



HC 02 T

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Syllabus Theorie
PPL(A)

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Einleitung

Dieser Syllabus soll Vortragende und Fluglehrer bei der Ausübung ihrer Unterrichtstätigkeit unterstützen.

Darüber hinaus ist es jedoch unerlässlich auch die relevanten Inhalte des Training Manuals, Operational Manuals und Organisation Management Manuals zu kennen. Ebenfalls haben Vortragende und Fluglehrer alle Informationen, welche von der ATO herausgegeben werden, sowie die jeweils geltenden administrativen und organisatorischen Vorgaben zu beachten.

Die persönliche Verantwortung für einen optimalen Ausbildungsablauf und die Einhaltung aller Sicherheitsbestimmungen, sowie des EASA Reglements wird durch den Syllabus aber nicht ersetzt.

Der Syllabus ist auch für Flugschülerinnen und Flugschüler als Ergänzung zu den anderen Lernunterlagen gedacht.

Er bietet einen Überblick über die Lerninhalte und kann so das Lernen von Theorie und Praxis begleitend unterstützen.

Referenz

AMC1 FCL.210; FCL.215

1.	AIR LAW AND ATC PROCEDURES	PPL
	International law: conventions, agreements and organisations	
	The Convention on international civil aviation (Chicago) Doc. 7300/6	
	Part I Air Navigation: relevant parts of the following chapters: (a) general principles and application of the convention; (b) flight over territory of Contracting States; (c) nationality of aircraft; (d) measures to facilitate air navigation; (e) conditions to be fulfilled on aircraft; (f) international standards and recommended practices; (g) validity of endorsed certificates and licences; (h) notification of differences.	x
	Part II The International Civil Aviation Organisation (ICAO): objectives and composition	x
	Annex 8: Airworthiness of aircraft	
	Foreword and definitions	x
	Certificate of airworthiness	x
	Annex 7: Aircraft nationality and registration marks	
	Foreword and definitions	x
	Common- and registration marks	x
	Certificate of registration and aircraft nationality	x
	Annex 1: Personnel licensing	
	Definitions	x
	Relevant parts of Annex 1 connected to Part- FCL and Part-Medical	x
	Annex 2: Rules of the air	
	Essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight rules, signals and interception of civil aircraft	x
	Procedures for air navigation: aircraft operations doc. 8168-ops/611, volume 1	
	Altimeter setting procedures (including ICAO doc. 7030 – regional supplementary procedures)	
	Basic requirements (except tables), procedures applicable to operators and pilots (except tables)	x
	Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – regional supplementary procedures)	
	Operation of transponders	x
	Phraseology	x
	Annex 11: Doc. 4444 air traffic management	
	Definitions	x
	General provisions for air traffic services	x
	Visual separation in the vicinity of aerodromes	x
	Procedures for aerodrome control services	x
	Radar services	x
	Flight information service and alerting service	x
	Phraseologies	x
	Procedures related to emergencies, communication failure and contingencies	x
	Annex 15: Aeronautical information service	
	Introduction, essential definitions	x
	AIP, NOTAM, AIRAC and AIC	x

	Annex 14, volume 1 and 2: Aerodromes	
	Definitions	X
	Aerodrome data: conditions of the movement area and related facilities	X
	Visual aids for navigation: (a) indicators and signalling devices; (b) markings; (c) lights; (d) signs;	X
	Visual aids for denoting obstacles: (a) marking of objects; (b) lighting of objects.	X
	Visual aids for denoting restricted use of areas	X
	Emergency and other services: (a) rescue and fire fighting; (b) apron management service.	X
	Annex 12: Search and rescue	
	Essential definitions	X
	Operating procedures: (a) procedures for PIC at the scene of an accident; (b) procedures for PIC intercepting a distress transmission; (c) search and rescue signals.	X
	Search and rescue signals: (a) signals with surface craft; (b) ground or air visual signal code; (c) air or ground signals.	X
	Annex 17: Security	
	General: aims and objectives	X
	Annex 13: Aircraft accident investigation	
	Essential definitions Applicability	X
	National law	
	National law and differences to relevant ICAO Annexes and relevant EU regulations.	X

