X						
(03)		Explain why static stability is the opposite of manoeuvrability, and why CAT aeroplanes are designed to be statically stable.	X	X						Clarity
(04)		Define 'dynamic stability': — describe/identify a dynamically stable, neutral and unstable motion (positive, neutral and negative dynamic stability); — describe/identify periodic and aperiodic motion.	X	X						
(05)		Explain what combinations of static and dynamic stability will return an aeroplane to the equilibrium state after a disturbance.	X	X						
081 04 01 02		***Precondition for static stability***								
(01)	X	Explain an equilibrium of forces and moments as the condition for the concept of static stability.	X	X						
081 04 01 03		***Sum of forces***								
(01)	X	Identify the forces considered in the equilibrium of forces.	X	X						
081 04 01 04		***Sum of moments***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Identify the moments about all three axes considered in the equilibrium of moments.	X	X						
(02)		Discuss the effect of sum of moments not being zero.	X	X						
081 04 02 00		**Intentionally left blank**								
081 04 03 00		**Static and dynamic longitudinal stability**								
081 04 03 01		***Methods for achieving balance***								
(01)	X	Explain the stabiliser ~~and the canard~~ as the means to satisfy the condition of nullifying the total sum of the moments about the lateral axis.	X	X						Canard irrelevant for CAT today
(02)		Explain the influence of the location of the wing CP ~~centre of pressure~~ relative to the CG~~centre of gravity~~ on the magnitude and direction of the balancing force on the stabiliser ~~and canard~~.	X	X						
~~LO (03)~~		~~Explain the influence of the indicated airspeed on the magnitude and direction of the balancing force on stabiliser and canard.~~	X	X						Not essential for line pilot
~~LO (04)~~		~~Explain the influence of the balancing force on the magnitude of the wing/fuselage lift.~~	~~X~~	~~X~~						Not essential for line pilot
(05)		Explain the use of the elevator deflection or stabiliser angle for the generation of the balancing force and its direction.	X	X						Clarity

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(06)		Explain the elevator deflection required to balance thrust changes.	X	X						
081 04 03 02		***Static longitudinal stability***								
~~LO (01)~~		~~Explain the changes in aerodynamic forces when varying angle of attack for a static longitudinally stable aeroplane.~~	~~X~~	~~X~~						Not essential
(02)		Discuss the effect of the CG location on pitch manoeuvrability and longitudinal stability.	X	X						Increased understanding
081 04 03 03		***Neutral point***								
(01)	X	Define 'neutral point'.	X	X						
(02)	X	Explain why the location of the neutral point is only dependent on the aerodynamic design of the aeroplane.	X	X						
081 04 03 04		***Factors affecting neutral point***								
(01)		Describe ~~Indicate~~ the location of the neutral point relative to the locations of the aerodynamic centre of the wing and tail~~/canard~~.	~~X~~	~~X~~						Increased skill level
~~LO (02)~~		~~Explain the influence of the downwash variations with angle-of-attack variation on the location of the neutral point.~~	~~X~~	~~X~~						Not essential for line pilot
~~LO (03)~~		~~Explain the contribution of engine nacelles.~~	~~X~~	~~X~~						Not essential for line pilot
081 04 03 05		***Location of centre of gravity (CG)***								
(01)		Explain the influence of the CG location on the static	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		longitudinal stability of the aeroplane.								
(02)		Explain the CG forward and aft limits with respect to: — longitudinal control forces; — elevator effectiveness; — stability.	X	X						Split from (01)
(03)	~~X~~	Define 'static margin'.	~~X~~	~~X~~						Split from (01)
081 04 03 06		***~~The C_m–α graph~~ Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Define the 'aerodynamic pitching moment coefficient (C_m)'.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Describe the C_m–α graph with respect to:~~ ~~— positive and negative sign;~~ ~~— linear relationship;~~ ~~— angle of attack for equilibrium state;~~ ~~— relationship between the slope of the graph and static stability.~~	~~X~~	~~X~~						
081 04 03 07		***~~Factors affecting the C_m–α graph~~ Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain:~~ ~~— the effect on the C_m–α graph of a shift of CG in the forward and aft direction;~~ ~~— the effect on the C_m–α graph when the elevator is moved up or down;~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— ~~the effect on the C_m–α graph when the trim is moved;~~ — ~~the effect of the wing contribution and how it is affected by CG location;~~ — ~~the effect of the fuselage contribution and how it is affected by CG location;~~ — ~~the tail contribution;~~ — ~~the effect of aerofoil camber change.~~								
081 04 03 08		~~***The elevator position versus speed graph (IAS)***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Describe the elevator position speed graph.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Explain:~~ — ~~the gradient of the elevator position speed graph;~~ — ~~the influence of the airspeed on the stick position stability.~~	~~X~~	~~X~~						
081 04 03 09		~~***Factors affecting the elevator position–speed graph***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain the contribution on the elevator position–speed graph of:~~ — ~~the location of centre of gravity;~~ — ~~the trim (trim tab and stabiliser trim);~~ — ~~high-lift devices.~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 04 03 10		***~~The stick force versus speed graph (IAS)~~ Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Define the 'stick force speed graph'.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Describe the minimum gradient for stick force versus speed that is required for certification according to CS 23 and CS 25.~~	~~X~~	~~X~~						
~~LO (03)~~		~~Explain the importance of the stick force gradient for good flying qualities of an aeroplane. Trim speed and CG~~	~~X~~	~~X~~						
~~LO (04)~~		~~Identify the trim speed in the stick force speed graph.~~	~~X~~	~~X~~						
~~LO~~		~~Explain how a pilot perceives stable static longitudinal stick force stability.~~	~~X~~	~~X~~						
081 04 03 11		***~~Factors affecting the stick force versus speed graph~~ Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain the contribution of:~~ ~~— the location of the centre of gravity;~~ ~~— the trim (trim tab and stabiliser trim);~~ ~~— down spring;~~ ~~— bob weight;~~ ~~— friction.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Explain the contribution of Mach number — Ref. 081 02 03 04.~~	~~X~~							
081 04 03 12		***The manoeuvring stability/stick force per g~~G~~***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)	X	Define the 'stick force per 'G', and describe that the stick force increases linearly with increase in 'G'.	X	X						Increased understanding
(02)		Explain why: — the stick force per G has a prescribed minimum and maximum value; — the stick force per G decreases with pressure altitude at the same indicated airspeed.	X	X						
081 04 03 13		***Intentionally left blank***								
081 04 03 14		~~***Factors affecting the manoeuvring stability/stick force per G***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain the influence on stick force per G of:~~ ~~— CG location;~~ ~~— trim setting;~~ ~~— a down spring in the control system;~~ ~~— a bob weight in the control system.~~	~~X~~	~~X~~						
081 04 03 15		~~***Stick force per G and the limit load factor***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain why the prescribed minimum and maximum values of the stick force per G are dependent on the limit load factor.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Calculate the stick force to achieve a certain load factor at a~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~given manoeuvre stability.~~								
081 04 03 16		***Dynamic longitudinal stability***								
(01)		Describe the phugoid and short-period motion in terms of period, damping, variations (if applicable) in speed, altitude and angle of attack.	X	X						
(02)		Explain why the short-period motion is more hazardous ~~important for flying qualities~~ than the phugoid.	X	X						Clarity
(03)		~~Define and d~~Describe 'pilot-induced oscillations'.	X	X						
(04)		Explain the effect of high altitude on dynamic stability.	X	X						
(05)		Describe the influence of the CG location on the dynamic longitudinal stability of the aeroplane.	X	X						
081 04 04 00		**Static directional stability**								
(01)	X	Define 'static directional stability'.	X	X						
(02)		Explain the effects of static directional stability being too weak or too strong.	X	X						
081 04 04 01		***Sideslip angle ~~β~~***								
(01)		Define 'sideslip angle'.	X	X						
~~LO (02)~~		~~Identify β as the symbol used for the sideslip angle.~~	~~X~~	~~X~~						Not essential for line pilot
081 04 04 02		***~~Yaw-moment coefficient C_n~~ Intentionally left blank***								Not essential for line pilot

