THE SYLLABUS

The content required by the european aviation authority is found in the document; aircrew regulation. This is an eu-regulation, numbered 1178/2012.

The document is easily found on the european aviation safety agency website. The curriculum is found in the document under the reference AMC1 to FCL.215.

There is no internal classification of topics in the AMC1 to FCL.215 since the syllabus is not numerically referenced in the documents provided by the authority.

To ensure compliance and identify deficiencies the syllabus is referenced by me in the course.

Here is the numbering used:

S1 AIR LAW AND ATC PROCEDURES

International law: conventions, agreements and organisations

The Convention on international civil aviation (Chicago) Doc. 7300/6

1 Part I Air Navigation: relevant parts of the following chapters:

1.1 (a) general principles and application of the convention;

1.2 (b) flight over territory of Contracting States;

1.3 (c) nationality of aircraft;

1.4 (d) measures to facilitate air navigation;

1.5 (e) conditions to be fulfilled on aircraft;

1.6 (f) international standards and recommended practices;

1.7 (g) validity of endorsed certificates and licences;

1.8 (h) notification of differences.

1.9 Part II The International Civil Aviation Organisation (ICAO): objectives and composition

2 Annex 8: Airworthiness of aircraft

2.1 Foreword and definitions

2.2 Certificate of airworthiness

3 Annex 7: Aircraft nationality and registration marks

3.1 Foreword and definitions

3.2 Common- and registration marks

3.3 Certificate of registration and aircraft nationality

4 Annex 1: Personnel licensing

4.1 Definitions

4.2 Relevant parts of Annex 1 connected to Part- FCL and Part-Medical

5 Annex 2: Rules of the air

5.1 Essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight rules, signals and interception of civil aircraft

Procedures for air navigation: aircraft operations doc. 8168-ops/611, volume 1

6 Altimeter setting procedures (including IACO doc. 7030 – regional supplementary procedures)

6.1 Basic requirements (except tables), procedures applicable to operators and pilots (except tables)

7 Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – regional supplementary procedures)

7.1 Operation of transponders

7.2 Phraseology

8 Annex 11: Doc. 4444 air traffic management

8.1 Definitions

8.2 General provisions for air traffic services

8.3 Visual separation in the vicinity of aerodromes

8.4 Procedures for aerodrome control services

8.5 Radar services

8.6 Flight information service and alerting service

8.7 Phraseologies

8.8 Procedures related to emergencies, communication failure and contingencies

9 Annex 15: Aeronautical information service

9.1 Introduction, essential definitions

9.2 AIP, NOTAM, AIRAC and AIC

10 Annex 14, volume 1 and 2: Aerodromes

10.1 Definitions

10.2 Aerodrome data: conditions of the movement area and related facilities

Visual aids for navigation:

10.3 (a) indicators and signalling devices;

10.4 (b) markings;

10.5 (c) lights;

10.6 (d) signs;

10.7 (e) markers.

Visual aids for denoting obstacles:

10.8 (a) marking of objects;

10.9 (b) lighting of objects.

10.10 Visual aids for denoting restricted use of areas

11 Emergency and other services:
11.1 (a) rescue and fire fighting;
11.2 (b) apron management service.

12 Annex 12: Search and rescue
12.1 Essential definitions
Operating procedures:
12.2 (a) procedures for PIC at the scene of an accident;
12.3 (b) procedures for PIC intercepting a distress transmission;
12.4 (c) search and rescue signals.

13 Search and rescue signals:
13.1 (a) signals with surface craft;
13.2 (b) ground or air visual signal code;
13.3 (c) air or ground signals.

14 Annex 17: Security
14.1 General: aims and objectives

15 Annex 13: Aircraft accident investigation
15.1 Essential definitions
15.2 Applicability

16 National law
16.1 National law and differences to relevant ICAO Annexes and relevant EU regulations.

S2 HUMAN PERFORMANCE

Human factors: basic concepts

T1 Human factors in aviation

1.1 Becoming a competent pilot

Basic aviation physiology and health maintenance

2 The atmosphere:

2.1 (a) composition;

2.2 (b) gas laws.

3 Respiratory and circulatory systems:

3.1 (a) oxygen requirement of tissues;

3.2 (b) functional anatomy;

3.3 (c) main forms of hypoxia (hypoxic and anaemic):

3.4 (1) sources, effects and counter-measures of carbon monoxide;

3.5 (2) counter measures and hypoxia;

3.6 (3) symptoms of hypoxia.

3.7 (d) hyperventilation;

3.8 (e) the effects of accelerations on the circulatory system;

3.9 (f) hypertension and coronary heart disease.