2.	HUMAN PERFORMANCE	PPL
	Human factors: basic concepts	
	Human factors in aviation	
	Becoming a competent pilot	X
	Basic aviation physiology and health maintenance	
	The atmosphere: (a) composition; (b) gas laws.	X
	Respiratory and circulatory systems: (a) oxygen requirement of tissues; (b) functional anatomy; (c) main forms of hypoxia (hypoxic and anaemic): (1) sources, effects and counter- measures of carbon monoxide; (2) counter measures and hypoxia; (3) symptoms of hypoxia. (d) hyperventilation; (e) the effects of accelerations on the circulatory system; (f) hypertension and coronary heart disease.	X
	Man and environment	
	Central, peripheral and autonomic nervous systems	X
	Vision: (a) functional anatomy; (b) visual field, foveal and peripheral vision; (c) binocular and monocular vision; (d) monocular vision cues; (e) night vision; (f) visual scanning and detection techniques and importance of 'look-out'; (g) defective vision.	X
	Hearing: (a) descriptive and functional anatomy; (b) flight related hazards to hearing; (c) hearing loss.	X
	Equilibrium: (a) functional anatomy; (b) motion and acceleration; (c) motion sickness.	X
	Integration of sensory inputs: (a) spatial disorientation: forms, recognition and avoidance; (b) illusions: forms, recognition and avoidance: (1) physical origin; (2) physiological origin; (3) psychological origin. (c) approach and landing problems.	X
	Health and hygiene	
	Personal hygiene: personal fitness	X
	Body rhythm and sleep: (a) rhythm disturbances; (b) symptoms, effects and management.	X
	Problem areas for pilots: (a) common minor ailments including cold, influenza and gastro-intestinal upset; (b) entrapped gases and barotrauma, (scuba diving); (c) obesity; (d) food hygiene; (e) infectious diseases; (f) nutrition; (g) various toxic gases and materials.	X

Intoxication: (a) prescribed medication; (b) tobacco; (c) alcohol and drugs; (d) caffeine; (e) self-medication.	x
Basic aviation psychology	
Human information processing	
Attention and vigilance: (a) selectivity of attention; (b) divided attention.	x
Perception: (A) perceptual illusions; (B) subjectivity of perception; (C) processes of perception.	x
Memory: (a) sensory memory; (b) working or short term memory; (c) long term memory to include motor memory (skills).	x
Human error and reliability	
Reliability of human behaviour	x
Error generation: social environment (group, organisation)	x
Decision making	
Decision-making concepts: (a) structure (phases); (b) limits; (c) risk assessment; (d) practical application.	x
Avoiding and managing errors: cockpit management	
Safety awareness: (a) risk area awareness; (b) situational awareness.	x
Communication: verbal and non-verbal communication	x
Human behaviour	
Personality and attitudes: (a) development; (b) environmental influences.	x
Identification of hazardous attitudes (error proneness)	x
Human overload and underload	
Arousal	x
Stress: (a) definition(s); (b) anxiety and stress; (c) effects of stress.	x
Fatigue and stress management: (a) types, causes and symptoms of fatigue; (b) effects of fatigue; (c) coping strategies; (d) management techniques; (e) health and fitness programmes;	x