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~LO (01)~~		~~Define the 'yawing-moment coefficient C_n'.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Define the relationship between C_n and β for an aeroplane with static directional stability.~~	~~X~~	~~X~~						
081 04 04 03		***~~C_n –β graph~~ Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Explain why:~~ ~~— C_n depends on the angle of sideslip;~~ ~~— C_n equals zero for that angle of sideslip that provides static equilibrium about the aeroplane's normal axis;~~ ~~— if no asymmetric engine thrust, flight control or loading condition prevails, the equilibrium angle of sideslip equals zero.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Identify how the slope of the C_n–β graph is a measure for static directional stability.~~	~~X~~	~~X~~						
081 04 04 04		***Factors affecting static directional stability***								
(01)		Describe how the following aeroplane components contribute to static directional stability: — wing; — fin; — dorsal fin; — ventral fin; — angle of sweep of the wing;	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— angle of sweep of the fin; — fuselage at high angles of attack; — strakes.								
(02)		Explain why both the fuselage and the fin contribution reduce static directional stability when the CG moves aft.	X	X						
081 04 05 00		**Static lateral stability**								
(01)	X	Define 'static lateral stability'.	X	X						
(02)		Explain the effects of static lateral stability being too weak or too strong.	X	X						
081 04 05 01		***Bank angle Ø***								
(01)	X	Define 'bank angle Ø'.	X	X						
081 04 05 02		~~***The roll moment coefficient C_l***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Define the 'roll moment coefficient C_l'.~~	~~X~~	~~X~~						
081 04 05 03		***Contribution of sideslip angle β***								
(01)		Explain how without coordination the bank angle creates sideslip angle.	X	X						
081 04 05 04		~~***The C_l–β graph***~~ ***Intentionally left blank***								Not essential for line pilot
~~LO (01)~~		~~Describe C_l–β graph.~~	~~X~~	~~X~~						
~~LO (02)~~		~~Identify the slope of the C_l–β graph as a measure for static~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		~~lateral stability.~~								
081 04 05 05		***Factors affecting static lateral stability***								
(01)		Explain the contribution to the static lateral stability of: — dihedral, anhedral; — high wing, low wing; — sweep angle of the wing; — ventral fin; — vertical tail.	X	X						
(02)	X	Define 'dihedral effect'.	X	X						
081 04 05 06		***Intentionally left blank***								
081 04 06 00		**Dynamic lateral/directional stability**								
~~***081 04 06 01***~~		~~***Effects of asymmetric propeller slipstream***~~ ***Intentionally left blank***								Covered in other 081 LOs
081 04 06 02		***Tendency to spiral dive***								
(01)		Explain how lateral and directional stability are coupled.	X	X						
(02)		Explain how high-static directional stability and ~~a~~ low-static lateral stability may cause spiral divergence (unstable spiral dive), and under which conditions the spiral dive mode is neutral or stable.	X	X						
(03)		Describe an unstable spiral dive mode with respect to	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		deviations in speed, bank angle, nose low-pitch attitude and decreasing altitude.								
081 04 06 03		***Dutch roll***								
(01)		Describe Dutch roll.	X	X						
(02)		Explain: — why Dutch roll occurs when the static lateral stability is large compared to~~with~~ static directional stability; — the condition for a stable, neutral or unstable Dutch roll motion; — the function of the yaw damper; — the actions to be taken in case of non-availability of the yaw damper.	X	X						
(03)		State the effect of Mach number on Dutch roll.	X							
081 04 06 04		***Effects of altitude on dynamic stability***								
(01)		Explain that increased pressure altitude reduces dynamic lateral/directional stability.	X	X						
081 05 00 00		**CONTROL**								
081 05 01 00		**General**								
081 05 01 01		***Basics~~,~~ — T~~t~~he three planes and three axes***								
(01)	X	Define:	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— lateral axis; — longitudinal axis; — normal axis.								
(02)	X	Define: — pitch angle; — bank angle; — yaw angle.	X	X						
(03)		Describe the motion about the three axes.	X	X						
(04)		Name and describe the devices that control these motions.	X	X						
081 05 01 02		***Camber change***								
(01)		State that ~~Explain how~~ camber is changed by movement of a control surface and explain the effect.	X	X						Relevance
~~***081 05 01 03***~~		~~***Angle of attack change***~~								Not essential for line pilot
~~LO (01)~~		~~Explain the influence of local angle-of-attack change by movement of a control surface.~~	~~X~~	~~X~~						
081 05 02 00		**Pitch (longitudinal) control**								
081 05 02 01		***Elevator/all-flying tails***								
(01)		Explain the working principle of the elevator/all-flying tail and describe its function.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
~~081 05 02 01 02~~		~~Describe the loads on the tailplane over the whole speed range.~~	~~X~~	~~X~~						Not essential for line pilot
081 05 02 02		***Downwash effects***								
(01)		Explain the effect of downwash on the tailplane angle of attack.	X	X						
(02)		Explain in this context the use of a T-tail or stabiliser trim.	X	X						
081 05 02 03		***~~Ice on tail~~ Intentionally left blank***								Covered in 081 01 08 05 (10)
~~LO (01)~~		~~Explain how ice can change the aerodynamic characteristics of the tailplane.~~	X	X						
~~LO (02)~~		~~Explain how this can affect the tail's proper function.~~	X	X						
081 05 02 04		***Location of centre of gravity (CG)***								
(01)		Explain the relationship between elevator deflection and CG location to produce a given aeroplane response.	X	X						
(02)		Explain the effect of forward CG limit on pitch control.	X	X						
081 05 02 05		***Moments due to engine thrust***								
(01)		Describe the effect of engine thrust on pitching moments for different engine locations.	X	X						
081 05 03 00		**Yaw (directional) control**								
(01)		Explain the working principle of the rudder and describe its function.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— State the relationship between rudder deflection and the moment about the normal axis~~;~~. — Describe the effect of sideslip on the moment about the normal axis.								
081 05 03 01		***Rudder limiting***								
(01)		Explain why and how rudder deflection is limited on CAT~~transport~~ aeroplanes.	X							
081 05 04 00		**Roll (lateral) control**								
081 05 04 01		***Ailerons***								
(01)		Explain the functioning of ailerons.	X	X						
(02)		Describe the adverse effects of ailerons. *(Refer to 081 05 04 04 and 081 06 01 02)*	X	X						
(03)		Explain why some aeroplanes have ~~in this context the use of~~ inboard and outboard ailerons.	X	X						Clarity
(04)		Describe ~~Explain~~ under which general conditions the outboard aileron~~'~~s are locked out ~~the general conditions under which this feature is used~~.	X	X						Clarity
(05)		Describe the use of aileron deflection in normal flight, flight with sideslip, crosswind landings, horizontal turns, flight with one engine out.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(06)	X	Define 'roll rate'.	X	X						
(07)	X	List the factors that affect roll rate.	X	X						
(08)		Describe f~~F~~laperons~~,~~ and aileron droop.	X	X						
081 05 04 02		***Intentionally left blank***								
081 05 04 03		***Spoilers***								
(01)		Explain how spoilers can be used to control the rolling movement in combination with or instead of the ailerons.	X	X						
081 05 04 04		***Adverse yaw***								
(01)		Explain why ~~how~~ the use of ailerons induces adverse yaw.	X	X						
081 05 04 05		***Means to avoid adverse yaw***								
(01)		Explain how the following reduce adverse yaw: — Frise ailerons; — differential aileron deflection; — rudder aileron cross-coupling; — roll spoilers.	X	X						
081 05 05 00		**Roll/yaw interaction**								
(01)		Explain the secondary effect of roll.	X	X						
(02)		Explain the secondary effect of yaw.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 05 06 00		**Means to reduce control forces**								
081 05 06 01		***Aerodynamic balance***								
(01)		Describe the purpose of aerodynamic balance.	X	X						
(02)		Describe the working principle of the ~~nose and~~ horn balance.	X	X						
(03)		Describe the working principle of the internal balance.	X	X						
(04)		Describe the working principle and the application of: — balance tab; — anti-balance tab; — spring tab; — servo tab.	X	X						
081 05 06 02		***Artificial means***								
(01)		Describe fully powered controls.	X	X						
(02)		Describe power-assisted controls.	X	X						
(03)		Describe ~~Explain why~~ artificial feel ~~is required~~.	X	X						
~~LO (04)~~		~~Explain the inputs to an artificial feel system.~~	~~X~~	~~X~~						Irrelevant
~~**081 05 07 00**~~		~~**Mass balance**~~								LO moved to 081 06 01 01
~~LO (01)~~		~~Refer to 081 06 01 01 for mass balance.~~ ~~Refer to 081 04 03 11 and 081 04 03 14 for bob weight.~~	~~X~~	~~X~~						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 05 08 00		**Trimming**								
081 05 08 01		***Reasons to trim***								
(01)		State the reasons for trimming devices.	X	X						
(02)		Explain the difference between a trim tab and the various balance tabs.	X	X						
081 05 08 02		***Trim tabs***								
(01)		Describe the working principle of a trim tab ~~including cockpit indications~~.	X	X						
081 05 08 03		***Stabiliser trim***								
(01)		Explain the advantages and disadvantages of a stabiliser trim compared to~~with~~ a trim tab.	X	X						
~~LO (02)~~		~~Explain elevator deflection when the aeroplane is trimmed in the case of fully powered and power-assisted pitch controls.~~	~~X~~	~~X~~						Not relevant for line pilot
(03)		Explain the relationship between CG position, take-off trim setting ~~factors influencing~~ and stabiliser trim position ~~setting~~.	X	X						Clarity
(04)		Explain the effect of errors in ~~influence of~~ the take-off stabiliser trim setting on the rotation characteristics and stick force during take-off rotation ~~at extremes of CG position~~.	X	X						TEM
(05)		Discuss the effects of jammed and runaway stabiliser.	X	X						
(06)		Explain the landing considerations with a jammed stabiliser.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 06 00 00		**LIMITATIONS**								
081 06 01 00		**Operating limitations**								
081 06 01 01		***Flutter***								
(01)		Describe the phenomenon of flutter and how IAS and mass distribution affects the likelihood of flutter occurrence. ~~list the factors:~~ — ~~elasticity;~~ — ~~backlash;~~ — ~~aeroelastic coupling;~~ — ~~mass distribution;~~ — ~~structural properties~~ — ~~IAS.~~	X	X						Removal of non-essential facts
~~LO (02)~~		~~List the flutter modes of an aeroplane:~~ — ~~wing.~~ — ~~tailplane.~~ — ~~fin.~~ — ~~control surfaces including tabs.~~	~~X~~	~~X~~						Not essential for line pilot
(03)		Describe the use of mass balance to alleviate the flutter problem by adjusting the mass distribution: — wing-mounted engines on pylons;	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— control surface mass balance.								
(04)		State how to avoid flutter, and possible actions if flutter occurred. ~~List the possible actions in the case of flutter in flight.~~	X	X						
081 06 01 02		***Aileron reversal***								
(01)		Describe the phenomenon of aileron reversal: — at low speeds; — at high speeds. Describe the aileron reversal speed in relationship to V_{NE} and V_{NO}.	X	X						
081 06 01 03		***Landing gear/flap operating***								
(01)		Describe the reason for flap/landing gear limitations. — define 'V_{LO}'; — define 'V_{LE}'.	X	X						
(02)		Explain why there is a difference between V_{LO} and V_{LE} in the case of some aeroplane types.	X	X						
(03)		Define 'V_{FE}' and describe flap-limiting speeds.	X	X						Increased understanding
(04)		Describe flap design features, procedures and warnings to prevent overload.	X	X						TEM
081 06 01 04		***V_{MO}, V_{NO}, V_{NE}***								
(01)	X	Define 'V_{MO}', 'V_{NO}', 'V_{NE}'.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02)		Describe ~~the differences between~~ V_{MO}, V_{NO} and V_{NE}, the relevance of the airspeed on which they are based, and the differences between the airspeeds.	X	X						Increased understanding
(03)		Explain the hazards ~~dangers~~ of flying at speeds close to V_{NE} and V_{MO}.	X	X						
081 06 01 05		***M_{MO}***								
(01)		Define 'M_{MO}' and state its limiting factors.	X							
081 06 02 00		**Manoeuvring envelope**								
081 06 02 01		***Manoeuvring-load diagram***								
(01)		Describe the manoeuvring-load diagram.	X	X						
(02)		Define limit and ultimate load factor, and explain what can happen if these values are exceeded.	X	X						
(03)		Define 'V_A', 'V_C', 'V_D'.	X	X						
(04)		Identify the varying features on the diagram: — load factor 'n'; — speed scale, equivalent airspeed~~, EAS~~; — equivalent airspeed boundary; — C_{LMAX} boundary; — 1g stall speed; — accelerated stall boundary ~~speed~~ (refer to 081 01 08 02).	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(05)		Describe the relationship between V_{MO} or V_{NE} and V_C.	X	X						
(06)		State all the manoeuvring limit load factors applicable to CS-23 and CS-25 aeroplanes.	X	X						
(07)		Explain the relationship between V_A and V_S in a formula, and calculate the values.	X	X						Increased skill level
(08)		Explain the significance of V_A and the adverse consequences of applying full, abrupt nose-up elevator deflection when exceeding V_A.	X	X						Clarity
081 06 02 02		***Factors affecting the manoeuvring-load diagram***								
(01)		State the relationship of mass to: — load-factor limits; — accelerated stall speed boundary limit; — V_A ~~and V_C.~~ and explain why if a single value for V_A is given, it will be at the aeroplane's maximum structural take-off mass and at low altitude.	X	X						Clarity and completeness
~~LO (02)~~		~~Explain the relationship between V_A, aeroplane mass and altitude.~~ Calculate the change of V_A with changing mass.	~~X~~	~~X~~						Part in 081 06 02 02 (01), second section was in 081 02 02 01
~~LO (03)~~		~~Describe the effect of altitude on Mach number, with respect to limitations.~~	~~X~~							Was 081 06 02 02 02, in (04) below
(04)		Explain why V_A loses significance at higher altitude where	X							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		compressibility effects occur.								
(05)	X	Define 'M_C' and 'M_D' and their relation with 'V_C' and 'V_D'.	X							
081 06 03 00		**Gust envelope**								
081 06 03 01		***Gust-load diagram***								
(01)		Recognise a typical gust-load diagram, and state the minimum gust speeds in ft/s, m/s and kt that the aeroplane must be designed to withstand at V_B to V_C and V_D.	X	X						Increased understanding
~~LO (02)~~		~~Identify and describe the various features shown on the diagram:~~ — ~~gust load factor 'n';~~ — ~~speed scale, equivalent airspeed and EAS;~~ — ~~C_{LMAX} boundary;~~ — ~~vertical gust velocities;~~ — ~~relationship of V_B to V_C and V_D.~~ — ~~gust limit load factor.~~	~~X~~	~~X~~						Not essential for line pilot
~~LO (03)~~		~~Define 'V_{RA}', 'V_B'.~~	~~X~~	~~X~~						
(04)		Discuss considerations for the selection of V_{RA} ~~this speed~~.	X	X						
(05)		Explain the adverse effects on the aeroplane when flying in turbulence.	X	X						
081 06 03 02		***Factors affecting the gust-load diagram***								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(01)		Describe and e~~E~~xplain the relationship between the gust-load factor and the lift-curve slope, aspect ratio, angle of sweep, altitude~~density ratio~~, wing loading, weight, wing area, equivalent airspeed (EAS), and speed of vertical gust.~~and equivalent vertical sharp-edged gust velocity and perform relevant calculations.~~	X	X						Clarity
(02) New		Explain why aeroplane types of different planforms and weights experience different gust-load factors from the same gust velocity, and discuss the significance of this.	X	X						Application
081 07 00 00		**PROPELLERS**								
081 07 01 00		**Conversion of engine torque to thrust**								
(01)		Explain the resolution of aerodynamic force on a propeller blade element into lift and drag or into thrust and torque.	X	X						
(02)		Describe how propeller thrust and aerodynamic torque vary ~~and their variation~~ with IAS.	X	X						
081 07 01 01		***Relevant propeller parameters***								
(01)		Describe the geometry of a typical propeller blade element at the reference section: — blade chord line; — propeller rotational velocity vector; — true airspeed vector;	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— blade angle of attack; — pitch or blade angle; — advance or helix angle; — define 'geometric pitch', 'effective pitch' and 'propeller slip'. *Remark: For theoretical knowledge examination purposes, the following definition is used for geometric pitch: the theoretical distance a propeller would advance in one revolution at zero blade angle of attack.*								
(02)		Describe how the terms ~~Define~~ 'fine pitch' and 'coarse pitch' can be used to express blade angle.	X	X						Clarity
081 07 01 02		***Blade twist***								
(01)	X	Define 'blade twist'.	X	X						
(02)		Explain why blade twist is necessary.	X	X						
081 07 01 03		***Fixed pitch and variable pitch/constant speed***								
(01)	X	List the different types of propellers: — fixed pitch; — adjustable pitch or variable pitch (non-governing); — variable pitch (governing)/constant speed.	X	X						
(02)		Discuss the advantages and disadvantages of fixed-pitch and constant-speed propellers.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(03)		Discuss climb and cruise propellers.	X	X						
(04)		Explain the relationship between blade angle, blade angle of attack and airspeed for fixed and variable pitch propellers.	X	X						
(05)		Describe ~~Given a diagram,~~ and explain the forces acting on a rotating blade element in normal, feathered, windmilling and reverse operation.	X	X						Clarity
(06)		Explain the effects of changing propeller pitch at constant IAS.	X	X						
081 07 01 04		***Propeller efficiency versus speed***								
(01)		Define 'propeller efficiency'.	X	X						
(02)		Explain and describe the relationship between propeller efficiency and speed (TAS) for different types of propellers.	X	X						Clarity
~~LO (03)~~		~~Plot propeller efficiency against speed for the types of propellers listed in 081 07 01 03 above.~~	X	X						Included above
(04)		Explain the relationship between blade angle and thrust.	X	X						
081 07 01 05		***Effects of ice on propeller***								
(01)		Describe the effects and hazards of ice on a propeller.	X	X						TEM
081 07 02 00		**Engine failure**								
081 07 02 01		***Windmilling drag***								
(01)		Describe ~~List~~ the effects of an inoperative engine on the	X	X						Increased skill level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		performance and controllability of an aeroplane: — thrust loss/drag increase; — influence on yaw moment during asymmetric power.								
081 07 02 02		***Feathering***								
(01)		Explain the reasons for feathering a propeller including the effect on the yaw moment, performance and controllability.	X	X						Clarity
~~LO (02)~~		~~Influence on yaw moment during asymmetric power.~~	~~X~~	~~X~~						In above LO
081 07 03 00		**Design features for power absorption**								
(01)	X	Name ~~Describe~~ the ~~factors of~~ propeller design characteristics that increase power absorption.	X	X						
~~081 07 03 01~~		***~~Aspect ratio of blade~~ Intentionally left blank***								Not relevant (comment on NPA 2014-29 (D)(2))
~~LO (01)~~		~~Define 'blade-aspect ratio'.~~	~~X~~	~~X~~						
081 07 03 02		***Diameter of propeller***								
(01)		Explain the reasons for restricting propeller diameter.	X	X						
081 07 03 03		***Number of blades***								
(01)	X	Define 'solidity'.	X	X						
(02)		Describe the advantages and disadvantages of increasing the	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		number of blades.								
081 07 03 04		***Propeller noise***								
(01)	X	Describe ~~Explain~~ how propeller noise can be minimised.	X	X						
081 07 04 00		**Secondary effects of propellers**								
081 07 04 01		***Torque reaction***								
(01)		Describe the effects of engine/propeller torque.	X	X						
(02)		Describe the following methods for counteracting engine/propeller torque: — counter-rotating propellers; — contra-rotating propellers.	X	X						
081 07 04 02		***Gyroscopic precession***								
(01)	X	Describe what causes gyroscopic precession.	X	X						
(02)		Describe the effect on the aeroplane due to the gyroscopic effect.	X	X						
081 07 04 03		***~~Asymmetric s~~Slipstream effect***								
(01)		Describe the possible ~~asymmetric~~ effects of the rotating propeller slipstream.	X	X						
081 07 04 04		***Asymmetric blade effect***								
(01)		Explain the asymmetric blade effect (also called P factor).	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02)		Explain the influence of direction of rotation on critical engine on twin-engine aeroplanes.	X	X						
081 07 04 05		***Hazards and management of propeller effects***								New paragraph
(01) New		Describe, given direction of propeller rotation, the propeller effects and their management during take-off run, rotation and initial climb.	X	X						Application
(02) New		Describe, given the direction of propeller rotation, the propeller effects and management during a go-around.	X	X						Application
(03) New		Describe situations in which the propeller effects during a go-around are more hazardous.	X	X						TEM
081 08 00 00		**FLIGHT MECHANICS**								
081 08 01 00		**Forces acting on an aeroplane**								
081 08 01 01		***Straight, horizontal, steady flight***								
(01)	X	Describe the forces acting on an aeroplane in straight, horizontal, steady flight.	X	X						
(02)	X	List the four forces and state where they act.	X	X						
(03)		Explain how the four forces are balanced including the function of the tailplane.	X	X						Clarity
~~LO (04)~~		~~Describe the function of the tailplane.~~	~~X~~	~~X~~						Combined with 081 08 01 01 (03)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 08 01 02		***Straight, steady climb***								
(01)	X	Define 'γ flight-path angle'.	X	X						
(02)		Describe the relationship between pitch attitude, flight-path angle and angle of attack for the zero-wind and zero-bank ~~and sideslip~~ conditions.	X	X						
(03)		Describe the forces acting on an aeroplane in a straight, steady climb.	X	X						
(04)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula relating to the parallel forces ($T = D + W \sin \gamma$). — Apply the formula relating to the perpendicular forces ($L = W \cos \gamma$).	X	X						
(05)		Explain why thrust is greater than drag.	X	X						
(06)		Explain why lift is less than weight.	X	X						
(07)		Explain the formula (for small angles) giving the relationship between flight-path angle, thrust, weight and lift–drag ratio, and use this formula for simple calculations.	X	X						
(08)		Explain how IAS, angle of attack and flight-path angle change in a climb performed with constant pitch attitude and normal thrust decay with altitude.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 08 01 03		***Straight, steady descent***								
(01)		Describe the forces acting on an aeroplane in a straight, steady descent.	X	X						
(02)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula for forces parallel to the direction of flight ($T = D – W \sin \gamma$). — Apply the formula relating to the perpendicular forces ($L = W \cos \gamma$).	X	X						
(03)		Explain why lift is less than weight.	X	X						
(04)		Explain why thrust is less than drag.	X	X						
081 08 01 04		***Straight, steady glide***								
(01)	X	Describe the forces acting on an aeroplane in a straight, steady glide.	X	X						
(02)		Name the forces parallel and perpendicular to the direction of flight. — Apply the formula for forces parallel to the direction of flight ($D = W \sin \gamma$)~~;~~. — Apply the formula for forces perpendicular to the direction of flight ($L = W \cos \gamma$).	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(03)		Describe the relationship between the glide gradient ~~angle~~ and the lift–drag ratio, calculate glide range from given data and discuss relevance.	X	X						Application
(04)		Explain ~~Describe~~ the relationship between angle of attack, V_{MD} and the best lift–drag ratio.	X	X						Better LO level
(05)		Explain the effect of wind component on glide angle, duration and distance.	X	X						
(06)		Explain the effect of mass change on glide angle, duration and distance, given that the aeroplane remains at either the same airspeed or at V_{MD}.	X	X						More precise
(07)		Explain the effect of configuration change on glide angle, duration, and reasons for, and management of, flap extension.	X	X						Application
(08)		Describe the relation between TAS, gradient of descent and rate of descent ~~sink rate~~.	X	X						
(09) New		Describe that minimum rate of descent in the glide will be at V_{MP}, and explain the relationship of this speed to the optimum speed for minimum glide angle.	X	X						Application
(10) New		Discuss when a pilot could elect to fly for minimum glide rate of descent or minimum glide angle, and why speed stability or headwinds/tailwinds may favour a speed that is faster or slower than the optimum airspeed in still air.	X	X						Application