4 Man and environment

4.1 Central, peripheral and autonomic nervous systems

5 Vision:

5.1 (a) functional anatomy;

5.2 (b) visual field, foveal and peripheral vision;

5.3 (c) binocular and monocular vision;

5.4 (d) monocular vision cues;

5.5 (e) night vision;

5.6 (f) visual scanning and detection techniques and importance of ‘look-out’;

5.7 (g) defective vision.

6 Hearing:

6.1 (a) descriptive and functional anatomy;

6.2 (b) flight related hazards to hearing;

6.3 (c) hearing loss.

Equilibrium:

6.4 (a) functional anatomy;

6.5 (b) motion and acceleration;

6.6 (c) motion sickness.

7 Integration of sensory inputs:

7.1 (a) spatial disorientation: forms, recognition and avoidance;
7.2 (b) illusions: forms, recognition and avoidance:
7.3 (1) physical origin;
7.4 (2) physiological origin;
7.5 (3) psychological origin.
7.6 (c) approach and landing problems.

8 Health and hygiene
8.1 Personal hygiene: personal fitness
9 Body rhythm and sleep:
9.1 (a) rhythm disturbances;
9.2 (b) symptoms, effects and management.
Problem areas for pilots:
9.3 (a) common minor ailments including cold, influenza and gastro-intestinal upset;
9.4 (b) entrapped gases and barotrauma, (scuba diving);
9.5 (c) obesity;
9.6 (d) food hygiene;
9.7 (e) infectious diseases;
9.8 (f) nutrition;
9.9s (g) various toxic gases and materials.

10 Intoxication:
10.1 (a) prescribed medication;
10.2 (b) tobacco;
10.3 (c) alcohol and drugs;
10.4 (d) caffeine;
10.5 (e) self-medication.

Basic aviation psychology
Human information processing
11 Attention and vigilance:
11.1 (a) selectivity of attention;
11.2 (b) divided attention.

12 Perception:
12.1 (A) perceptual illusions;
12.2 (B) subjectivity of perception;
12.3 (C) processes of perception

13 Memory:
13.1 (a) sensory memory;
13.2 (b) working or short term memory;
13.3 (c) long term memory to include motor memory (skills).

14 Human error and reliability
14.1 Reliability of human behaviour
14.2 Error generation: social environment (group, organisation)

Decision making
15 Decision-making concepts:
15.1 (a) structure (phases);
15.2 (b) limits;
15.3 (c) risk assessment;
15.4 (d) practical application.

Avoiding and managing errors: cockpit management
16 Safety awareness:
16.1 (a) risk area awareness;
16.2 (b) situational awareness.
16.3 Communication: verbal and non-verbal communication

Human behaviour
17 Personality and attitudes:
17.1 (a) development;
17.2 (b) environmental influences.
17.3 Identification of hazardous attitudes (error proneness)

18 Human overload and underload
18.1 Arousal
Stress:
18.2 (a) definition(s);
18.3 (b) anxiety and stress;
18.4 (c) effects of stress.
Fatigue and stress management:
18.5 (a) types, causes and symptoms of fatigue;
18.6 (b) effects of fatigue;
18.7 (c) coping strategies;
18.8 (d) management techniques;
18.9 (e) health and fitness programmes;

S3 METEOROLOGY

The atmosphere

1 Composition, extent and vertical division

1.1 Structure of the atmosphere

1.2 Troposphere

2 Air temperature

2.1 Definition and units

2.2 Vertical distribution of temperature

2.3 Transfer of heat

2.4 Lapse rates, stability and instability

2.5 Development of inversions and types of inversions

2.6 Temperature near the earth's surface, surface effects, diurnal and seasonal

2.7 variation, effect of clouds and effect of wind

3 Atmospheric pressure

3.1 Barometric pressure and isobars

3.2 Pressure variation with height

3.3 Reduction of pressure to mean sea level

3.4 Relationship between surface pressure centres and pressure centres aloft

4 Air density

4.1 Relationship between pressure, temperature and density

4.2 ISA

ICAO standard atmosphere

5 Altimetry

5.1 Terminology and definitions

5.2 Altimeter and altimeter settings

5.3 Calculations

5.4 Effect of accelerated airflow due to topography

6 Wind

6.1 Definition and measurement of wind

6.2 Definition and measurement

7 Primary cause of wind

7.1 Primary cause of wind, pressure gradient, coriolis force and gradient wind

7.2 Variation of wind in the friction layer

7.3 Effects of convergence and divergence

8 Clouds and Precipitation
8.1 Formation of cloud
8.2 Principle cloud types
8.3 Precipitation

9 Visibility
9.1 Fog and mist
9.2 Haze and smoke
9.3 Visibility in precipitation

10 Air Masses
10.1 Characteristics of air masses

11 Low Pressure Systems
11.1 The warm sector depression
11.2 The warm front
11.3 The cold front
11.4 Occluded fronts
11.5 Troughs and convergence