3.	METEOROLOGY	PPL
	The atmosphere	
	Composition, extent and vertical division	
	Structure of the atmosphere and Troposphere	x
	Air temperature	
	Definition and units Vertical distribution of temperature Transfer of heat Lapse rates, stability and instability Development of inversions and types of inversions	x
	Temperature near the earth's surface, surface effects, diurnal and seasonal variation, effect of clouds and effect of wind	x
	Atmospheric pressure	
	Barometric pressure and isobars	x
	Pressure variation with height Reduction of pressure to mean sea level Relationship between surface pressure centres and pressure centres aloft	x
	Air density	
	Relationship between pressure, temperature and density	x
	ISA	
	ICAO standard atmosphere	x
	Altimetry	
	Terminology and definitions Altimeter and altimeter settings Calculations Effect of accelerated airflow due to topography	x
	Wind	
	Definition and measurement of wind	
	Definition and measurement	x
	Primary cause of wind	
	Primary cause of wind, pressure gradient, coriolis force and gradient wind	x
	Variation of wind in the friction layer Effects of convergence and divergence	x
	General global circulation	
	General circulation around the globe	X
	Local winds	
	Anabatic and katabatic winds, mountain and valley winds, Venturi effects, land and sea breezes	X
	Mountain waves (standing waves, lee waves)	
	Origin and characteristics	X
	Turbulence	
	Description and types of turbulence	X
	Formation and location of turbulence	X
	THERMODYNAMICS	
	Humidity	
	Water vapour in the atmosphere	X
	Mixing ratio	X
	Temperature/dew point, relative humidity	X
	Change of state of aggregation	
	Condensation, evaporation, sublimation, freezing and melting, latent heat	X
	Adiabatic processes	
	Adiabatic processes, stability of the atmosphere	X

CLOUDS AND FOG	
Cloud formation and description	
Cooling by adiabatic expansion and by advection	X
Cloud types and cloud classification	X
Influence of inversions on cloud development	X
Fog, mist, haze	
General aspects	X
Radiation fog	X
Advection fog	X
Steaming fog	X
Frontal fog	X
Orographic fog (hill fog)	X
PRECIPITATION	
Development of precipitation	
Processes of development of precipitation	X
Types of precipitation	
Types of precipitation, relationship with cloud types	X
AIR MASSES AND FRONTS	
Air masses	
Description, classification and source regions of air masses	X
Modifications of air masses	X
Fronts	
General aspects	X
Warm front, associated clouds and weather	X
Cold front, associated clouds and weather	X
Warm sector, associated clouds and weather	X
Weather behind the cold front	X
Occlusions, associated clouds and weather	X
Stationary front, associated clouds and weather	X
Movement of fronts and pressure systems, life cycle	X
Changes of meteorological elements at a frontal wave	X
PRESSURE SYSTEMS	
Anticyclone	
Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence	X
Non frontal depressions	
Thermal-, orographic-, polar depressions, troughs	X
CLIMATOLOGY	
Climatic zones	
General seasonal circulation in the troposphere	X
Typical weather situations in the mid-latitudes	
Westerly situation	X
High pressure area	X
Flat pressure pattern	X
Local winds and associated weather	
e.g. Foehn	X
FLIGHT HAZARDS	
Icing	
Conditions for ice accretion	X
Types of ice accretion	X
Hazards of ice accretion, avoidance	X
Turbulence	
Effects on flight, avoidance	X
Wind shear	
Definition of wind shear	X
Weather conditions for wind shear	X
Effects on flight, avoidance	X



	Thunderstorms	
	Conditions for and process of development, forecast, location, type specification	X
	Structure of thunderstorms, life history, squall lines, electricity in the atmosphere, static charges	X
	Electrical discharges	X
	Development and effects of downbursts	X
	Thunderstorm avoidance	X
	Inversions	
	Influence on aircraft performance	X
	Hazards in mountainous areas	
	Influence of terrain on clouds and precipitation, frontal passage	X
	Vertical movements, mountain waves, wind shear, turbulence, ice accretion	X
	Development and effect of valley inversions	X
	Visibility reducing phenomena	
	Reduction of visibility caused by precipitation and obscuration	X
	Reduction of visibility caused by other phenomena	X
	METEOROLOGICAL INFORMATION	
	Observation	
	Surface observations	X
	Radiosonde observations	X
	Satellite observations	X
	Weather radar observations	X
	Aircraft observations and reporting	X
	Weather charts	
	Significant weather charts	X
	Surface charts	X
	Information for flight planning	
	Aviation weather messages	X
	Meteorological broadcasts for aviation	X
	Use of meteorological documents	X
	Meteorological warnings	X
	Meteorological services	
	World area forecast system and meteorological offices	X