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
081 08 01 05		***Steady, coordinated turn***								
(01)		Describe the forces acting on an aeroplane in a steady, coordinated turn.	X	X						
(02)		Resolve the forces acting horizontally and vertically during a coordinated turn ($\tan\phi = \frac{V^2}{gR}$).	X	X						
(03)		Describe the difference between a coordinated and an uncoordinated turn, ~~and explain~~ describe how to correct an uncoordinated turn using turn and slip indicator or turn coordinator, and the hazards of using rudder to tighten a turn in a swept-wing aeroplane.	X	X						Application
(04)		Explain why the angle of bank is independent of mass and only depends on TAS and radius of turn.	X	X						
(05)		Resolve the forces to show that for a given angle of bank the radius of turn is determined solely by airspeed ($\tan\phi = \frac{V^2}{gR}$).	X	X						
(06)		Calculate the turn radius of a steady turn given TAS and angle of bank ~~load factor and the time for a complete turn for relevant parameters given for a steady turn~~.	X	X						Clarity
(07)		Explain ~~Discuss~~ the effects of bank angle on: — load factor (LF = $1/\cos\phi$);	X	X						Improved LO level

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		— angle of attack; — thrust; — drag.								
(08)	X	Define 'angular velocity'.	X	X						
(09)	X	Define 'rate of turn' and 'rate-one turn'.	X	X						
(10)		Explain the influence of TAS on rate of turn at a given bank angle.	X	X						
(11) New		Calculate the load factor and stall speed in a turn given angle of bank and 1g stall speed.	X	X						Application
(12) New		Explain situations in which turn radius is relevant for safety, such as maximum speed limits on departure or arrival plates, or outbound speed categories on approach plates, and the implications/hazards of exceeding given speeds.	X	X						Application
081 08 02 00		**Asymmetric thrust**								
(01)		Describe the effects on the aeroplane of asymmetric thrust during flight, ~~with asymmetric thrust~~ including both jet-engined and propeller-driven aeroplanes.	X	X						
(02)		Explain ~~Discuss~~ critical engine, include effect of crosswind when on the ground, and for a propeller-driven aeroplane the direction of propeller rotation.	X	X						Application
(03)		Explain the effect of steady, asymmetric flight on a	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		conventional (ball) slip indicator/turn indicator.								
081 08 02 01		***Balanced m~~M~~oments about the normal axis***								
~~LO (01)~~		~~Describe the moments about the normal axis.~~	~~X~~	~~X~~						In (02)
(02)		Explain the yaw~~ing~~ moments about the CG.	X	X						
(03)		Explain ~~Describe~~ the change to the yaw~~ing~~ moment caused by the effect of air density ~~power~~ on thrust.	X	X						
(04)		Describe the changes to the yaw~~ing~~ moment caused by engine distance from CG.	X	X						
(05)		Describe the methods to achieve balance.	X	X						
081 08 02 02		***Intentionally left blank***								
081 08 02 03		***Forces parallel to the lateral axis***								
(01)		Explain: — the force on the vertical fin; — the fuselage side force due to sideslip (using wing-level method); — the use of bank angle to tilt the lift vector (in wing-down method).	X	X						Clarity
~~(02)~~		~~Explain how bank angle and sideslip are related in a steady asymmetric flight.~~	~~X~~	~~X~~						
(03)		Explain why the required small bank angle~~,~~ will vary with the	X	X						Clarity

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
		size of rudder force required to stop the yaw ~~must be limited~~.								
(04)		Explain the effect on fin angle of attack due to sideslip.	X	X						
081 08 02 04		***Influence of aeroplane mass***								
(01)		Explain why controllability with one engine inoperative is a typical problem encountered at low aeroplane mass.	X	X						
081 08 02 05		***Intentionally left blank***								
081 08 02 06		~~***Secondary propeller effects***~~ ***Intentionally left blank***								Covered in 081 07 04
~~LO (01)~~		~~Describe propeller effects:~~ ~~— slip stream;~~ ~~— torque reaction;~~ ~~— asymmetric blade effect.~~	~~X~~	~~X~~						
081 08 02 07		***Intentionally left blank***								
081 08 02 08		***V_{MC}***								
(01)		Define 'V_{MC}'.	X	X						
(02)		Describe how V_{MC} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 09		***V_{MCL}***								
(01)		Define 'V_{MCL}'.	X	X						

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL			
(02)		Describe how V_{MCL} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 10		***V_{MCG}***								
(01)		Define 'V_{MCG}'.	X	X						
(02)		Describe how V_{MCG} is determined.	X	X						
(03)		Explain the influence of the CG location.	X	X						
081 08 02 11		***Influence of density***								
(01)		Describe the influence of density.	X	X						
(02)		Explain why V_{MCA}, V_{MCL} and V_{MCG} reduce with an increase in altitude and temperature.	X	X						
081 08 03 00		**~~Particular~~Significant points on a polar curve**								
(01)		Identify and explain t~~T~~he significant ~~particular~~ points on a polar curve ~~and explain their significance, assuming a parabolic approximation~~.	X	X						Clarity

Overview of the proposed amendments to Subject 082 'Principles of flight (helicopter)'

The knowledge about displacement of the centre of pressure (CP) is marked as not essential.

Some Learning Objectives (LOs) have been amended to increase understanding and for more precise description. LOs about velocities of the blade, azimuth angle of the blades, and forces and stresses on the blade have been deleted.

The paragraphs 'Origins of the vertical vibrations', 'Tail-rotor description', 'Fenestron', 'NOTAR' and 'Tail-rotor vibrations' have been moved to Subject 021 17 00 00.

The knowledge in the LOs about stability and control power has been decreased to the knowledge necessary for a helicopter pilot.

SUBJECT 082 — PRINCIPLES OF FLIGHT (HELICOPTER)

(1) VOCABULARY OF MECHANICS

Speed is a scalar quantity; it has only magnitude.

Velocity is a vector quantity ~~having~~ with magnitude and direction.

The velocity ~~(speed)~~ of a point on a rotor blade when rotating ~~of the aerofoil in the rotation~~ around ~~its~~ an axis is the 'linear' or 'tangential' velocity, ~~(speed). The rotational velocity (speed) of a body around an axis is an angular velocity (speed)~~ which can be expressed in revolutions per minute (RPM)~~, or degrees per second (deg/s), or radians per second (rad/s)~~.

Density is the mass of the fluid per unit volume: (kg/m^3) in the international system ~~SI~~ of units of measurement (SI).

(2) AERONAUTICAL DEFINITIONS

~~The blade is the aerofoil between a root radius and the tip radius (R) attached to the hub with hinges or flexible elements.~~

A rotor blade is a high-aspect ratio aerofoil attached by its root to the rotor hub with hinges or flexible elements.

~~The cross section of a blade perpendicular to the feathering axis, the blade section at a distance (radius) from the hub centre shows the shape of the aerofoil.~~

~~Such section is characterised by a contour, a leading and trailing edge, a chord line, a chord, a camber line, the maximum thickness or depth, the thickness-to-chord ratio.~~

~~The blade element is a spanwise piece of the blade. It is assumed that its radial extension is small such that the aerodynamic forces don't vary with radial distance. The aerodynamic forces on the blade element produce lift, drag and a pitching moment.~~

A blade element is a spanwise slice of the blade, so thin that the aerodynamic forces involved may be assumed not to vary. The forces produce lift, drag and a pitching moment. Such a cross section has a contour, a leading and trailing edge, a chord line, a mean camber line, a maximum thickness or depth, and a thickness-to-chord ratio.

The centre of pressure (CP) is defined as the point on the chord line where the resultant of all aerodynamic forces acts~~, such that the pitching moment about this point is zero~~.

The planform ~~of the blade~~ is the shape of a blade as seen from above.

The pitch angle ~~of a section~~ (of a blade or an element) is the angle between the chord line and the plane of rotation. ~~a reference plane. (The reference planes will be defined later in this text.)~~

The blade is without twist when the pitch angle is constant from root to tip.

~~The blade is twisted when the pitch angle of the sections varies as a function of the radial distance (the chord lines are not parallel). If the pitch angle decreases towards the tip, this is called washout.~~

A blade is twisted when the pitch angle of its elements' sections varies with their distance from the root (in other words, the chord lines of the elements involved are not parallel). Washout exists when the pitch angle decreases towards the tip.

The vector sum of the undisturbed upstream velocity ~~and the thrust-induced velocity is the relative velocity.~~ (i.e. that found in the plane of rotation of the blades) and the induced velocity is the relative airflow.

~~In the helicopter theory we use the following definitions for 'angle of attack', 'lift' and 'drag':~~

~~— The angle between the relative velocity and the chord line is the angle of attack α or AoA, called effective angle of attack. The geometric angle of attack is the angle between the undisturbed upstream velocity and the chord line.~~

~~— Lift is the component of the aerodynamic force on a blade element perpendicular to the relative velocity.~~

~~— Profile drag is the component of the aerodynamic force on a blade element parallel to the relative velocity.~~

~~Profile drag is produced by the pressure forces and by skin-friction forces that act on the surface of the blade element.~~

~~The component of the drag force due to the pressure forces is the pressure or form drag.~~

~~The component of the drag due to the shear forces over the aerofoil is termed skin-friction drag.~~

~~The sum of the pressure drag and the skin-friction drag is the profile drag.~~

The angle between the relative airflow and the chord line of a blade element is the angle of attack (α or AoA).

Lift is the component of the aerodynamic force on a blade element that is perpendicular to the relative airflow.

Profile drag is the component of the aerodynamic force on a blade element that is parallel to the plane of rotation. Induced drag is the component of the aerodynamic force on a blade element that is parallel to the relative airflow.

Profile drag consists of pressure forces and skin friction acting on the surface of the blade element. The component of profile drag that arises from pressure forces (between the leading and trailing edges) is pressure or form drag. The component of profile drag due to shear forces over the surface is skin friction.

The total rotor thrust is the vertical upwards force from the rotor disc as a whole, as the sum of all the blade thrusts. This term has been reinstated because there is already a term 'rotor thrust' that is used to denote the thrust along the axis of rotation that acts directly opposite the weight of the helicopter in a blade element.

(3) HELICOPTER CHARACTERISTICS

Disc loading is ~~by definition~~ the mass (M) ~~or weight (W)~~ of the helicopter divided by the area of the disc.

~~(The disc area is πR^2, R being the tip radius).~~

~~The disc loading is $M/(\pi R^2)$ or $W/(\pi R^2)$.~~

Blade loading is ~~by definition~~ the mass ~~(weight)~~ divided by the total planform area of the blades.

The area of a rectangular blade is given by the chord ~~times~~ multiplied by the tip radius. For tapered blades, the mean geometric chord is taken as an approximately equivalent chord.

~~Blade loading is defined as the mass or weight of the helicopter divided by the total area of all blades.~~

Rotor solidity is the ratio of the total blade area to the disc area.

(4) PLANES, AXES AND REFERENCE SYSTEMS OF THE ROTOR

— Shaft axis: The physical axis of the rotor shaft (mast).

— Hub plane: A plane perpendicular to the shaft axis through the centre of the hub.