12 High Pressure Systems
12.1 Anticyclones
12.2 Ridges
12.3 Cols

13 Hazardous Weather Conditions: Icing
13.1 Airframe icing
13.2 Rain ice
13.3 Frost
13.4 Piston engine icing

14 Hazardous Weather Conditions: Thunderstorms
14.1 Formation of thunderstorms
14.2 Hazards for aircraft

Other Hazardous Weather Conditions:
15 Mountainous areas
15.1 Turbulence
15.2 Wind shear
15.3 Strong winds

16 Meteorological Information
16.1 Synoptic charts

16.2 Satellite imagery
16.3 Ground based weather radar
16.4 Area and significant weather forecasts
16.5 TAFs and METARs
16.6 Sources of meteorological information
16.7 Forecast and observation parameters and tolerances

17 National Procedures
17.1 National procedures

S4 COMMUNICATIONS
VFR COMMUNICATIONS
1 Definitions
1.1 Meanings and significance of associated terms
1.2 ATS abbreviations
1.3 Q-code groups commonly used in RTF air-ground communications
1.4 Categories of messages

2 General operating procedures
2.1 Transmission of letters
2.2 Transmission of numbers (including level information)
2.3 Transmission of time
2.4 Transmission technique
2.5 Standard words and phrases (relevant RTF phraseology included)
2.6 R/T call signs for aeronautical stations including use of abbreviated call signs
2.7 R/T call signs for aircraft including use of abbreviated call signs
2.8 Transfer of communication
2.9 Test procedures including readability scale
2.10 Read back and acknowledgement requirements

3 Relevant weather information terms (VFR)
3.1 Aerodrome weather
3.2 Weather broadcast
3.3 Action required to be taken in case of communication failure

4 Distress and urgency procedures
4.1 Distress (definition, frequencies, watch of distress frequencies, distress signal and distress message)
4.2 Urgency (definition, frequencies, urgency signal and urgency message)

5.1 General principles of VHF propagation and allocation of frequencies

S5 PRINCIPLES OF FLIGHT

PRINCIPLES OF FLIGHT: AEROPLANE

Subsonic aerodynamics

Basics concepts, laws and definitions

1 Laws and definitions:

1.1 (a) conversion of units;

1.2 (b) Newton´s laws;

1.3 (c) Bernoulli's equation and venture;

1.4 (d) static pressure, dynamic pressure and total pressure;

1.5 (e) density;

1.6 (f) IAS and TAS.

2 Basics about airflow:

2.1 (a) streamline;

2.2 (b) two-dimensional airflow;

2.3 (c) three-dimensional airflow.

3 Aerodynamic forces on surfaces:

3.1 (a) resulting airforce;

3.2 (b) lift;

3.3 (c) drag;

3.4 (d) angle of attack.

4 Shape of an aerofoil section:

4.1 (a) thickness to chord ratio;

4.2 (b) chord line;

4.3 (c) camber line;

4.4 (d) camber;

4.5 (e) angle of attack.

5 The wing shape:

5.1 (a) aspect ratio;

5.2 (b) root chord;

5.3 (c) tip chord;

5.4 (d) tapered wings;

5.5 (e) wing planform.

6 The two-dimensional airflow about an aerofoil

6.1 Streamline pattern

6.2. Stagnation point

6.3 Pressure distribution
6.4 Centre of pressure
6.5 Influence of angle of attack
6.6 Flow separation at high angles of attack
6.7 The lift – α graph

7 The coefficients
7.1 The lift coefficient Cl: the lift formula
7.2 The drag coefficient Cd: the drag formula

The three-dimensional airflow round a wing and a fuselage
8 Streamline pattern:
8.1 (a) span-wise flow and causes;
8.2 (b) tip vortices and angle of attack;
8.3 (c) upwash and downwash due to tip vortices;
8.4 (d) wake turbulence behind an aeroplane (causes, distribution and duration of the phenomenon).

9 Induced drag:
9.1 (a) influence of tip vortices on the angle of attack;
9.2 (b) the induced local α;
9.3 (c) influence of induced angle of attack on the direction of the lift vector;
9.4 (d) induced drag and angle of attack.