4.	COMMUNICATIONS	PPL
	VFR COMMUNICATIONS	
	Definitions	
	Meanings and significance of associated terms	x
	ATS abbreviations	x
	Q-code groups commonly used in RTF air- ground communications	x
	Categories of messages	x
	General operating procedures	
	Transmission of letters	x
	Transmission of numbers (including level information)	x
	Transmission of time	x
	Transmission technique	x
	Standard words and phrases (relevant RTF phraseology included)	x
	R/T call signs for aeronautical stations including use of abbreviated call signs	x
	R/T call signs for aircraft including use of abbreviated call signs	x
	Transfer of communication	x
	Test procedures including readability scale	x
	Read back and acknowledgement requirements	x
	Relevant weather information terms (VFR)	
	Aerodrome weather	x
	Weather broadcast	x
	Action required to be taken in case of communication failure	x
	Distress and urgency procedures	
	Distress (definition, frequencies, watch of distress frequencies, distress signal and distress message)	x
	Urgency (definition, frequencies, urgency signal and urgency message)	x
	General principles of VHF propagation and allocation of frequencies	x

5.	PRINCIPLES OF FLIGHT	PPL
5.1.	PRINCIPLES OF FLIGHT: AEROPLANE	
	Subsonic aerodynamics	
	Basics concepts, laws and definitions	
	Laws and definitions: (a) conversion of units; (b) Newton's laws; (c) Bernoulli's equation and venturi; (d) static pressure, dynamic pressure and total pressure; (e) density; (f) IAS and TAS.	X
	Basics about airflow: (a) streamline; (b) two-dimensional airflow; (c) three-dimensional airflow.	X
	Aerodynamic forces on surfaces: (a) resulting airforce; (b) lift; (c) drag; (d) angle of attack.	X
	Shape of an aerofoil section: (a) thickness to chord ratio; (b) chord line; (c) camber line; (d) camber; (e) angle of attack.	X
	The wing shape: (a) aspect ratio; (b) root chord; (c) tip chord; (d) tapered wings; (e) wing planform.	X
	The two-dimensional airflow about an aerofoil	
	Streamline pattern	X
	Stagnation point	X
	Pressure distribution	X
	Centre of pressure	X
	Influence of angle of attack	X
	Flow separation at high angles of attack	X
	The lift – graph	X
	The coefficients	
	The lift coefficient C_l : the lift formula	X
	The drag coefficient C_d : the drag formula	X
	The three-dimensional airflow round a wing and a fuselage	
	Streamline pattern: (a) span-wise flow and causes; (b) tip vortices and angle of attack; (c) upwash and downwash due to tip vortices; (d) wake turbulence behind an aeroplane (causes, distribution and duration of the phenomenon).	X
	Induced drag, (a) influence of tip vortices on the angle of attack; (b) the induced local (c) influence of induced angle of attack on the direction of the lift vector; (d) induced drag and angle of attack.	X

	Drag	
	The parasite drag: (a) pressure drag; (b) interference drag; (c) friction drag.	x
	The parasite drag and speed	x
	The induced drag and speed	x
	The total drag	x
	The ground effect	
	Effect on take off and landing characteristics of an aeroplane	x
	The stall	
	Flow separation at increasing angles of attack: (a) the boundary layer: (1) laminar layer; (2) turbulent layer; (3) transition. (b) separation point; (c) influence of angle of attack; (d) influence on: (1) pressure distribution; (2) location of centre of pressure; (3) C_L ; (4) C_D ; (5) pitch moments. (e) buffet; (f) use of controls.	x
	The stall speed: (a) in the lift formula; (b) 1g stall speed; (c) influence of: (1) the centre of gravity; (2) power setting; (3) altitude (IAS); (4) wing loading; (5) load factor n: (i) definition; (ii) turns; (iii) forces.	x
	The initial stall in span-wise direction: (a) influence of planform; (b) geometric twist (wash out); (c) use of ailerons.	x
	Stall warning: (a) importance of stall warning; (b) speed margin; (c) buffet; (d) stall strip; (e) flapper switch; (f) recovery from stall.	x
	Special phenomena of stall: (a) the power-on stall; (b) climbing and descending turns; (c) t-tailed aeroplane; (d) avoidance of spins: (1) spin development; (2) spin recognition; (e) ice (in stagnation point and on surface): (1) absence of stall warning; (2) abnormal behaviour of the aircraft during stall.	x