— Tip p~~P~~ath p~~P~~lane: The plane traced out by the blade tips. ~~This plane is also the no-flapping plane.~~

— Virtual rotation axis: The axis through the centre of the hub and perpendicular to the t~~T~~ip p~~P~~ath p~~P~~lane. ~~Another name for this axis is no-flapping axis.~~

— ~~Rotor disc plane: another name for the tip-path plane.~~

— Rotor disc: The disc traced out by the blade tips in the t~~T~~ip p~~P~~ath p~~P~~lane.

— Plane of rotation: T~~t~~he plane parallel to the t~~T~~ip p~~P~~ath p~~P~~lane that acts through the hub centre.

— ~~No-feathering plane: is also called the control plane. This is the reference plane relative to which the pitch of the rotating blade has no variation during a full rotation. The control plane is parallel to the swash plate in the simple feathering mechanism (no flap-feathering coupling).~~

— ~~Control axis or axis of no-feathering. Axis through the hub centre and perpendicular to the no-feathering or control plane.~~

— ~~The azimuthal angle of a blade is the angle in the rotor-disc plane counted in the rotation sense from the direction opposite to the helicopter velocity.~~

~~(5) REFERENCE SYSTEMS (sometimes called frames of reference)~~

~~There are three different reference systems in which the movement of the blades can be studied or observed:~~

— ~~The tip-path plane with the virtual rotation axis: the observer in this system observes no flapping, only cyclic feathering.~~

— ~~The no-feathering plane (or control plane) with the control axis: the observer in this system observes no feathering, only cyclic flapping.~~

— ~~The hub plane and shaft axis: the observer in this system observes both cyclic flapping and cyclic feathering.~~

(6) ANGLES OF THE BLADES, INDUCED VELOCITY

— Pitch angle of a blade ~~section~~ element: The angle between the chord line of the ~~section~~ element and ~~the hub plane (the reference plane),~~ its plane of rotation, sometimes ~~also~~ called 'local pitch angle'.

— ~~Pitch angle of the blade: the pitch angle at 75 % of the tip radius~~

— Blade pitch angle: Taken to be equivalent to the pitch angle of the blade element found at 75 % of the blade radius.

— Flapping angle: The angle between the longitudinal axis of the blade and the hub plane.

— Coning angle: The angle between the longitudinal axis of the blade and the t~~T~~ip p~~P~~ath p~~P~~lane.

— ~~Advance angle: The azimuthal angle between the flapping axis and the point where the pitch link is connected to the swash plate (not to be confused with the phase lag from pitch input to flapping response).~~

~~The induced velocity is the velocity induced by the rotor thrust in the plane of the rotor disc (about 10 m/s for a light helicopter in hover). The slipstream velocity continues to increase downstream of the rotor. In the hover out-of-ground-effect (HOGE), the velocity in the ultimate wake is equal to two times the induced velocity.~~

Induced velocity is that induced by the engine power perpendicular to the plane of rotation.

Aerodynamic forces on the blades~~BLADES~~ and the rotor~~ROTOR~~

~~The airflow around the blade element produces an aerodynamic force resolvable in two components: lift and drag. Lift is perpendicular to the relative air velocity, and drag is parallel to the relative air velocity.~~

~~The aerodynamic force may also be resolved into thrust perpendicular to the tip path plane (or plane of rotation) and drag parallel to the tip path plane. This drag is the sum of the profile drag and the induced drag.~~

~~Because the angle between the lift vector and the thrust vector is very small, the magnitudes of these two vectors may be taken as equal.~~

The thrust from a blade (blade thrust) is the sum of the thrusts ~~of all blade elements along the blade radius~~ from each blade element.

The sum of the thrusts from all blades is the (total) rotor thrust acting perpendicular to the t~~T~~ip p~~P~~ath p~~P~~lane in the direction of the virtual rotation axis.

The result of the induced drag forces on all the blade elements of all blades is a torque on the shaft which, ~~—~~ multiplied by the angular velocity of the ~~rotor~~ blade, ~~—~~ gives the required induced power.

The result of ~~all~~ the profile drag~~s~~ forces is a torque on the shaft which, ~~—~~ multiplied by the angular velocity of the blade, ~~rotor —~~ gives the required profile power.

(7) TYPES OF ROTOR HUBS

There are basically four types of rotor hubs in use:

1. Teetering rotor or seesaw rotor: The two blades are connected together; the 'hinge' is on the shaft axis, and the head is underslung. A variation is the gimballed hub; the blades and the hub are attached to the rotor shaft by means of a gimbal or universal joint (Bell 47). It is sometimes called semi-articulated because there is no movement of the blade in a drag-wise sense.

2. Fully articulated rotor: ~~The rotor has more than two blades.~~ There are more than two rotor blades and each has a flapping hinge, a lead-lag (drag) hinge, and a feathering hinge or bearing.

3. Hingeless rotor: There are no flapping or ~~and lead-lag~~ dragging hinges. They are replaced by flexible elements (virtual hinges) at ~~the root~~ some part of the blade~~s~~ radius which allow ~~flapping and lead-lag~~ such movements. A ~~The~~ feathering bearing allows feathering of the blade.

4. Bearingless rotor: There are no hinges or rotating bearings. Flapping and ~~lead or lag~~ dragging movements are obtained ~~by~~ with flexible elements called elastomeric hinges ~~and~~. F~~f~~eathering is obtained by twisting the element.

When it refers to their equipment, Airbus call this a semi-articulated head (ref.: their training material).

Two remarks:

1. Hinge offset and equivalent hinge offset

   The hinge offset is the distance between the shaft axis and the axis of the hinge. ~~In the h~~Hingeless and bearingless rotors have~~, we define~~ an equivalent hinge offset.

2. Elastomeric hinges

   This bearing consists of alternate layers of elastomer and metal. The ~~elasticity in~~ flexibility of the elastomer allows ~~the movements of~~ flapping, ~~lead-lag~~ dragging and feathering.

(8) DRAG AND POWERS

~~The induced power is the power resulting from the induced velocity in the rotor disc for the generation of lift. For any given thrust, the induced power is minimum when the induced velocity is uniform over the rotor disc. Such velocity distribution can be approximated by using some blade twist (a truly uniform velocity cannot be obtained).~~

~~The rotor profile drag results from the component opposite to the blade velocities of all the profile drags of the blade elements of all the blades.~~

~~The resulting power is the rotor profile power or the profile-drag power (sum of the powers to overcome the torque).~~

~~The parasite drag is the drag on the helicopter fuselage including the drag of the rotor hub and all external equipment such as wheels, winch, etc. The tail-rotor drag is also included in the parasite drag. The power to overcome this drag is the parasite power.~~

~~In the level flight at constant speed, the main rotor induced power, the rotor profile power and the parasite power are summed to give the total power required to drive the main rotor.~~

~~The tail rotor induced power and the tail rotor profile power are summed to give the power required to drive the tail rotor.~~

~~The power required to drive the auxiliary services, such as oil pumps and electrical generators, is the accessory or ancillary power. The power to overcome the mechanical friction in the transmissions is included in the accessory power.~~

~~The total power required in level flight at constant speed is the sum of the total power for the main rotor, the power for the tail rotor and the accessory power.~~

~~In the low speed region, the required power in straight and level flight decreases as speed increases. The phenomenon is called translational lift.~~

Induced power is that required to generate the induced velocity in the rotor disc for the production of lift. For any given thrust, induced power is minimum when the induced velocity is uniform over the rotor disc. This can be approximated by using washout and ensuring that the blades are in track (a truly uniform velocity cannot be obtained).

Rotor profile drag results from those components acting in the opposite direction to the blade velocities (i.e. the sum of all the profile drags from each blade element). The power required to overcome it is rotor profile power (the sum of the powers needed to overcome the torque).

Parasite drag is the drag from the helicopter fuselage including that from the rotor hub and all external equipment such as wheels, the winch, external loads, etc. (any drag from the tail rotor is included, but not from the rotor blades, which produce profile drag). The power to overcome this drag is parasite power.

In level flight at constant speed, induced power, rotor profile power and parasite power are summed to give the total power required to drive the main rotor.

Induced and profile power for the tail rotor are summed to give the power required to drive the tail rotor.

The power required to drive auxiliary services, such as oil pumps and electrical generators, is called accessory or ancillary power. It includes the power needed to overcome mechanical friction in transmissions.

The total power required in level flight at constant speed is the sum of all the above.

When transitioning from the hover, the power required decreases as speed increases. This is called translational lift.

The term limited power means that the total power required to hover out of ground effect (HOGE) is greater than the available power.

(9) PHASE ANGLE IN FLAPPING MOVEMENT OF THE BLADE

~~The cyclic movement tilts the rotor disc in the direction of the intended helicopter velocity.~~

~~The flapping response is approximately 90° later than the applied cyclic pitch (somewhat less than 90° for hingeless rotors).~~

The movement of the cyclic control tilts the rotor disc in the direction of the intended movement of the helicopter.

For teetering heads, the flapping response is 90° later than the applied cyclic control movement (less than 90° for rotors with offset hinges).

The pitch mechanism consists of the swash plate, and for each blade the pitch mechanism consists of a pitch link attached to the swash plate and a pitch horn attached to the blade.

(10) AXES THROUGH THE CENTRE OF THE HELICOPTER

Longitudinal axis or roll axis: A straight line through the centre of gravity (CG) of the helicopter from the nose to the tail about which the helicopter can roll left or right.

Lateral axis, transverse axis or pitch axis: A straight line through the CG~~centre of gravity~~ of the helicopter about which the helicopter can pitch its nose up or down~~. T~~(this axis is also perpendicular to the reference plane of the aircraft, which is the plane either side of which the components that constitute the major part of the aircraft are symmetrically disposed in the port and starboard sense).

Normal axis or yaw axis: A straight line perpendicular to the plane defined by the longitudinal and lateral axes and about which the helicopter can yaw.

~~Aircraft reference plane: The plane with respect to which a subset of the components that constitutes the major part of the aircraft is symmetrically disposed in the port and starboard sense.~~

Note that the term 'mass' is used to describe a quantity of matter, and 'weight' when describing the force. However, the term 'weight' is normally used in aviation to colloquially describe mass. The professional pilot should always note the units to determine if the term 'weight' is being used to describe a force (e.g. unit newton) or quantity of matter (e.g. unit kilogram).

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
080 00 00 00		**PRINCIPLES OF FLIGHT**							
082 00 00 00		**PRINCIPLES OF FLIGHT — HELICOPTER**							
082 01 00 00		**SUBSONIC AERODYNAMICS**							
082 01 01 00		**Basic concepts, laws and definitions**							
082 01 01 01		***International system ~~SI~~ of units of measurement (SI) and conversion of SI units***							
(01)	X	List the fundamental quantities and units in ~~the~~ SI ~~system:~~, such as mass (kg), length (m), time (s).			X	X	X		
(02)	X	~~Show and apply tables of conversion of units of~~ Be able to convert ~~English~~imperial units to SI units and vice versa.			X	X	X		Text added
~~LO (03)~~		~~The units of the physical quantities should be mentioned when they are introduced.~~			~~X~~	~~X~~	~~X~~		Covered in the LO above
082 01 01 02		***Definitions and basic concepts ~~about~~ of air***							
(01)	X	Describe air temperature and pressure as functions of height.			X	X	X		
(02)	X	Define the ~~Use the table of the~~ International Standard Atmosphere.			X	X	X		
(03)	X	Define air density~~;~~, and explain the relationship between density, pressure and temperature.			X	X	X		
(04)	X	Explain the influence of moisture content on density.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(05)	X	Define pressure altitude and density altitude.			X	X	X		
082 01 01 03		***Newton's laws***							
(01)	X	~~Describe~~ State and interpret Newton's ~~second law: force equals product of mass and acceleration.~~ three laws of motion.			X	X	X		
(02)	X	Distinguish between mass and weight, and their units.			X	X	X		
~~LO (03)~~		~~Describe the other form of the second law, applicable to thrust.~~			~~X~~	~~X~~	~~X~~		Covered in (01)
~~LO (04)~~		~~Describe Newton's third law: action and reaction, force and torque.~~			~~X~~	~~X~~	~~X~~		Covered in (01)
082 01 01 04		***Basic concepts of airflow***							
(01)	X	Describe steady and unsteady airflow.			X	X	X		
(02)	X	Define 'streamline' and 'stream tube'.			X	X	X		
(03)	X	Explain the principle of the continuity equation or ~~mass conservation~~ the conservation of mass. ~~Equation of continuity or mass conservation.~~			X	X	X		
(04)	X	Describe the m~~M~~ass flow rate through a stream tube section.			X	X	X		
~~LO (05)~~		~~Describe the relationship between the external force on a stream tube and the variation in momentum of the airflow.~~			~~X~~	~~X~~	~~X~~		
(06)		~~State the Bernoulli's equation in a non-viscous airflow, use this equation to explain and define static pressure, dynamic pressure and total pressure.~~			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		State Bernoulli's equation and use it to explain and define the relationship between static, dynamic and total pressure.							
(07)		Define the stagnation point in ~~a~~ the flow around an aerofoil and explain the pressure obtained ~~in~~ at the stagnation point.			X	X	X		
(08)		Use the pitot system to ~~Describe the pitot system and~~ explain the measurement of airspeed (no compressibility effects).			X	X	X		
(09)		Define 'TAS', 'IAS', and 'CAS'.			X	X	X		
(10)	X	~~Define a two-dimensional airflow and an aerofoil of infinite span. Explain the difference between a two- and a three-dimensional airflow.~~ Define two-dimensional airflow and its relationship to an aerofoil of infinite span (i.e. no tip vortices and, therefore, no induced drag). Explain the difference between two- and three-dimensional airflows.			X	X	X		
(11)	X	Explain that viscosity is a feature of any fluid (gas or liquid).			X	X	X		
(12)		~~Describe the airflow over a flat surface and e~~Explain the tangential friction between air and the surface of an aerofoil, and the development of a boundary layer.			X	X	X		
(13)		~~Define a~~ Describe laminar and turbulent boundary layers~~, a turbulent boundary layer~~ and the transition from laminar to turbulent. Show the influence of the roughness of the surface on the position of the transition point.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 01 02 00		**Two-dimensional airflow**							
082 01 02 01		***Aerofoil section geometry***							
(01)	X	Define the terms 'aerofoil section', 'aerofoil element', 'chord line', 'chord', 'thickness', 'thickness-to-chord ratio ~~of section~~', 'camber line', 'camber', 'leading-edge radius'.			X	X	X		
(02)		Describe ~~different aerofoil sections,~~ symmetrical and asymmetrical aerofoil sections.			X	X	X		
082 01 02 02		***Aerodynamic forces on aerofoil elements***							
(01)		Define the angle of attack (α).			X	X	X		
~~LO (02)~~		~~Describe the pressure distribution on the upper and lower surfaces of an aerofoil.~~			X	X	X		Covered in 082 01 02 02 (04)
~~LO (03)~~		~~Describe the boundary layers on the upper and lower surfaces for small angles of attack (below the onset of stall).~~			X	X	X		Covered below in 082 01 02 02 (04)
(04)		Describe: — the resultant force ~~due to~~ from the pressure distribution and the friction at the element~~;~~. — the resultant force from the boundary layers and the velocities in the wake; and~~,~~ — the loss of momentum due to friction forces.			X	X	X		
(05)		Resolve the aerodynamic force into the components of lift and			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		drag.							
(06)		Define the lift coefficient (C_L) and the drag coefficient (C_D)~~, with equations~~.			X	X	X		
(07)		Show that the C_L~~lift coefficient~~ is a function of the α~~angle of attack. draw the graph~~.			X	X	X		
(08)		Explain how drag is caused by pressure forces on the surfaces of an aerofoil and by friction in the boundary layers. Define the term 'profile drag'.			X	X	X		
(09)		~~Draw the graph of lift (or lift coefficient) as a function of drag or of the drag coefficient and define~~ Define the lift–drag ratio.			X	X	X		
(10)		Use the lift and drag equations to show the influence of speed and density on lift and drag for a given α~~angle of attack and to calculate lift and drag~~.			X	X	X		
(11)		Define the action line of the aerodynamic force~~,~~ and the CP~~centre of pressure, the pitching moment~~.			X	X	X		
~~LO (12)~~		~~Know that the pitching moment about the centre of pressure is zero by definition.~~			~~X~~	~~X~~	~~X~~		Not essential
(13)		Know that symmetrical aerofoils have ~~the~~ a centre of pressure that is approximately a quarter chord behind the leading edge ~~independently of the angle of attack, as long as the angle of attack remains smaller than the angle of stall~~.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
~~LO (14)~~		~~Taking an asymmetrical aerofoil section with different cambers, know the position of the centre of pressure, the influence of the angle of attack on the centre of pressure and the pitching moment about a line which is a quarter chord behind the leading edge.~~			~~X~~	~~X~~	~~X~~		
082 01 02 03		***Stall***							
(01)		Explain the boundary layer separation when α~~the angle of attack~~ increases beyond the onset of stall and the decrease of lift and the increase of drag. Define the 'separation point ~~and line~~'.			X	X	X		
~~LO (02)~~		~~Draw a graph of lift and drag coefficients as a function of the angle of attack before and beyond the stall onset.~~			~~X~~	~~X~~	~~X~~		Covered in 082 01 02 02
~~LO (03)~~		~~Describe how the stall phenomenon displaces the centre of pressure and how pitching moments appear about the line at quarter chord behind the leading edge.~~			~~X~~	~~X~~	~~X~~		Not essential knowledge
082 01 02 04		***Disturbances due to profile contamination***							
(01)		Explain ice contamination, the modification of the section profile and ~~the~~ surfaces due to ice and snow, the influence on lift (L) and drag (D) and the L–D ratio, the influence on α~~the angle of attack~~ at stall onset, and the effect of the ~~weight~~ increase in weight.			X	X	X		
(02)		Explain the ~~erosion~~ effect of erosion by ~~of~~ heavy rain on the blade ~~wing~~ and subsequent increase ~~of~~ in profile drag.			X	X	X		
082 01 03 00		**Three-dimensional airflow around a blade ~~(wing) and a fuselage~~**							Helicopters do not use wings