Drag
10 The parasite drag:
10.1 (a) pressure drag;
10.2 (b) interference drag;
10.3 (c) friction drag.
10.4 The parasite drag and speed
10.5 The induced drag and speed
10.6 The total drag

11 The ground effect
11.1 Effect on take off and landing characteristics of an aeroplane

The stall
12 Flow separation at increasing angles of attack:
12.1 (a) the boundary layer:
12.2 (1) laminar layer;
12.3 (2) turbulent layer;
12.4 (3) transition.
12.5 (b) separation point;

12.6 (c) influence of angle of attack;
(d) influence on:
12.7 (1) pressure distribution;
12.8 (2) location of centre of pressure;
12.9 (3) CL;
12.10 (4) CD;
12.11 (5) pitch moments.
12.12 (e) buffet;
12.13 (f) use of controls.

13 The stall speed:
13.1 (a) in the lift formula;
13.2 (b) 1g stall speed;
(c) influence of:
13.3 (1) the centre of gravity;
13.4 (2) power setting;
13.5 (3) altitude (IAS);
13.6 (4) wing loading;
(5) load factor n:
13.7 (i) definition;
13.8 (ii) turns;
13.9 (iii) forces.

14 The initial stall in span-wise direction:
14.1 (a) influence of planform;
14.2 (b) geometric twist (wash out);
14.3 (c) use of ailerons.

15 Stall warning:
15.1 (a) importance of stall warning;
15.2 (b) speed margin;
15.3 (c) buffet;
15.4 (d) stall strip;
15.5 (e) flapper switch;
15.6 (f) recovery from stall.

16 Special phenomena of stall:
161 (a) the power-on stall;
16.2 (b) climbing and descending turns;
16.3 (c) t-tailed aeroplane;
(d) avoidance of spins:
16.4 (1) spin development;
16.5 (2) spin recognition;

16.6 (3) spin recovery.
(e) ice (in stagnation point and on surface):
16.7 (1) absence of stall warning;
16.8 (2) abnormal behaviour of the aircraft during stall.

CL augmentation
17 Trailing edge flaps and the reasons for use in take-off and landing:
17.1 (a) influence on CL - α-graph;
17.2 (b) different types of flaps;
17.3 (c) flap asymmetry;
17.4 (d) influence on pitch movement.
17.5 Leading edge devices and the reasons for use in take- off and landing

The boundary layer
18 Different types:
18.1 (a) laminar;
18.2 (b) turbulent.

Special circumstances
19 Ice and other contamination:
19.1 (a) ice in stagnation point;
19.2 (b) ice on the surface (frost, snow and clear ice);
19.3 (c) rain;
19.4 (d) contamination of the leading edge;
19.5 (e) effects on stall;
19.6 (f) effects on loss of controllability;
19.7 (g) effects on control surface moment;
19.8 (h) influence on high lift devices during take-off, landing and low speeds.

Stability
20 Condition of equilibrium in steady horizontal flight
20.1 Precondition for static stability
Equilibrium:
20.2 (a) lift and weight;
20.3 (b) drag and thrust.

21 Methods of achieving balance
21.1 Wing and empennage (tail and canard)
21.2 Control surfaces
21.3 Ballast or weight trim
Static and dynamic longitudinal stability
Basics and definitions:
21.4 (a) static stability, positive, neutral and negative;

21.5 (b) precondition for dynamic stability;
21.6 (c) dynamic stability, positive, neutral and negative.
Location of centre of gravity:
21.7 (a) aft limit and minimum stability margin;
21.8 (b) forward position;
21.9 (c) effects on static and dynamic stability.

22 Dynamic lateral or directional stability
22.1 Spiral dive and corrective actions

Control
23 General
23.1 Basics, the three planes and three axis
23.2 Angle of attack change

24 Pitch control
24.1 Elevator
24.2 Downwash effects
24.3 Location of centre of gravity

25 Yaw control
25.1 Pedal or rudder

26 Roll control
26.1 Ailerons: function in different phases of flight
26.2 Adverse yaw
Means to avoid adverse yaw:
26.3 (a) frise ailerons;
26.4 (b) differential ailerons deflection.

Means to reduce control forces
27 Aerodynamic balance:
27.1 (a) balance tab and anti-balance tab;
27.2 (b) servo tab.

28 Mass balance
28.1 Reasons to balance: means

29 Trimming
29.1 Reasons to trim
29.2 Trim tabs

Limitations

30 Operating limitations

30.1 Flutter

30.2 vfe

30.3 vno, vne

30.4 Manoeuvring envelope

31 Manoeuvring load diagram:

31.1 (a) load factor;

31.2 (b) accelerated stall speed;

31.3 (c) va;

31.4 (d) manoeuvring limit load factor or certification category.