	C_L augmentation	
	Trailing edge flaps and the reasons for use in take-off and landing: (a) influence on C _L - α -graph; (b) different types of flaps; (c) flap asymmetry; (d) influence on pitch movement.	x
	Leading edge devices and the reasons for use in take-off and landing	x
	The boundary layer	
	Different types: (a) laminar; (b) turbulent.	x
	Special circumstances	
	Ice and other contamination: (a) ice in stagnation point; (b) ice on the surface (frost, snow and clear ice); (c) rain; (d) contamination of the leading edge; (e) effects on stall; (f) effects on loss of controllability; (g) effects on control surface moment; (h) influence on high lift devices during take- off, landing and low speeds.	x
	Stability	
	Condition of equilibrium in steady horizontal flight	
	Precondition for static stability	x
	Equilibrium: (a) lift and weight; (b) drag and thrust.	x
	Methods of achieving balance	
	Wing and empennage (tail and canard)	x
	Control surfaces	x
	Ballast or weight trim	x
	Static and dynamic longitudinal stability	
	Basics and definitions: (a) static stability, positive, neutral and negative, (b) precondition for dynamic stability; (c) dynamic stability, positive, neutral and negative.	x
	Location of centre of gravity: (a) aft limit and minimum stability margin; (b) forward position; (c) effects on static and dynamic stability.	x
	Dynamic lateral or directional stability	
	Spiral dive and corrective actions	x
	Control	
	General	
	Basics, the three planes and three axis	x
	Angle of attack change	x
	Pitch control	
	Elevator	x
	Downwash effects	x
	Location of centre of gravity	x
	Yaw control	
	Pedal or rudder	x

	Roll control	
	Ailerons: function in different phases of flight	x
	Adverse yaw	x
	Means to avoid adverse yaw: (a) frise ailerons; (b) differential ailerons deflection.	x
	Means to reduce control forces	
	Aerodynamic balance: (a) balance tab and anti-balance tab; (b) servo tab.	x
	Mass balance	
	Reasons to balance: means	x
	Trimming	
	Reasons to trim	x
	Trim tabs	x
	Limitations	
	Operating limitations	
	Flutter	x
	V_{fe}	x
	V_{no} , V_{ne}	x
	Manoeuvring envelope	
	Manoeuvring load diagram: (a) load factor; (b) accelerated stall speed; (c) v_a ; (d) manoeuvring limit load factor or certification category.	x
	Contribution of mass	x
	Gust envelope	
	Gust load diagram	x
	Factors contributing to gust loads	x
	Propellers	
	Conversion of engine torque to thrust	
	Meaning of pitch	x
	Blade twist	x
	Effects of ice on propeller	x
	Engine failure or engine stop	
	Windmilling drag	x
	Moments due to propeller operation	
	Torque reaction, Asymmetric slipstream effect, Asymmetric blade effect	x
	Flight mechanics	
	Forces acting on an aeroplane	
	Straight horizontal steady flight	x
	Straight steady climb, descent, glide	x
	Steady coordinated turn: (a) bank angle; (b) load factor; (c) turn radius; (d) rate one turn.	x

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

7.	FLIGHT PERFORMANCE AND PLANNING	PPL
7.1.	MASS AND BALANCE: AEROPLANES OR HELICOPTERS	
	Purpose of mass and balance considerations	
	Mass limitations	
	Importance in regard to structural limitations	x
	Importance in regard to performance limitations	x
	CG limitations	
	Importance in regard to stability and controllability	x
	Importance in regard to performance	x
	Loading	
	Terminology	
	Mass terms	x
	Load terms (including fuel terms)	x
	Mass limits	
	Structural limitations	x
	Performance limitations	x
	Baggage compartment limitations	x
	Mass calculations	
	Maximum masses for take-off and landing	x
	Use of standard masses for passengers, baggage and crew	x
	Fundamentals of CG calculations	
	Definition of centre of gravity	x
	Conditions of equilibrium (balance of forces and balance of moments)	x
	Basic calculations of CG	x
	Mass and balance details of aircraft	
	Contents of mass and balance documentation	
	Datum and moment arm	x
	CG position as distance from datum	x
	Extraction of basic mass and balance data from aircraft documentation	
	BEM	x
	CG position or moment at BEM	x
	Deviations from standard configuration	x
	Determination of CG position	
	Methods	
	Arithmetic method	x
	Graphic method	x
	Load and trim sheet	
	General considerations	x
	Load sheet and CG envelope for light aeroplanes and for helicopters	x