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 01 03 01		***The blade***							
(01)		Describe the various ~~different~~ blade planforms ~~of blades, and describe untwisted and twisted blades.~~			X	X	X		
(02)		Define ~~the root chord and the tip chord, the mean chord, the~~ aspect ratio and ~~the~~ blade twist.			X	X	X		
082 01 03 02		***Airflow pattern and influence on lift***							
(01)		Explain the spanwise flow ~~in the case of~~ around a blade and the appearance of ~~the~~ tip vortices which are a loss of energy.			X	X	X		
(02)		Show that the strength of the vortices increases as α~~the angle of attack~~ and ~~the~~ lift increase.			X	X	X		
~~LO (03)~~		~~Show that downwash causes vortices.~~			~~X~~	~~X~~	~~X~~		
(04)		Define the ~~effective air velocity~~ relative airflow as the resultant of the undisturbed air velocity and ~~the~~ induced velocity, and define α ~~the effective angle of attack~~.			X	X	X		
(05)		Explain the spanwise lift distribution and ~~how~~ the way in which it can be modified by twist (washout).			X	X	X		
082 01 03 03		***Induced drag***							
(01)		Explain ~~the thrust~~ induced drag~~,~~ and the influence of α~~the angle of attack~~ and ~~of the~~ aspect ratio.			X	X	X		
082 01 03 04		***The airflow around ~~a~~ the fuselage***							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(01)		Describe the ~~aircraft~~ fuselage and the external components ~~which~~ that cause (parasite) drag, the airflow around the fuselage, and the influence of the pitch angle of the fuselage. Describe fuselage shapes that minimise drag.			X	X	X		
(02)		Define ~~parasite~~ profile drag as the sum of pressure (form) drag and skin friction drag.			X	X	X		
(03)		Define 'interference drag'.			X	X	X		
~~LO (04)~~		~~Describe fuselage shapes that minimise drag.~~			X	X	X		Moved to 082 01 03 04 (01)
(05)		Know the drag formula ~~of the parasite drag and explain the influence of the speed~~.			X	X	X		Edited for simplicity
082 02 00 00		**TRANSONIC AERODYNAMICS AND COMPRESSIBILITY EFFECTS**							
082 02 01 00		**Airflow speeds and velocities**							
082 02 01 01		***Speeds and Mach number***							
(01)		Define the speed of sound in air.			X	X	X		
(02)		State that the speed of sound is proportional to the square root of the absolute temperature (~~unit~~ in Kelvins).			X	X	X		
(03)		Explain the variation ~~of~~ in the speed of sound with altitude.			X	X	X		
(04)		Define Mach number.			X	X	X		
(05)		Explain the meaning of incompressibility and compressibility of air; relate this to the value of the Mach number.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(06)		Define ~~subsonic,~~ high subsonic, transonic and supersonic flows in relation to the value of the Mach number.			X	X	X		
082 02 01 02		***Shock waves***							
(01)		Describe ~~a~~ shock waves in a supersonic flow and the changes in pressure and speed ~~changes by the shock~~.			X	X	X		
(02)		Describe the appearance of local supersonic flows ~~at~~ on the ~~upper~~ surfaces of a blade ~~section and the compression by a shock when the section is in an upstream high subsonic flow~~.			X	X	X		
~~LO (03)~~		~~Describe the effect of the shock on lift, drag, the pitching moment and the C_L–C_D ratio, drag divergence Mach number.~~			~~X~~	~~X~~	~~X~~		Covered in 082 02 01 02 01 as far as is necessary for helicopter pilots
082 02 01 03		***Influence of aerofoil section and blade planform***							
(01)		Explain the different shapes ~~which~~ that allow higher ~~upstream~~ Mach numbers without generating a shock wave on the upper surface, such as: — reducing the section thickness-to-chord ratio; — ~~special aerofoil sections as supercritical shapes;~~ — a planform with a sweep angle~~, positive and negative~~.			X	X	X		Edited for content as far as is necessary for helicopter pilots
082 03 00 00		**ROTORCRAFT TYPES**							
082 03 01 00		**Rotorcraft**							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 03 01 01		***Rotorcraft types***							
(01)		~~Define the 'autogyro' and the 'helicopter'.~~ Explain the difference between an autogyro and a helicopter.			X	X	X		
~~LO (02)~~		~~Explain the rolling moment on an autogyro with fixed blades, the necessity for using flapping hinges and the ensuing reduction of the moment arm, the flapback of the blades.~~			~~X~~	~~X~~	~~X~~		Not relevant
082 03 02 00		**Helicopters**							
082 03 02 01		***Helicopter configurations***							
(01)		Describe (briefly) the single-main-rotor helicopter and other configurations: tandem, coaxial, side by side, synchrocopter (with intermeshing blades). ~~the compound helicopter, tilt wing and tilt rotor.~~			X	X	X		
082 03 02 02		***The helicopter, characteristics and associated terminology***							
~~LO (01)~~		~~Describe the general layout of a single main rotor helicopter, fuselage, engine or engines, main gearbox, main rotor shaft and rotor hub.~~			~~X~~	~~X~~	~~X~~		Covered in 082 03 02 02
(02)		Mention the tail rotor ~~at the aft of the fuselage~~, the ~~f~~Fenestron and the no tail rotor~~NOTOR~~ (NOTAR) ~~(No Tail Rotor)~~.			X	X	X		
(03)		Define the rotor disc area and the blade area~~, the blades turning in the hubplane~~.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(04)		Describe the teetering rotor with ~~the~~ its hinge axis on the shaft axis and ~~the~~ rotors with more than two blades with offset hinge axes.			X	X	X		
(05)		Define the fuselage centre line and the three axes: roll, pitch and normal (yaw).			X	X	X		
(06)		Define gross weight and ~~the~~ gross mass (and the units involved), ~~the~~ disc and blade loading.			X	X	X		
082 04 00 00		**MAIN-ROTOR AERODYNAMICS**							
082 04 01 00		**Hover flight o~~O~~utside g~~G~~round e~~E~~ffect (HOGE)**							
082 04 01 01		**Airflow through the rotor disc and around the blades**							
~~LO (01)~~		~~Define the circumferential (tangential) velocity of the blade sections, which equals the angular velocity of the rotor multiplied by the radius of the section.~~			~~X~~	~~X~~	~~X~~		Not essential
~~LO (02)~~		~~Keep the blade fixed and define the undisturbed upstream air velocity relative to the blade.~~			~~X~~	~~X~~	~~X~~		Not essential
(03)	X	Based on Newton's second law (momentum), explain that the upward vertical force ~~on~~ from the disc, the rotor thrust, ~~produces~~ is the result of vertical downward velocities ~~in~~ inside the rotor disc. ~~The values of these thrust-induced velocities increase as the thrust increases and decrease with increasing rotor diameter. Know that the velocities some distance downstream are twice the~~			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		~~value of the induced speed in the disc plane.~~							
(04)		Explain why the production of the induced flow requires ~~a~~ power ~~on~~ applied to the shaft, i.e. ~~the~~ induced power. ~~The~~ l~~i~~nduced power is ~~smaller~~ least if the induced velocities have the same value ~~over~~ on the whole disc (i.e. there is ~~flow~~ uniformity of flow over the disc).			X	X	X		
~~LO (05)~~		~~Describe uniform and typical non-uniform velocities through the rotor disc.~~			~~X~~	~~X~~	~~X~~		Covered in 082 04 01 01 (04)
(06)		Explain why vertical rotor thrust must be ~~somewhat~~ higher than the weight of the helicopter because of the vertical drag on the fuselage.			X	X	X		
~~LO (07)~~		~~Describe the vertical air velocities relative to the rotor disc as the sum of the upstream air velocities and the induced velocities.~~			~~X~~	~~X~~	~~X~~		Not essential
(08)		Define the pitch angle and the α~~angle of attack~~ of a blade element.			X	X	X		
(09)		Explain lift and ~~the profile~~ drag ~~of~~ relating to a blade element (including induced and profile drag).			X	X	X		Conundrum — a blade element is two-dimensional and induced drag does not exist in two-dimensional flow!
~~LO (10)~~		~~Explain the resulting lift and the thrust on the blade, define the resulting rotor thrust.~~			~~X~~	~~X~~	~~X~~		Covered above in the above line of this LO
(11)		Explain the necessity ~~of~~ for collective pitch angle changes, the			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		influence on the angles of attack and ~~on the~~ rotor thrust, and the ~~necessity of~~ need for blade feathering.							
~~LO (12)~~		~~Explain the blade twist necessary to obtain a more even induced airspeed over the disc.~~			~~X~~	~~X~~	~~X~~		This makes no sense
~~LO (13)~~		~~Describe the different blade shapes (as viewed from above).~~			~~X~~	~~X~~	~~X~~		Not essential, as there are not that many The BERP tends to be only used on military helicopters
(14)		Explain how profile drag on the blade elements generates a torque on the main shaft, and define the resulting rotor profile power.			X	X	X		
(15)		Explain the influence of air density on the required powers.			X	X	X		
~~LO (16)~~		~~Show the effect on the airflow over the blade tips.~~			~~X~~	~~X~~	~~X~~		Not needed here
082 04 01 02		***Anti-torque force and tail rotor***							
(01)		~~Based on~~ Using Newton's third law, explain the need ~~of a~~ for tail-rotor thrust, the required value being proportional to ~~the~~ main-rotor torque. Show that ~~the~~ tail-rotor power is proportional to ~~the~~ tail-rotor thrust.			X	X	X		
(02)		Explain the necessity ~~of blade feathering~~ for feathering of the tail-rotor blades and ~~the~~ their control by the yaw pedals, and the maximum and minimum values of the pitch angles of the blades.			X	X	X		
082 04 01 03		***Total power required and h~~H~~over o~~O~~utside g~~G~~round e~~E~~ffect***							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		(HOGE)							
(01)		Define ~~the~~ ancillary equipment and its power requirement.			X	X	X		
(02)		Define the total power required.			X	X	X		
(03)	X	Describe the influence of ambient pressure, temperature and moisture on the required power.			X	X	X		
082 04 02 00		**Vertical climb**							
082 04 02 01		***Relative airflow and angles of attack***							
(01)	X	Describe the dependence of the vertical climb speed ~~and~~ on the opposite vertical air velocity relative to the rotor disk.			X	X	X		
~~LO (02)~~		~~Explain the relative air velocities and angles of attack of the blade elements.~~			X	X	X		Not essential
(03)		Explain how α~~the angle of attack~~ is controlled by the collective pitch angle control.			X	X	X		
082 04 02 02		***Power and vertical speed***							
(01)		Define ~~the~~ total main-rotor power as the sum of ~~the~~ parasite power, ~~the~~ induced power, ~~the~~ climb power and ~~the~~ rotor profile power.			X	X	X		
(02)		Explain why the total main-rotor power required increases when the rate of climb increases.			X	X	X		
~~LO (03)~~		~~Define the total required power in vertical flight.~~			X	X	X		Covered in 082 04 02 02 (01)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 04 03 00		**Forward flight**							
082 04 03 01		***Airflow and forces in uniform inflow distribution***							
(01)		Explain the assumption of a uniform inflow distribution on the rotor disc.			X	X	X		
~~LO (02)~~		~~Define the azimuth angle of a blade, the advancing blade angular range centred at 90°, and the retreating blade range centred at 270°.~~			~~X~~	~~X~~	~~X~~		Too controversial — some say it is measured from the tail boom, others against the relative wind Not essential anyway
(03)		Show the upstream air velocities relative to the blade elements and the different effects on the advancing and retreating blades. Define the area of reverse flow. Explain the influence of forward speed on the ~~tip~~ circumferential speed of the tip.			X	X	X		
(04)		Assuming constant pitch angles and rigid blade attachments, explain the ~~huge~~ roll moment from ~~by~~ the asymmetric ~~lift~~ distribution of lift.			X	X	X		
(05)		Show that through cyclic feathering this imbalance could be eliminated by a low α~~angle of attack~~ (accomplished by a low pitch angle) on the advancing blade and a high α~~angle of attack~~ (accomplished by a high pitch angle) on the retreating blade.			X	X	X		
(06)		Describe the high air velocity at the advancing blade tip and the compressibility effects which limit ~~the~~ maximum speed ~~of the~~			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		~~helicopter~~.							
(07)		Describe the low air velocities on the retreating blade tip resulting from the difference between the circumferential speed and ~~the~~ forward speed, the ~~necessity of~~ need for high angles of attack and the onset of stall.			X	X	X		
(08)		Define the tip speed ratio ~~and show the limits~~.			X	X	X		The definition is enough
(09)		Explain the total r~~R~~otor t~~T~~hrust that is perpendicular to the rotor disc and the ~~necessity to~~ need for tilting the thrust vector forward. ~~(Realisation will be explained in 082 05 00 00)~~			X	X	X		Total rotor thrust is the usual term, not the previous 'rotor thrust'
(10)		Explain the conditions of equilibrium ~~conditions~~ in steady straight and level flight.			X	X	X		
082 04 03 02		***The flare (powered flight)***							
(01)		Explain the flare in powered flight, the rearward tilt of the rotor disc and ~~of~~ the thrust vector. Show the horizontal thrust component that is in the opposite direction to ~~the speed~~ forward velocity.			X	X	X		
(02)		State the increase ~~of the~~ in thrust due to the upward inflow, and show the modifications ~~of~~ in the angles of attack.			X	X	X		
(03)		Explain the increase ~~of~~ in rotor RPM ~~in the case of~~ for a non-governed rotor.			X	X	X		
~~LO (04)~~		~~Explain the actions to be taken by the pilot.~~			~~X~~	~~X~~	~~X~~		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 04 03 03		***Non-uniform inflow distribution in relation to inflow roll***							
(01)		~~Explain why the uniform inflow distribution is an assumption to simplify the theory and describe the real.~~ Describe the inflow distribution which modifies α~~the angle of attack~~ and ~~the~~ lift especially on the ~~forward~~ advancing and ~~backward~~ retreating blades.			X	X	X		
082 04 03 04		***Power and maximum speed***							
(01)		Explain that the induced velocities and ~~induced~~ power values decrease as the speed of the helicopter ~~speed~~ increases.			X	X	X		
(02)		Define ~~the~~ profile drag and ~~the~~ profile power and the~~ir~~ increase in their values with the speed of the helicopter ~~speed~~.			X	X	X		
(03)		Define ~~the fuselage~~ parasite drag and ~~the~~ parasite power, and the increase in their values with the speed of the helicopter ~~speed~~.			X	X	X		
(04)		Define ~~the~~ total drag and ~~the~~ its increase with helicopter speed.			X	X	X		
(05)		Describe the ~~tail rotor~~ power required for the tail rotor and the power required by ~~the~~ ancillary equipment.			X	X	X		
(06)		Define the total power requirement as a sum of the above partial powers, and explain how ~~this total power~~ it varies with the speed of the helicopter ~~speed~~.			X	X	X		
(07)		Explain the influence of ~~the~~ helicopter mass, ~~the~~ air density and additional external equipment on the partial powers and the total			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		power required.							
(08)		Describe ~~the~~ translational lift and show the decrease ~~of~~ in required total power as the helicopter increases its speed ~~in the low-speed region~~ from the hover.			X	X	X		
082 04 04 00		**Hover and forward flight i~~I~~n g~~G~~round e~~E~~ffect (HIGE)**							
082 04 04 01		***Airflow in ground effect, downwash***							
(01)		Explain how the vicinity of the ground changes the downward flow pattern and the consequences on lift (thrust) at constant rotor power. Show that ~~the~~ ground effect depends on the height of the rotor above the ground and the rotor diameter. Show the required rotor power at constant all-up mass (AUM) as a function of height above the ground. Describe the influence of ~~the~~ forward speed.			X	X	X		
082 04 05 00		**Vertical descent**							
082 04 05 01		***Vertical descent, power on***							
(01)		Describe the airflow ~~to~~ around the rotor disc in a trouble-free vertical descent, power on, the airflow ~~opposite to~~ opposing the helicopter's velocity, the relative airflow ~~air velocity~~ and α~~the angle of attack~~.			X	X	X		
(02)		Explain the vortex-ring state, ~~the~~ also known as settling with power. State the approximate ~~values of~~ vertical descent speeds ~~for~~ that allow the formation of vortex ring, related to the values of the induced velocities.			X	X	X		For modern helicopters, this should be at least 400–500 ft/m and inside the effective translational lift