31.5 Contribution of mass

32 Gust envelope

32.1 Gust load diagram

32.2 Factors contributing to gust loads

Propellers

33 Conversion of engine torque to thrust

33.1 Meaning of pitch

33.2 Blade twist

33.3 Effects of ice on propeller

34 Engine failure or engine stop

34.1 Windmilling drag

35 Moments due to propeller operation

35.1 Torque reaction

35.2 Asymmetric slipstream effect

35.3 Asymmetric blade effect

Flight mechanics

36 Forces acting on an aeroplane

36.1 Straight horizontal steady flight

36.2 Straight steady climb

36.3 Straight steady descent

36.4 Straight steady glide

Steady coordinated turn:

36.5 (a) bank angle;

36.6 (b) load factor;

36.7 (c) turn radius;

36.8 (d) rate one turn.

S6 OPERATIONAL PROCEDURES

General

1 Operation of aircraft: ICAO Annex 6, General requirements
1.1 Definitions
1.2 Applicability

22.1 Special operational procedures and hazards (general aspects)
2 Noise abatement
2.1 Noise abatement procedures
2.2 Influence of the flight procedure (departure, cruise and approach)
2.3 Runway incursion awareness (meaning of surface markings and signals)

3 Fire or smoke
3.1 Carburettor fire
3.2 Engine fire
3.3 Fire in the cabin and cockpit, (choice of extinguishing agents according to fire
3.4 classification and use of the extinguishers)
3.5 Smoke in the cockpit and (effects and action to be taken) and smoke in the
3.6 cockpit and cabin (effects and actions taken)

4 Windshear and microburst
4.1 Effects and recognition during departure and approach
4.2 Actions to avoid and actions taken during encounter

5 Wake turbulence
5.1 Cause
5.2 List of relevant parameters
5.3 Actions taken when crossing traffic, during take-off and landing

6 Emergency and precautionary landings
6.1 Definition
6.2 Cause
6.3 Passenger information
6.4 Evacuation
6.5 Action after landing

7 Contaminated runways
7.1 Kinds of contamination
7.2 Estimated surface friction and friction coefficient

S7 FLIGHT PERFORMANCE AND PLANNING

MASS AND BALANCE: AEROPLANES OR HELICOPTERS

Purpose of mass and balance considerations

1 Mass limitations

1.1 Importance in regard to structural limitations

1.2 Importance in regard to performance limitations

2 CG limitations

2.1 Importance in regard to stability and controllability

2.2 Importance in regard to performance

Loading

3 Terminology

3.1 Mass terms

3.2 Load terms (including fuel terms)

4 Mass limits

4.1 Structural limitations

4.2 Performance limitations

4.3 Baggage compartment limitations

5 Mass calculations

5.1 Maximum masses for take-off and landing

5.2 Use of standard masses for passengers, baggage and crew

6 Fundamentals of CG calculations

6.1 Definition of centre of gravity

6.2 Conditions of equilibrium (balance of forces and balance of moments)

6.3 Basic calculations of CG

Mass and balance details of aircraft

7 Contents of mass and balance documentation

7.1 Datum and moment arm

7.2 CG position as distance from datum

8 Extraction of basic mass and balance data from aircraft documentation

8.1 BEM

8.2 CG position or moment at BEM

8.3 Deviations from standard configuration

Determination of CG position

9 Methods

9.1 Arithmetic method
9.2 Graphic method

10 Load and trim sheet
10.1 General considerations
10.2 Load sheet and CG envelope for light aeroplanes and for helicopters

PERFORMANCE: AEROPLANES
11 Introduction
11.1 Performance classes
11.2 Stages of flight
11.3 Effect of aeroplane mass, wind, altitude, runway slope and runway conditions
11.4 Gradients

12 SE aeroplanes
12.1 Definitions of terms and speeds

13 Take-off and landing performance
13.1 Use of aeroplane flight manual data

14 Climb and cruise performance
14.1 Use of aeroplane flight data
14.2 Effect of density altitude and aeroplane mass
14.3 Endurance and the effects of the different recommended power or thrust settings
14.4 Still air range with various power or thrust settings

FLIGHT PLANNING AND FLIGHT MONITORING
Flight planning for VFR flights
15 VFR navigation plan
15.1 Routes, airfields, heights and altitudes from VFR charts
15.2 Courses and distances from VFR charts
15.3 Aerodrome charts and aerodrome directory
15.4 Communications and radio navigation planning data
15.5 Completion of navigation plan