7.2.	PERFORMANCE: AEROPLANES	
	Introduction	
	Performance classes	X
	Stages of flight	X
	Effect of aeroplane mass, wind, altitude, runway slope and runway conditions	X
	Gradients	X
	SE aeroplanes	
	Definitions of terms and speeds	X
	Take-off and landing performance	
	Use of aeroplane flight manual data	X
	Climb and cruise performance	
	Use of aeroplane flight data	X
	Effect of density altitude and aeroplane mass	X
	Endurance and the effects of the different recommended power or thrust settings	X
	Still air range with various power or thrust settings	X
7.3.	FLIGHT PLANNING AND FLIGHT MONITORING	
	Flight planning for VFR flights	
	VFR navigation plan	
	Routes, airfields, heights and altitudes from VFR charts	X
	Courses and distances from VFR charts	X
	Aerodrome charts and aerodrome directory	X
	Communications and radio navigation planning data	X
	Completion of navigation plan	X
	Fuel planning	
	General knowledge	X
	Pre-flight calculation of fuel required	
	Calculation of extra fuel	X
	Completion of the fuel section of the navigation plan (fuel log) and calculation of total fuel	X
	Pre-flight preparation	
	AIP and NOTAM briefing	
	Ground facilities and services	X
	Departure, destination and alternate aerodromes	X
	Airway routings and airspace structure	X
	Meteorological briefing	
	Extraction and analysis of relevant data from meteorological documents	X
	ICAO flight plan (ATS flight plan)	
	Individual flight plan	
	Format of flight plan	X
	Completion of the flight plan	X
	Submission of the flight plan	X
	Flight monitoring and in-flight re- planning	
	Flight monitoring	
	Monitoring of track and time	X
	In-flight fuel management	X
	In-flight re-planning in case of deviation from planned data	X

8.	AIRCRAFT GENERAL KNOWLEDGE	PPL
8.1.	AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT	
	System design, loads, stresses, maintenance	
	Loads and combination loadings applied to an aircraft's structure	x
	Airframe	
	Wings, tail surfaces and control surfaces	
	Design and constructions	x
	Structural components and materials	x
	Stresses	x
	Structural limitations	x
	Fuselage, doors, floor, wind-screen and windows	
	Design and constructions	x
	Structural components and materials	x
	Stresses	x
	Structural limitations	x
	Hydraulics	
	Hydromechanics: basic principles	x
	Hydraulic systems	x
	Hydraulic fluids: types and characteristics, limitations	x
	System components: design, operation, degraded modes of operation, indications and warnings	x
	Landing gear, wheels, tyres and brakes	
	Landing gear	
	Types and materials	x
	Nose wheel steering: design and operation	x
	Brakes	
	Types and materials	x
	System components: design, operation, indications and warnings	x
	Wheels and tyres	
	Types and operational limitations	x
	Helicopter equipments	
	Flight controls	
	Mechanical or powered	x
	Control systems and mechanical	x
	System components: design, operation, indications and warnings, degraded modes of operation and jamming	x
	Secondary flight controls	
	System components: design, operation, degraded modes of operation, indications and warnings	x
	Anti-icing systems	
	Types and operation (pitot and windshield)	x
	Fuel system	
	Piston engine	
	System components: design, operation, degraded modes of operation, indications and warnings	x
	Turbine engine	
	System components: design, operation, degraded modes of operation, indications and warnings	
	Electrics	
	Electrics: general and definitions	
	Direct current: voltage, current, resistance, conductivity, Ohm's law, power and work	x