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
									(ETL) (around 12 kt)
(03)		Describe the airflow relative to the blades, the root stall, the loss of lift ~~on~~ at the blade tip, the turbulence. Show the effect of raising the lever and ~~discuss~~ describe the effects on the controls.			X	X	X		
082 04 05 02		***Autorotation***							
(01)		State the need for early recognition ~~of malfunctions~~ and for a quick initiation of recovery. Describe the recovery actions.			X	X	X		
(02)		Explain that the collective lever ~~position~~ must be lowered ~~sufficient~~ quickly enough to avoid a rapid decay of rotor RPM due to drag on the blades, and explain the influence of ~~the~~ rotational inertia of the rotor on the rate of decay.			X	X	X		
(03)		Show the induced flow through the rotor disc, the rotational velocity and ~~the~~ relative airflow, the inflow and inflow angles.			X	X	X		
(04)		Show how the aerodynamic forces on the blade elements vary from root to tip and distinguish three zones: the inner ~~stalled ring (~~stalled region~~)~~, the middle ~~autorotation ring (~~driving region~~)~~, and the ~~outer anti-autorotation ring (~~driven region~~)~~. ~~Explain the RPM stability of the RPM at a given collective pitch.~~			X	X	X		
(05)		Explain the control of the rotor RPM with collective pitch.			X	X	X		
(06)		Show the need ~~of~~ for negative tail-rotor thrust ~~for~~ with yaw			X	X	X		Edited for English

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		control.							
(07)		Explain the final increase in rotor thrust caused by pulling the collective to decrease the vertical descent speed and the decay in rotor RPM.			X	X	X		
082 04 06 00		**Forward flight — a~~A~~utorotation**							
082 04 06 01		***Airflow at the rotor disc***							
(01)		Explain the factors affecting inflow angle and α~~angle of attack~~, the autorotative power distribution and the ~~assymetry~~ dissymmetry over the rotor disc in forward flight.			X	X	X		
082 04 06 02		***Flight and landing***							
(01)		Show the effect of forward speed on the vertical descent speed.			X	X	X		
(02)		Explain the effects of gross weight, rotor RPM and altitude (density) on endurance and range.			X	X	X		
(03)		Explain the ~~manoeuvers~~manoeuvres of turning and touchdown.			X	X	X		
(04)		Explain the height–velocity ~~avoidance graph or dead man's~~ curves.			X	X	X		
082 05 00 00		**MAIN-ROTOR MECHANICS**							
082 05 01 00		**Flapping of the blade in hover**							
082 05 01 01		***~~Forces and stresses on the blade~~ Intentionally left blank***							Moved to 021 17 01 03
~~LO (01)~~		~~Show how the centrifugal forces depend on rotor RPM and blade mass and how they pull on the blade's attachment to the hub.~~			~~X~~	~~X~~	~~X~~		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		~~Apply the formula to an example. Justify the upper limit of the rotor RPM.~~							
~~LO (02)~~		~~Assume a rigid attachment and show how thrust may cause huge oscillating bending moments which stress the attachment.~~			~~X~~	~~X~~	~~X~~		
~~LO (03)~~		~~Explain why flapping hinges do not transfer such moments. Show the small flapping hinge offset on fully articulated rotors and zero offset in the case of teetering rotors.~~			~~X~~	~~X~~	~~X~~		
~~LO (04)~~		~~Describe the working principle of the flexible element in the hingeless rotor and describe the equivalent flapping hinge offset compared to that of the articulated rotor.~~			~~X~~	~~X~~	~~X~~		
082 05 01 02		***Centrifugal turning moment (CTM)***							
(01)		Describe the centrifugal forces on the mass elements of a blade with pitch applied and the components of ~~these~~ those forces. Show how ~~these~~ the forces generate a moment ~~which~~ that tries to reduce the blade pitch angle.			X	X	X		
(02)		Explain the methods of counteracting CTM ~~by~~ with hydraulics, bias springs and balance masses.			X	X	X		
082 05 01 03		***Coning angle in the hover***							
(01)		Define the tip path plane and the coning angle.			X	X	X		(01) and (02) have been swapped for a better order
(02)		Show how the equilibrium of the moments about the flapping			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		hinge of lift (thrust) and of ~~the~~ centrifugal force determine the coning angle of the blade (the blade ~~weight~~ mass being negligible).							
(03)		~~Explain the influence of rotor RPM and lift on the coning angle, j~~Justify the lower limit of ~~the~~ rotor RPM~~, relate the lift on one blade to the gross weight~~.			X	X	X		Covered in 082 05 01 03 02
(04)		Explain the effect of the mass of ~~the~~ a blade on the tip path and the tracking.			X	X	X		
082 05 02 00		**Flapping angles of the blade in forward flight**							
082 05 02 01		***Forces on the blade in forward flight without cyclic feathering***							
(01)		Assume rigid attachments of the blade to the hub and show the periodic lift, moment and stresses on the attachment, the ensuing metal fatigue, the roll moment on the helicopter, and justify the necessity for a flapping hinge.			X	X	X		
(02)		Assume no cyclic pitch and describe the lift on the advancing and ~~the~~ retreating blades.			X	X	X		
(03)		State the azimuthal phase lag (90° or less) between the input (applied pitch) and the output (flapping angle). Explain ~~the~~ ~~rotor~~ flapback (the rearward tilting of the tip path plane and ~~the rotor thrust~~ total rotor thrust).			X	X	X		
082 05 02 02		***Cyclic pitch (feathering) in ~~helicopter mode,~~ forward flight***							
(01)		Show that in order to assume and maintain forward flight, the			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		~~rotor thrust~~ total rotor thrust vector must ~~get~~ obtain a forward component by tilting the tip path plane.							
(02)		Show how the applied cyclic pitch modifies the lift on the advancing and retreating blades and produces the required forward tilting of the tip path plane and the total rotor thrust.			X	X	X		
(03)		Show the cone described by the blades and define the virtual axis of rotation ~~(or the no flapping axis)~~. Define the plane of rotation.			X	X	X		
(04)		Define the reference system in which ~~we define~~ the movements are defined: the shaft axis and the hub plane.			X	X	X		
(05)		Describe the swash plates, the pitch links and ~~the pitch~~ horns. Explain how the collective lever moves the non-rotating swash plate up or down ~~alongside~~ the shaft axis.			X	X	X		
(06)		Describe the mechanism by which the desired cyclic blade pitch can be produced by tilting the swash plate with the cyclic stick.			X	X	X		
~~LO (07)~~		~~Define the no feathering or control plane (control orbit) and the no feathering axis or control axis.~~			X	X	X		No practical use
(08)		Explain the translational lift effect when the speed increases.			X	X	X		
(09)	X	Justify the increase of the tilt angle of the thrust vector and of the ~~Tip Path Plane~~ disc in order to increase the speed.			X	X	X		
082 05 03 00		**Blade-lag motion in forward flight**							
082 05 03 01		***Forces on the blade in the disc plane (tip path plane) in forward***							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		flight							
(01)		Explain the Coriolis force due to flapping, the resulting periodic moments in the hub plane, and the resulting periodic stresses which make lead-lag hinges necessary to avoid material fatigue.			X	X	X		
(02)		Describe the profile drag forces on the blade elements and the periodic variation of these forces.			X	X	X		
082 05 03 02		***The drag or lag hinge***							
~~LO (01)~~		~~Describe the drag hinge of the fully articulated rotor and the lag flexure in the hingeless rotor.~~			~~X~~	~~X~~	~~X~~		Moved to 021 17 01 02 (03)
~~LO (02)~~		~~Explain the necessity for drag dampers.~~			~~X~~	~~X~~	~~X~~		Moved to 021 17 01 02 (04)
082 05 03 03		***Ground resonance***							
(01)		Explain the movement of the CG ~~centre of gravity~~ of the blades due to ~~the~~ lead-lag movements in the multibladed rotor.			X	X	X		
(02)		Show the effect on the fuselage and the danger of resonance between this force and the fuselage and undercarriage when the gear touches the ground. ~~State the conditions likely to lead to ground resonance.~~			X	X	X		
082 05 04 00		**Rotor systems**							
082 05 04 01		***See-saw or teetering rotor***							
(01)		Explain that a teetering rotor is prone to mast bumping in low-g~~G~~			X	X	X		The lack of offset means that