16 Fuel planning
16.1 General knowledge

17 Pre-flight calculation of fuel required
17.1 Calculation of extra fuel
17.2 Completion of the fuel section of the navigation plan (fuel log) and calculation of total fuel

Pre-flight preparation

18 AIP and NOTAM briefing

18.1 Ground facilities and services

18.2 Departure, destination and alternate aerodromes

18.3 Airway routings and airspace structure

19 Meteorological briefing

19.1 Extraction and analysis of relevant data from meteorological documents

ICAO flight plan (ATS flight plan)

20 Individual flight plan

20.1 Format of flight plan

20.2 Completion of the flight plan

20.3 Submission of the flight plan

Flight monitoring and in-flight re-planning

21 Flight monitoring

21.1 Monitoring of track and time

21.2 In-flight fuel management

21.3 In-flight re-planning in case of deviation from planned data

S8 AIRCRAFT GENERAL KNOWLEDGE

AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT

1 System design, loads, stresses, maintenance

1.1 Loads and combination loadings applied to an aircraft's structure

Airframe

2 Wings, tail surfaces and control surfaces

2.1 Design and constructions

2.2 Structural components and materials

2.3 Stresses

2.4 Structural limitations

3 Fuselage, doors, floor, wind-screen and windows

3.1 Design and constructions

3.2 Structural components and materials

3.3 Stresses

3.4 Structural limitations

4 Flight and control surfaces

4.1 Design and constructions

4.2 Structural components and materials

4.3 Stresses and aero elastic vibrations

4.4 Structural limitations

5 Hydraulics

Hydromechanics: basic principles

Hydraulic systems

5.1 Hydraulic fluids: types and characteristics, limitations

4.2 System components: design, operation, degraded modes of operation, indications and warnings

Landing gear, wheels, tyres and brakes

6 Landing gear

6.1 Types and materials

6.2 Nose wheel steering: design and operation

7 Brakes

7.1 Types and materials

7.2 System components: design, operation, indications and warnings

8 Wheels and tyres

8.1 Types and operational limitations

9 Flight controls
9.1 Mechanical or powered
9.2 Control systems and mechanical
9.3 System components: design, operation, indications and warnings, degraded modes of operation and jamming

10 Secondary flight controls
10.1 System components: design, operation, degraded modes of operation, indications and warnings

11.0 Anti-icing systems
11.1 Types and operation (pitot and windshield)

Fuel system
12 Piston engine
12.1 System components: design, operation, degraded modes of operation, indications and warnings

Electrics
13 Electrics: general and definitions
13.1 Direct current: voltage, current, resistance, conductivity, Ohm's law, power and work
13.2 Alternating current: voltage, current, amplitude, phase, frequency and resistance
13.3 Circuits: series and parallel
13.4 Magnetic field: effects in an electrical circuit

14 Batteries
14.1 Types, characteristics and limitations
14.2 Battery chargers, characteristics and limitations

15 Static electricity: general
15.1 Basic principles
15.2 Static dischargers
15.3 Protection against interference
15.4 Lightning effects

16 Generation: production, distribution and use
16.1 DC generation: types, design, operation, degraded modes of operation, indications and warnings
16.2 AC generation: types, design, operation, degraded modes of operation, indications and warnings

17 Electric components

17.1 Basic elements: basic principles of switches, circuit- breakers and relays

18 Distribution

General:

18.1 (a) bus bar, common earth and priority;

18.2 (b) AC and DC comparison.

Piston engines

19 General

19.1 Types of internal combustion engine: basic principles and definitions

19.2 Engine: design, operation, components and materials

20 Fuel

20.1 Types, grades, characteristics and limitations

20.2 Alternate fuel: characteristics and limitations

21 Carburettor or injection system

21.1 Carburettor: design, operation, degraded modes of operation, indications and warnings

21.2 Injection: design, operation, degraded modes of operation, indications and warnings

21.3 Icing

22 Air cooling systems

22.1 Design, operation, degraded modes of operation, indications and warnings

23 Lubrication systems

23.1 Lubricants: types, characteristics and limitations

23.2 Design, operation, degraded modes of operation, indications and warnings

24 Ignition circuits

24.1 Design, operation, degraded modes of operation

25 Mixture

25.1 Definition, characteristic mixtures, control instruments, associated control levers and indications

26 Propellers

26.1 Definitions and general:

26.2 (a) aerodynamic parameters;

26.3 (b) types;

26.4 (c) operating modes.