Alternating current: voltage, current, amplitude, phase, frequency and resistance	X
Circuits: series and parallel	X
Magnetic field: effects in an electrical circuit	X
Batteries	
Types, characteristics and limitations	X
Battery chargers, characteristics and limitations	X
Static electricity: general	
Basic principles	X
Static dischargers	X
Protection against interference	X
Lightning effects	X
Generation: production, distribution and use	
DC generation: types, design, operation, degraded modes of operation, indications and warnings	X
AC generation: types, design, operation, degraded modes of operation, indications and warnings	X
Electric components	
Basic elements: basic principles of switches, circuit-breakers and relays	X
Distribution	
General: (a) bus bar, common earth and priority; (b) AC and DC comparison.	X
Piston engines	
General	
Types of internal combustion engine: basic principles and definitions	X
Engine: design, operation, components and materials	X
Fuel	
Types, grades, characteristics and limitations	X
Alternate fuel: characteristics and limitations	X
Carburettor or injection system	
Carburettor: design, operation, degraded modes of operation, indications and warnings	X
Injection: design, operation, degraded modes of operation, indications and warnings	X
Icing	X
Air cooling systems	
Design, operation, degraded modes of operation, indications and warnings	X
Lubrication systems	
Lubricants: types, characteristics and limitations	X
Design, operation, degraded modes of operation, indications and warnings	X
Ignition circuits	
Design, operation, degraded modes of operation	X
Mixture	
Definition, characteristic mixtures, control instruments, associated control levers and indications	X
Propellers	
Definitions and general: (a) aerodynamic parameters; (b) types; (c) operating modes.	X
Constant speed propeller: design, operation and system components	X
Propeller handling: associated control levers, degraded modes of operation, indications and warnings	X

	Performance and engine handling	
	Performance: influence of engine parameters, influence of atmospheric conditions, limitations and power augmentation systems	x
	Engine handling: power and mixture settings during various flight phases and operational limitations	x
8.2.	INSTRUMENTATION	
	Instrument and indication systems	
	Pressure gauge	
	Different types, design, operation, characteristics and accuracy	x
	Temperature sensing	
	Different types, design, operation, characteristics and accuracy	x
	Fuel gauge	
	Different types, design, operation, characteristics and accuracy	x
	Flow meter	
	Different types, design, operation, characteristics and accuracy	x
	Position transmitter	
	Different types, design, operation, characteristics and accuracy	x
	Torque meter	
	Design, operation, characteristics and accuracy	
	Tachometer	
	Design, operation, characteristics and accuracy	x
	Measurement of aerodynamic parameters	
	Pressure measurement	
	Static pressure, dynamic pressure, density and definitions	x
	Design, operation, errors and accuracy	x
	Temperature measurement: aeroplane	
	Design, operation, errors and accuracy	x
	Displays	x
	Temperature measurement: helicopter	
	Design, operation, errors and accuracy	
	Displays	
	Altimeter	
	Standard atmosphere	x
	The different barometric references (QNH, QFE and 1013.25)	x
	Height, indicated altitude, true altitude, pressure altitude and density altitude	x
	Design, operation, errors and accuracy	x
	Displays	x
	Vertical speed indicator	
	Design, operation, errors and accuracy	x
	Displays	x
	Air speed indicator	
	The different speeds IAS, CAS, TAS: definition, usage and relationships	x
	Design, operation, errors and accuracy	x
	Displays	x
	Magnetism: direct reading compass	
	Earth magnetic field	x
	Direct reading compass	

	Design, operation, data processing, accuracy and deviation	X
	Turning and acceleration errors	X
	Gyroscopic instruments	
	Gyroscope: basic principles	
	Definitions and design	X
	Fundamental properties	X
	Drifts	X
	Turn and bank indicator	
	Design, operation and errors	X
	Attitude indicator	
	Design, operation, errors and accuracy	X
	Directional gyroscope	
	Design, operation, errors and accuracy	X
	Communication systems	
	Transmission modes: VHF, HF and SATCOM	
	Principles, bandwidth, operational limitations and use	X
	Voice communication	
	Definitions, general and applications	X
	Alerting systems and proximity systems	
	Flight warning systems	
	Design, operation, indications and alarms	X
	Stall warning	
	Design, operation, indications and alarms	X
	Integrated instruments: electronic displays	
	Display units	
	Design, different technologies and limitations	X