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		situations, ~~because of having no flapping hinge offset~~ and that it is difficult to counteract because there is no lift force to provide sideways movement.							there is no sideways control because there is no lift force — it is not the cause of mast bumping per se
082 05 04 02		***~~Fully articulated rotor~~ Intentionally left blank***							
~~LO (01)~~		~~Describe the fully articulated rotor with hinges and feathering bearings.~~			~~X~~	~~X~~	~~X~~		Moved to 021 17 01 01 (03)
~~LO (02)~~		~~Describe ball and roller bearings and elastomeric bearings, their advantages and disadvantages.~~			~~X~~	~~X~~	~~X~~		No practical use
082 05 04 03		***Hingeless rotor, bearingless rotor***							
(01)		Show the forces on the flapping hinges with a large offset (virtual hinge) and the resulting moments, and compare them with other rotor systems.			X	X	X		
082 05 05 00		**Blade sailing**							
082 05 05 01		***Blade sailing and causes***							
(01)		Define blade sailing, the influence of low rotor RPM and of a headwind.			X	X	X		
082 05 05 02		***Minimising the danger***							
(01)		Describe ~~the~~ actions ~~to~~ that minimise danger and the demonstrated wind envelope for engaging and disengaging rotors.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 05 05 03		***Droop stops***							
(01)		Explain the ~~utility of the~~ purpose of droop stops, and their retraction ~~of the stops~~.			X	X	X		
082 05 06 00		**Vibrations due to main rotor**							
082 05 06 01		***~~Origins of the vertical vibrations~~ Intentionally left blank***							Moved to 021 17 01 07
~~LO (01)~~		~~Explain the lift (thrust) variations per revolution of a blade and the resulting vertical (total) rotor thrust variation in the case of perfect identical blades.~~			~~X~~	~~X~~	~~X~~		
~~LO (02)~~		~~Show the resulting frequencies and amplitudes as a function of the number of blades.~~			~~X~~	~~X~~	~~X~~		
~~LO (03)~~		~~Explain the thrust variation in case of an out of track blade, causes, frequencies (one-per-revolution).~~			~~X~~	~~X~~	~~X~~		
~~LO (04)~~		~~Explain the importance of the hinges offset on the effect of the vibrations on the fuselage.~~			~~X~~	~~X~~	~~X~~		No practical use
082 05 06 02		***~~Lateral vibrations~~ Intentionally left blank***							Moved to 021 17 01 08
~~LO (01)~~		~~Explain imbalances of a blade, causes, and effects.~~			~~X~~	~~X~~	~~X~~		
~~LO (02)~~		~~Explain the frequencies lateral one-per-revolution vibration.~~			~~X~~	~~X~~	~~X~~		No practical use
082 06 00 00		**TAIL ROTORS**							
082 06 01 00		**Conventional tail rotor**							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 06 01 01		***~~Tail rotor description~~ Intentionally left blank***							Moved to 021 17 02 01
~~LO (01)~~		~~Describe the two-bladed rotor with teetering hinge, the and rotors with more than two blades.~~			~~X~~	~~X~~	~~X~~		
~~LO (02)~~		~~Show the flapping hinges and the feathering bearing.~~			~~X~~	~~X~~	~~X~~		No practical use
~~LO (03)~~		~~Describe the dangers to ground personnel, to the rotor blades, and the possibilities of minimising these dangers.~~			~~X~~	~~X~~	~~X~~		
082 06 01 02		***Tail-rotor aerodynamics***							
(01)		Explain the airflow around the blades in the hover and in forward flight, and the effects of the tip speeds on ~~the~~ noise production and ~~the~~ compressibility~~, limits~~.			X	X	X		
(02)		Explain ~~in hovering~~ the effect of wind on ~~the~~ tail-rotor aerodynamics and thrust in the hover, and any problems.			X	X	X		
(03)		Explain ~~the~~ tail-rotor thrust and the control through pitch ~~control~~ alterations (feathering).			X	X	X		
(04)		Explain tail-rotor flapback, and the effects of ~~d~~Delta 3~~-three hinges~~.			X	X	X		
(05)		Describe the roll moment and drift as side effects of the tail rotor.			X	X	X		
(06)		Explain the effects of ~~the~~ tail-rotor failure.			X	X	X		
(07)		Explain the loss of tail-rotor effectiveness (LTE), tail-rotor vortex-ring state, causes, crosswind and yaw speed.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 06 01 03		***Strakes on the tail boom***							
(01)		Describe the strake and explain ~~the~~ its function ~~of the device~~.			X	X	X		
~~**082 06 02 00**~~		~~**The fenestron**~~							Entire subtopic moved to 021 17 02 06
~~***082 06 02 01***~~		~~***Technical layout***~~							
~~LO (01)~~		~~Show Describe the technical details layout of a fenestron tail rotor.~~			~~X~~	~~X~~	~~X~~		
~~***082 06 02 02***~~		~~***Control concepts***~~							
~~LO (01)~~		~~Explain the control concepts of a fenestron tail rotor.~~			~~X~~	~~X~~	~~X~~		No practical use
~~***082 06 02 03***~~		~~***Advantages and disadvantages***~~							
~~LO (01)~~		~~Explain the advantages and disadvantages.~~			~~X~~	~~X~~	~~X~~		Only public safety and noise are affected
~~**082 06 03 00**~~		~~**The NOTAR**~~							Entire subtopic moved to 021 17 02 07
~~***082 06 03 01***~~		~~***Technical layout***~~							
~~LO (01)~~		~~Show the technical layout.~~			~~X~~	~~X~~	~~X~~		
~~***082 06 03 02***~~		~~***Control concepts***~~							
~~LO (01)~~		~~Explain the control concepts.~~			~~X~~	~~X~~	~~X~~		
~~***082 06 03 03***~~		~~***Advantages and disadvantages***~~							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
~~LO (01)~~		~~Explain the advantages and disadvantages.~~			~~X~~	~~X~~	~~X~~		
~~***082 06 04 00***~~		~~***Vibrations***~~							
~~***082 06 04 01***~~		~~***Tail rotor vibrations***~~							
~~LO (01)~~		~~Explain the sources of vibration of the tail rotor and the resulting high frequencies.~~			~~X~~	~~X~~	~~X~~		
~~***082 06 04 02***~~		~~***Balancing and tracking***~~							
~~LO (01)~~		~~Explain balancing and tracking of the tail rotor.~~			~~X~~	~~X~~	~~X~~		
082 07 00 00		**EQUILIBRIUM, STABILITY AND CONTROL**							
082 07 01 00		**Equilibrium and helicopter attitudes**							
082 07 01 01		***Hover***							
(01)		Explain why the vector sum of forces and moments must be zero in any acceleration-free situation.			X	X	X		
(02)		Indicate the forces and the moments about the lateral axis in a steady hover.			X	X	X		
(03)		Indicate the forces and the moments about the longitudinal axis in a steady hover.			X	X	X		
(04)		Deduce how the roll angle in a steady hover without wind results from the moments about the longitudinal axis.			X	X	X		
(05)		Explain how the cyclic is used to ~~create equilibrium of~~ equalise			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
		moments about the lateral axis in a steady hover.							
(06)		Explain the consequence of the cyclic stick reaching its forward or aft limit during an attempt to take off to the hover.			X	X	X		
(07)		Explain the influence of ~~the~~ density altitude on the equilibrium of forces and moments in a steady hover.			X	X	X		
082 07 01 02		***Forward flight***							
(01)		Explain why the vector sum of forces and of moments must be zero in unaccelerated flight.			X	X	X		
(02)		Indicate the forces and the moments about the lateral axis ~~acting on a helicopter~~ in ~~a~~ steady straight and level flight.			X	X	X		
(03)		Explain the influence of ~~All Up Mass (~~AUM~~)~~ on the forces and moments about the lateral axis in forward flight.			X	X	X		
(04)		Explain the influence of the position of the CG ~~centre of gravity~~ on the forces and moments about the lateral axis in forward flight.			X	X	X		
(05)		Explain the role of the cyclic stick position in creating equilibrium of forces and moments about the lateral axis in forward flight.			X	X	X		
(06)		Explain how forward speed influences the fuselage attitude.			X	X	X		
(07)		Describe and explain the inflow roll effect.			X	X	X		
082 07 02 00		**Stability**							
082 07 02 01		***Static longitudinal, roll and directional stability***							

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(01)		Define static stability; give an example of static stability and of static instability.			X	X	X		
(02)		Explain the contribution of the main rotor to speed stability.			X	X	X		
(03)		Describe the influence of the horizontal stabiliser on static longitudinal stability.			X	X	X		
(04)		Explain the effect of hinge offset on static stability.			X	X	X		
(05)		Describe the influence of the tail rotor on static directional stability.			X	X	X		
(06)		Describe the influence of the vertical stabiliser on static directional stability.			X	X	X		
(07)		Explain the influence of the main rotor on ~~the~~ static roll stability.			X	X	X		
(08)		Describe the influence of the longitudinal position of the CG ~~centre of gravity~~ on ~~the~~ static longitudinal stability.			X	X	X		
082 07 02 02		***Static stability in the hover***							
(01)		Describe the initial movements of a hovering helicopter after the occurrence of a horizontal gust.			X	X	X		
082 07 02 03		***Dynamic stability***							
(01)		Define dynamic stability; give an example of dynamic stability and of dynamic instability.			X	X	X		
(02)		Explain why static stability is a precondition for dynamic stability.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 07 02 04		***Longitudinal stability***							
(01)		Explain the individual contributions of α~~angle of attack~~ and speed stability together with the stabiliser and fuselage on ~~the~~ dynamic longitudinal stability.			X	X	X		
~~LO (02)~~		~~Explain the principle of stability augmentation systems.~~			~~X~~	~~X~~	~~X~~		In 022 07 03 01 01
~~LO (03)~~		~~Define the characteristics of a phugoid.~~			~~X~~	~~X~~	~~X~~		Not relevant
082 07 02 05		***Roll stability and directional stability***							
~~LO (01)~~		~~Explain the effect of a dihedral on a helicopter.~~			~~X~~	~~X~~	~~X~~		Helicopters only get this with preconing — and not all helicopters have it
~~LO (02)~~		~~Describe how a dihedral influences the static roll stability.~~			~~X~~	~~X~~	~~X~~		
(03)		Know that a large static roll stability together with a small directional stability may lead to a Dutch roll.			X	X	X		
~~LO (04)~~		~~Explain which stability features taken together may result in spiral dive and the reason why.~~			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing
~~LO (05)~~		~~Explain the static directional stability features of a tandem rotor type helicopter.~~			~~X~~	~~X~~	~~X~~		
082 07 03 00		**Control**							
082 07 03 01		***Manoeuvrer~~e~~ stability***							
~~LO (01)~~		~~Define the meaning of stick force stability.~~			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
~~LO (02)~~		~~Define the meaning of stick position stability.~~			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing
~~LO (03)~~		~~Explain the meaning of the stick-force diagram and trim speed~~.			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing
~~LO (04)~~		~~Explain the meaning of stick force per G.~~			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing
~~LO (05)~~		~~Explain how a bob weight influences stick force per G.~~			~~X~~	~~X~~	~~X~~		Irrelevant for rotary wing
(06)		Explain how helicopter control can be limited because of available stick travel.			X	X	X		
(07)		Explain how the position of the CG ~~centre of gravity~~ influences the remaining stick travel.			X	X	X		
082 07 03 02		***Control power***							
(01)		Explain the meaning of the control moment.			X	X	X		
(02)		Explain the importance of the CG ~~centre of gravity~~ position on the control moment.			X	X	X		
~~LO (03)~~		~~Explain how the changes of magnitude of rotor thrust of a helicopter during manoeuvres influence the control moment.~~			~~X~~	~~X~~	~~X~~		Too detailed
~~LO (04)~~		~~Explain which control moment provides control for a helicopter rotor with zero-hinge offset (central flapping hinge).~~			~~X~~	~~X~~	~~X~~		Too detailed and doesn't make sense anyway
~~LO (05)~~		~~Explain the different type of rotor control moments which together provide the control of helicopters with a hingeless or a fully articulated rotor system.~~			~~X~~	~~X~~	~~X~~		Too detailed and doesn't make sense anyway
(06)		Explain the influence of hinge offset on controllability.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
082 07 03 03		***~~Static and dynamic~~ Dynamic rollover***							
(01)		Explain the mechanism which causes dynamic rollover.			X	X	X		
(02)		Explain the required pilot action when dynamic rollover is starting to develop.			X	X	X		
082 08 00 00		**HELICOPTER FLIGHT MECHANICS**							
082 08 01 00		**Flight limits**							
082 08 01 01		***Hover and vertical flight***							
(01)		Show the power required HOGE and HIGE and the power available~~, the OGE and IGE maximum hover height (see subject 020, piston engines and turbine engines)~~.			X	X	X		
(02)		Explain the effects of ~~All-Up Mass (~~AUM~~)~~, ambient temperature and pressure, density altitude and moisture.			X	X	X		
(03)		~~Discuss~~ Describe the rate of climb in a vertical flight.			X	X	X		
082 08 01 02		***Forward flight***							
(01)		Compare the power required and the power available as a function of speed in straight and level flight.			X	X	X		
(02)		Define the maximum speed limited by power and the value relative to V_{NE} and V_{NO}.			X	X	X		
(03)		Use the power graph to determine the speeds of maximum rate of climb and the maximum angle of climb.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(04)		Use the power graph to define ~~the~~ true airspeed (TAS) for maximum range and maximum endurance, and consider the case of ~~the~~ piston engine and ~~the~~ turbine engine. Explain the effects of tailwind or headwind on the speed for maximum range.			X	X	X		The turbine engine uses fuel flow, not power
(05)		Explain the effects of AUM, pressure and temperature, density altitude, humidity.			X	X	X		
082 08 01 03		***Manoeuvring***							
(01)		Define the load factor, the radius ~~of turn~~ and the rate of turn.			X	X	X		
(02)		Explain the relationship between the ~~bank~~ angle of bank, the airspeed and the radius of turn, and between the ~~bank~~ angle of bank and the load factor.			X	X	X		
(03)		Explain the influence of ~~All Up Mass (~~AUM~~)~~, pressure and temperature, density altitude, humidity.			X	X	X		
~~LO (04)~~		~~Define the limit load factors and the certification categories.~~			~~X~~	~~X~~	~~X~~		Not essential for principles of flight (POF)
082 08 02 00		**Special conditions**							
082 08 02 01		***Operating with limited power***							
(01)		Explain ~~the~~ operations with limited power, use the power graph to show the limitations on vertical ~~flight~~ and level flight, ~~discuss~~ and describe ~~the~~ power checks and procedures for take-off and landing.			X	X	X		

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	Comments
			ATPL	CPL	ATPL /IR	ATPL	CPL		
(02)		Describe manoeuvres with limited power.			X	X	X		
082 08 02 02		***Overpitch, overtorque***							
(01)		Describe overpitching and show the consequences.			X	X	X		
(02)		Describe situations likely to lead to overpitching.			X	X	X		
(03)		Describe ~~overtorqueing~~ overtorquing and show the consequences.			X	X	X		
(04)		Describe situations likely to lead to ~~overtorqueing~~ overtorquing.			X	X	X		

Overview of the proposed amendments to Subject 090 'VFR and IFR communications'

The Subjects 091 'VFR communications' and 092 'IFR communications' have been combined into one Subject, and renumbered as 090, for the following reasons:

1. Many Learning Objectives (LOs) in both Subjects overlap.
2. Pilots conducting visual flight rules (VFR) and instrument flight rules (IFR) flights very often operate in the same airspace. For safety as well as threat and error management (TEM) reasons, it is necessary that a VFR pilot understands IFR communications and vice versa.
3. A part of the instruction hours for private pilot licence (PPL) is IFR, therefore it is also logical that all professional pilots and those operating in airspace in close proximity to commercial traffic should have knowledge of both VFR and IFR communications.