26.5 Constant speed propeller: design, operation and system components
26.6 Propeller handling: associated control levers, degraded modes of operation, indications and warnings

27 Performance and engine handling
27.1 Performance: influence of engine parameters, influence of atmospheric conditions, limitations and power augmentation systems
27.2 Engine handling: power and mixture settings during various flight phases and operational limitations

INSTRUMENTATION
Instrument and indication systems
28 Pressure gauge
28.1 Different types, design, operation, characteristics and accuracy

29 Temperature sensing
29.1 Different types, design, operation, characteristics and accuracy

30 Fuel gauge
30.1 Different types, design, operation, characteristics and accuracy

31 Flow meter
31.1 Different types, design, operation, characteristics and accuracy

32 Position transmitter
32.1 Different types, design, operation, characteristics and accuracy

33 Tachometer
33.1 Design, operation, characteristics and accuracy

Measurement of aerodynamic parameters
34 Pressure measurement
34.1 Static pressure, dynamic pressure, density and definitions
34.2 Design, operation, errors and accuracy

35 Temperature measurement: aeroplane
35.1 Design, operation, errors and accuracy
35.2 Displays

36 Altimeter
36.1 Standard atmosphere
36.2 The different barometric references (QNH, QFE and 1013.25)
36.3 Height, indicated altitude, true altitude, pressure altitude and density altitude

36.4 Design, operation, errors and accuracy
36.5 Displays

37 Vertical speed indicator
37.1 Design, operation, errors and accuracy
37.2 Displays

38 Air speed indicator
38.1 The different speeds IAS, CAS, TAS: definition, usage and relationships
38.2 Design, operation, errors and accuracy
38.3 Displays

39 Magnetism: direct reading compass
39.1 Earth magnetic field
Direct reading compass
39.2 Design, operation, data processing, accuracy and deviation
39.3 Turning and acceleration errors

Gyroscopic instruments
40 Gyroscope: basic principles
40.1 Definitions and design
40.2 Fundamental properties
40.3 Drifts

41 Turn and bank indicator
41.1 Design, operation and errors

42 Attitude indicator
42.1 Design, operation, errors and accuracy

43 Directional gyroscope
43.1 Design, operation, errors and accuracy

Communication systems
44 Transmission modes: VHF, HF and SATCOM
44.1 Principles, bandwidth, operational limitations and use

45 Voice communication
45.1 Definitions, general and applications

Alerting systems and proximity systems
46 Flight warning systems
46.1 Design, operation, indications and alarms

47 Stall warning

47.1 Design, operation, indications and alarms

Integrated instruments: electronic displays

48 Display units

48.1 Design, different technologies and limitations

S9 NAVIGATION

GENERAL NAVIGATION

Basics of navigation

T1 The solar system

1.1 Seasonal and apparent movements of the sun

1-What date have the longest day

2-What date have the longest night

3-What type of twilight exists

2 The earth

2.1 Great circle, small circle and rhumb line

1-What signifies a Small Circle

2-What geographic coordinate system is used along the earths axis

3-What geographic coordinate system is used across the earths axis

4-What is a rhumb line

2.2 - Latitude and difference of latitude

1 - What divisions are used when measuring latitude and longitude?

2 - What subdivisions (two) are used?

3 - How many divisions in each sub division?

4 - What is the maximum figure of latitude?

5 - What is the maximum difference in latitude obtainable?

6 - Is latitude measured along parallels?

7 - Is latitude measured along meridians?

8 - How are Meridians represented in a map?

9 - How are parallels represented in a map?

2.3 - Longitude and difference of longitude

1 - What is the maximum figure of longitude?

2 - What is the maximum difference in longitude obtainable?

3 - Is longitude measured along parallels

4 - Is longitude measured along meridians

2.4 - Use of latitude and longitude co-ordinates to locate any specific position

1 - What is the geographical coordinate of the train station in Bremen? (Accurate to 1 subdivision)

2 - What is the position of the centre of the Eiffel Tower? (accurate to 2 subdivisions)

3 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/; What is found at position 5546,5N 01126,0E (55 46 30N 011 25 00E)?

4 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/; What is found a position 5528,7N 01105,6E (55 28 42N 011 05 36E)?

5 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/; What is found a position 5511N 01150E?

6 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/; What are the coordinates for the Helipad in the city of Slagelse? (lower right quadrant of the map)? (answer using 2 subdivisions)
7 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/; What are the coordinates for the parachute drop site of Gileleje? (Upper left quadrant of the map)(answer using 2 subdivisions)?
8 - With reference to the 1:250 000 map found https://aim.naviair.dk/da/kort/;What are the coordinates for the parachute drop site of Hundested? (Upper middle of the map) (answer using 2 subdivisions)

3 Time and time conversions
3.1 Apparent time
1-What is the reason for the difference between the length the solar day and the sidereal day?