9.	NAVIGATION	PPL
9.1.	GENERAL NAVIGATION	
	Basics of navigation	
	The solar system	
	Seasonal and apparent movements of the sun	x
	The earth	
	Great circle, small circle and rhumb line	x
	Latitude and difference of latitude	x
	Longitude and difference of longitude	x
	Use of latitude and longitude co-ordinates to locate any specific position	x
	Time and time conversions	
	Apparent time	x
	UTC	x
	LMT	x
	Standard times	x
	Dateline	x
	Definition of sunrise, sunset and civil twilight	x
	Directions	
	True north, magnetic north and compass north	x
	Compass deviation	x
	Magnetic poles, isogonals, relationship between true and magnetic	x
	Distance	
	Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres and ft	x
	Conversion from one unit to another	x
	Relationship between nautical miles and minutes of latitude and minutes of longitude	x
	Magnetism and compasses	
	General principles	
	Terrestrial magnetism	x
	Resolution of the earth's total magnetic force into vertical and horizontal components	x
	Variation-annual change	x
	Aircraft magnetism	
	The resulting magnetic fields	x
	Keeping magnetic materials clear of the compass	x
	Charts	
	General properties of miscellaneous types of projections	
	Direct Mercator	x
	Lambert conformal conic	x
	The representation of meridians, parallels, great circles and rhumb lines	
	Direct Mercator	x
	Lambert conformal conic	x
	The use of current aeronautical charts	
	Plotting positions	x
	Methods of indicating scale and relief (ICAO topographical chart)	x
	Conventional signs	x
	Measuring tracks and distances	x
	Plotting bearings and distances	x

	DR navigation	
	Basis of DR	
	Track	X
	Heading (compass, magnetic and true)	X
	Wind velocity	X
	Air speed (IAS, CAS and TAS)	X
	Groundspeed	X
	ETA	X
	Drift and wind correction angle	X
	DR position fix	X
	Use of the navigational computer	
	Speed	X
	Time	X
	Distance	X
	Fuel consumption	X
	Conversions	X
	Air speed	X
	Wind velocity	X
	True altitude	X
	The triangle of velocities	
	Heading	X
	Ground speed	X
	Wind velocity	X
	Track and drift angle	X
	Measurement of DR elements	
	Calculation of altitude	X
	Determination of appropriate speed	X
	In-flight navigation	
	Use of visual observations and application to in-flight navigation	X
	Navigation in cruising flight, use of fixes to revise navigation data	
	Ground speed revision	X
	Off-track corrections	X
	Calculation of wind speed and direction	X
	ETA revisions	X
	Flight log	X
9.2.	RADIO NAVIGATION	
	Basic radio propagation theory	
	Antennas	
	Characteristics	X
	Wave propagation	
	Propagation with the frequency bands	X
	Radio aids	
	Ground DF	
	Principles	X
	Presentation and interpretation	X
	Coverage	X
	Range	X

	Errors and accuracy	x
	Factors affecting range and accuracy	x
	NDB/ADF	
	Principles	x
	Presentation and interpretation	x
	Coverage	x
	Range	x
	Errors and accuracy	x
	Factors affecting range and accuracy	x
	VOR	
	Principles	x
	Presentation and interpretation	x
	Coverage	x
	Range	x
	Errors and accuracy	x
	Factors affecting range and accuracy	x
	DME	
	Principles	x
	Presentation and interpretation	x
	Coverage	x
	Range	x
	Errors and accuracy	x
	Factors affecting range and accuracy	x
	Radar	
	Ground radar	
	Principles	x
	Presentation and interpretation	x
	Coverage	x
	Range	x
	Errors and accuracy	x
	Factors affecting range and accuracy	x
	Secondary surveillance radar and transponder	
	Principles	x
	Presentation and interpretation	x
	Modes and codes	x
	GNSS	
	GPS, GLONASS OR GALILEO	
	Principles	x
	Operation	x
	Errors and accuracy	x
	Factors affecting accuracy	x