SUBJECT ~~091~~ 090 — VFR AND IFR COMMUNICATIONS

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
~~090 00 00 00~~		**~~COMMUNICATIONS~~**								
09~~1~~0 00 00 00		**VISUAL FLIGHT RULES (VFR) AND INSTRUMENT FLIGHT RULES (IFR) COMMUNICATIONS**								
09~~1~~0 01 00 00		**~~DEFINITIONS~~CONCEPTS**								
09~~1~~0 01 01 00		**Meanings and significance of associated terms**								
(01)		Stations	X	X	X	X	X	X	X	
(02)		Communication methods	X	X	X	X	X	X	X	
(03)		The terms used in conjunction with the approach and holding procedures	X	X	X	X	X	X	X	Moved from old 092 01 01 00 (03)
09~~1~~0 01 02 00		**Air t~~T~~raffic s~~S~~ervices (ATS) abbreviations**								
(01)		Define commonly used ~~Air Traffic Control~~ ATS abbreviations: — flight conditions; — airspace; — services; — time; — miscellaneous.	X	X	X	X	X	X	X	

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(02)		The additional IFR-related terms	X		X			X	X	Moved from 092 01 02 00 (02)
09~~1~~0 01 03 00		**Q-code groups commonly used in radio-telephony (RT~~F~~) air–ground communications**								
(01)		Define Q-code groups commonly used in RT~~F~~ air-to-ground communications: — pressure settings; — directions and bearings.	X	X	X	X	X	X	X	
(02)		State the procedure for obtaining bearing information in flight.	X	X	X	X	X	X	X	
09~~1~~0 01 04 00		**~~Categories of messages~~**								No practical use
~~LO (01)~~		~~List the categories of messages in order of priority.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (02)~~		~~Identify the types of messages appropriate to each category.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
~~LO (03)~~		~~List the priority of a message (from given examples of messages to compare).~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			
09~~1~~0 02 00 00		**GENERAL OPERATING PROCEDURES**								
09~~1~~0 02 01 00		**Transmission of letters**								
(01)		State the phonetic alphabet used in ~~radio-telephony~~ RT.	X	X	X	X	X	X	X	

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(02)		Identify the occasions when words should be spelt.	X	X	X	X	X	X	X	
0910 02 02 00		**Transmission of numbers (including level information)**								
(01)		Describe the method of transmission of numbers: — pronunciation; — single digits, whole hundreds and whole thousands.	X	X	X	X	X	X	X	
0910 02 03 00		**Transmission of time**								
(01)		Describe the ways of transmitting time: — standard time reference (Coordinated Universal Time (UTC)); — mMinutes, minutes and hours, when required.	X	X	X	X	X	X	X	
0910 02 04 00		**Transmission technique**								
(01)		Explain the techniques used for making good R/T transmissions.	X	X	X	X	X	X	X	
0910 02 05 00		**Standard words and phrases (relevant RTF phraseology included)**								
(01)		Define the meaning of ‘standard words and phrases’.	X	X	X	X	X	X	X	
(02)		Use the correct phraseology for each phase of VFR flight.	X	X	X	X	X	X	X	

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(03)		Describe the following ~~A~~aerodrome procedures: — departure information; — taxiing instructions; — aerodrome traffic and circuits; — final approach and landing; — after landing; — essential aerodrome information.	X	X	X	X	X	X	X	
(04)		Describe VFR departure RT.	X	X	X	X	X			
(05)		Describe VFR arrival RT.	X	X	X	X	X			
(06)		~~Use~~ Recognise and describe the correct standard phraseology for each phase of IFR flight: — pushback; — IFR departure; — airways clearance~~s~~; — position reporting; — approach procedures; — IFR arrival~~s~~.	X		X			X	X	Moved from old 092 02 05 00 (02)
(07) New		Explain selective calling system (SELCAL) and aircraft communications addressing and reporting system (ACARS) phraseology.	X	X	X	X	X			

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(08) New		Explain traffic alert and collision avoidance system (TCAS) phraseology.	X	X	X	X	X	X	X	
09~~1~~0 02 06 00		**RT~~Radio telephony~~ call signs for aeronautical stations including use of abbreviated call signs**								
(01)		Name the two parts of the call sign of an aeronautical station.	X	X	X	X	X	X	X	
(02)		Identify the call-sign suffixes for aeronautical stations.	X	X	X	X	X	X	X	
(03)		Explain when the call sign may be omitted or abbreviated to the use of suffix only.	X	X	X	X	X	X	X	
09~~1~~0 02 07 00		**RT~~Radio telephony~~ call signs for aircraft including use of abbreviated call signs**								
(01)		~~List~~ Describe the three different ways to compose an aircraft call sign.	X	X	X	X	X	X	X	
(02)		Describe the abbreviated forms for aircraft call signs.	X	X	X	X	X	X	X	
(03)		Explain when aircraft call signs may be abbreviated.	X	X	X	X	X	X	X	
(04)		Explain when the suffix ‘HEAVY’ or ‘SUPER’ should be used with an aircraft call sign.	X		X			X		Moved from 092 02 07 00 (04)
(05)		Explain the use of the phrase ‘Change your call sign to…’.	X		X			X	X	Moved from 092 02 07 00 (05)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(06)		Explain the use of the phrase 'Revert to flight plan call sign'.	X		X			X	X	Moved from 092 02 07 00 (06)
0910 02 08 00		**Transfer of communication**								
(01)		Describe the procedure for transfer of communication: — by ground station; — by aircraft.	X	X	X	X	X	X	X	Categories added from old 092 02 08 00 (01)
0910 02 09 00		**Test procedures including readability scale**								
(01)		Explain how to test radio transmission and reception.	X	X	X	X	X	X	X	
(02)		State the readability scale and explain its meaning.	X	X	X	X	X	X	X	
0910 02 10 00		**Read-back and acknowledgement requirements**								
(01)		~~State~~Describe the requirement to read back ATC route clearances.	X	X	X	X	X	X	X	
(02)		State the requirement to read back clearances related to the runway in use.	X	X	X	X	X	X	X	
(03)		State the requirement to read back other clearances including conditional clearances.	X	X	X	X	X	X	X	
(04)		State the requirement to read back other data such as runway, secondary surveillance radar (SSR) codes, etc.	X	X	X	X	X	X	X	

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
091~~0~~ 02 11 00		**Radar procedural phraseology**								
(01)		Use the correct phraseology for an aircraft receiving a radar service: — radar identification; — radar vectoring; — traffic information and avoidance; — SSR procedures.	X	X	X	X	X	X	X	
090 02 12 00		**Level changes and reports**								New subtopic number Moved from 092 02 12 00
(01)		Use the correct term to describe vertical position in relation to: — ~~in relation to~~ flight level (standard pressure setting); — ~~in relation to~~ altitude (metres/feet on QNH); — ~~in relation to~~ height (metres/feet on QFE).	X		X			X	X	
090 02 13 00		**DATA link messages**								New subtopic number
(01)		List the different types of messages of the controller–pilot data link communications (CPDLC) function and give examples of data link messages	X	X	X	X	X	X	X	Moved from 022 10 02 00 (08)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
0910 03 00 00		**RELEVANT WEATHER INFORMATION TERMS (VFR)**								
0910 03 01 00		**Aerodrome weather**								
(01)		List the contents of aerodrome weather reports and state units of measurement used for each item: — wind direction and speed; — variation of wind direction and speed; — visibility; — present weather; — cloud amount and type (including the ~~meaning~~ definition of cloud and visibility OK (CAVOK); — air temperature and dew point; — pressure values (QNH, QFE); — supplementary information (aerodrome warnings, landing runway, runway conditions, restrictions, obstructions, wind-shear warnings, etc.).	X	X	X	X	X	X	X	
0910 03 02 00		**Weather broadcast**								
(01)		List the sources (VOLMET and ATIS units) of weather information available for aircraft in flight, and describe situation(s) in which a pilot would normally obtain each.	X	X	X	X	X	X	X	Sources added for clarity

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(02)		Explain the meaning of the acronyms 'D-ATIS', 'ATIS', and 'VOLMET'.	X	X	X	X	X	X	X	D-ATIS added for clarity
0910 04 00 00		**ACTION REQUIRED TO BE TAKEN IN CASE OF COMMUNICATION FAILURE**								
(01)		State the action to be taken in case of communication failure on a controlled VFR flight.	X	X	X	X	X			
(02)		Identify the frequencies to be used in an attempt to establish communication.	X	X	X	X	X			
(03)		State the additional information that should be transmitted in the event of receiver failure.	X	X	X	X	X			
(04)		Identify the SSR code that may be used to indicate communication failure.	X	X	X	X	X			
(05)		Explain the action to be taken by a pilot experiencing a~~with~~ communication failure in the aerodrome traffic pattern at controlled aerodromes.	X	X	X	X	X			
(06)		Describe the action to be taken in case of communication failure on an IFR flight.	X		X			X	X	Moved from 092 03 00 00 (01)
(07)		Describe the action to be taken in case of communication failure on an IFR flight when flying in visual meteorological conditions (VMC) and the flight will be terminated in VMC.	X		X			X	X	Moved from 092 03 00 00 (02)

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(08)		Describe the action to be taken in case of communication failure on an IFR flight when flying in instrument meteorological conditions (IMC).	X		X			X	X	Moved from 092 03 00 00 (03)
09~~1~~0 05 00 00		**DISTRESS AND URGENCY PROCEDURES**								
09~~1~~0 05 01 00		**Distress (definition, frequencies, watch of distress frequencies, distress signal, distress message)**								
(01)		State the DISTRESS procedures.	X	X	X	X	X	X	X	
(02)		Define 'DISTRESS'.	X	X	X	X	X	X	X	
(03)		Identify the frequencies that should be used by aircraft in DISTRESS.	X	X	X	X	X	X	X	
(04)		Specify the emergency SSR codes that may be used by aircraft, and the meaning of the codes.	X	X	X	X	X	X	X	
(05)		Describe the action to be taken by the station which receives a DISTRESS message.	X	X	X	X	X	X	X	
(06)		Describe the action to be taken by all other stations when a DISTRESS procedure is in progress.	X	X	X	X	X	X	X	
(07)		~~List~~ Describe the content of a DISTRESS signal/message in the correct sequence.	X	X	X	X	X	X	X	
(08) New		Describe the use of discrete frequencies (DEF) in case of distress or urgency.	X	X	X	X	X	X	X	New LO

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
091~~0~~ 05 02 00		**Urgency (definition, frequencies, urgency signal, urgency message)**								
(01)		State the URGENCY procedures.	X	X	X	X	X	X	X	
(02)		Define 'URGENCY'.	X	X	X	X	X	X	X	
(03)		Identify the frequencies that should be used by aircraft in URGENCY.	X	X	X	X	X	X	X	
(04)		Describe the action to be taken by the station which receives an URGENCY message.	X	X	X	X	X	X	X	
(05)		Describe the action to be taken by all other stations when an URGENCY procedure is in progress.	X	X	X	X	X	X	X	
(06)		~~List~~ Describe the content of an URGENCY signal/message in the correct sequence.	X	X	X	X	X	X	X	
		~~**PAN MEDICAL**~~								Moved from 092 04 01 00
		~~Describe the type of flights to which PAN MEDICAL applies.~~	~~X~~		~~X~~			~~X~~	~~X~~	Outdated
		~~List the content of a PAN MEDICAL message in correct sequence.~~	~~X~~		~~X~~			~~X~~	~~X~~	Outdated
091~~0~~ 06 00 00		**GENERAL PRINCIPLES OF VHF PROPAGATION AND ALLOCATION OF FREQUENCIES**								

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(01)		Describe the radio-frequency spectrum with particular reference to VHF.	X	X	X	X	X	X	X	
(02)		Describe the radio-frequency spectrum of the bands into which the radio-frequency spectrum is divided.	X	X	X	X	X	X	X	
(03)		Identify the frequency range of the VHF band.	X	X	X	X	X	X	X	
(04)		~~Name~~ State the band normally used for a~~A~~eronautical m~~M~~obile s~~S~~ervice (AMS) voice communication.	X	X	X	X	X	X	X	
(05)		State the frequency separation allocated between consecutive VHF frequencies.	X	X	X	X	X	X	X	
~~LO (06)~~		~~Describe the propagation characteristics of radio transmissions in the VHF band.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			No practical use
(07)		Describe the factors which reduce the effective range and quality of radio transmissions.	X	X	X	X	X	X	X	
(08)		State which of these factors apply to the VHF band.	X	X	X	X	X	X	X	
~~LO (09)~~		~~Calculate the effective range of VHF transmissions assuming no attenuating factors.~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~			Duplication of 062 01 03 03
090 07 00 00		**Weather broadcast**								From 092 05 02 00 Renumbered

Syllabus reference	BK	Syllabus details and associated Learning Objectives	Aeroplane		Helicopter			IR	CBIR(A) & EIR	Comments
			ATPL	CPL	ATPL/ IR	ATPL	CPL			
(01)		Explain when aircraft routine meteorological observations should be made.	X		X			X	X	
(02)		Explain when aircraft special meteorological observations should be made.	X		X			X	X	
~~092 07 00 00~~ **090 08 00 00**		**MORSE CODE**								Renumbered
(01)		~~Identify radio-navigation aids (VOR, DME, NDB, ILS) from their Morse-code identifiers.~~ Find the Morse code identifiers of radio navigation aids (VHF omnidirectional radio range (VOR), distance-measuring equipment (DME), non-directional radio beacon (NDB), instrument landing system (ILS)) using aeronautical charts.	X	X	X	X	X	X	X	Rephrased

The table containing the LOs for Subject 092 'IFR communications' is deleted as it has been incorporated in the table of Subject 090 'VFR communications'. The LOs in the old 092 table, that have not been incorporated in the above table, are proposed to be deleted.

~~**P. SUBJECT 092 — IFR COMMUNICATIONS**~~