3.2 UTC
1-What is behind the abbreviation?
2-Where is noon the same locally as well as UTC?
3-If it is noon in Madagascar, what is it UTC?
4-What is the difference between your location and UTC?
5-What is Zulu time?
6-How will daylight saving time affect UTC?

3.3 LMT
1-What are LMT tabels used for?

3.4 Standard times
1-What is the principle of standard time?
2-How many standard times exists in your country?
3-Were can you find standard time tables?

3.5 Dateline
1-What is the date line.

3.6 Definition of sunrise, sunset and civil twilight
1-What is the definition of sunrise
2-What is the definition of sunset
3-What is the definition of the beginning and end of civil twilight.

- - -
4 Directions
4.1 True north, magnetic north and compass north
4.2 Compass deviation
4.3 Magnetic poles, isogonals, relationship between true and magnetic

5 Distance

5.1 Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres and ft

5.2 Conversion from one unit to another

5.3 Relationship between nautical miles and minutes of latitude and minutes of longitude

- - -

Magnetism and compasses

6 General principles

6.1 Terrestrial magnetism

6.2 Resolution of the earth's total magnetic force into vertical and horizontal components

6.3 Variation-annual change

7 Aircraft magnetism

7.1 The resulting magnetic fields

7.2 Keeping magnetic materials clear of the compass

Charts

8 General properties of miscellaneous types of projections

8.1 Direct Mercator

8.2 Lambert conformal conic

9 The representation of meridians, parallels, great circles and rhumb lines

9.1 Direct Mercator

9.2 Lambert conformal conic

10 The use of current aeronautical charts

10.1 Plotting positions

10.2 Methods of indicating scale and relief (ICAO topographical chart)

10.3 Conventional signs

10.4 Measuring tracks and distances

10.5 Plotting bearings and distances

- - -

DR navigation

11 Basis of DR

11.1 Track

11.2 Heading (compass, magnetic and true)

11.3 Wind velocity

11.4 Air speed (IAS, CAS and TAS)

11.5 Groundspeed

11.6 ETA

11.7 Drift and wind correction angle
11.8 DR position fix

12 Use of the navigational computer
12.1 Speed
12.2 Time
12.3 Distance
12.4 Fuel consumption
12.5 Conversions
12.6 Air speed
12.7 Wind velocity
12.8 True altitude

13 The triangle of velocities
13.1 Heading
13.2 Ground speed
13.3 Wind velocity
13.4 Track and drift angle

14 Measurement of DR elements
14.1 Calculation of altitude
14.2 Determination of appropriate speed

15 In-flight navigation
15.1 Use of visual observations and application to in- flight navigation

16 Navigation in cruising flight, use of fixes to revise navigation data
16.1 Ground speed revision
16.2 Off-track corrections
16.3 Calculation of wind speed and direction
16.4 ETA revisions
16.5 Flight log

RADIO NAVIGATION
Basic radio propagation theory
17 Antennas
17.1 Characteristics

18 Wave propagation
18.1 Propagation with the frequency bands

Radio aids
19 Ground DF

19.1 Principles
19.2 Presentation and interpretation
19.3 Coverage
19.4 Range
19.5 Errors and accuracy
19.6 Factors affecting range and accuracy

20 NDB/ADF
20.1 Principles
20.2 Presentation and interpretation
20.3 Coverage
20.4 Range
20.5 Errors and accuracy
20.5 Factors affecting range and accuracy

21 VOR
21.1 Principles
21.2 Presentation and interpretation
21.3 Coverage
21.4 Range
21.5 Errors and accuracy
21.6 Factors affecting range and accuracy

22 DME
22.1 Principles
22.2 Presentation and interpretation
22.3 Coverage
22.4 Range
22.5 Errors and accuracy
22.6 Factors affecting range and accuracy

Radar
23 Ground radar
23.1 Principles
23.2 Presentation and interpretation
23.3 Coverage
23.4 Range
23.5 Errors and accuracy
23.6 Factors affecting range and accuracy

24 Secondary surveillance radar and transponder
24.1 Principles
24.2 Presentation and interpretation

24.4 Modes and codes

GNSS
25 GPS, GLONASS OR GALILEO
25.1 Principles
25.2 Operation
25.3 Errors and accuracyTHE SYLLABUS
The content required by the european aviation authority is found in the document; aircrew regulation. This is an eu-regulation, numbered 1178/2012.

The document is easily found on the european aviation safety agency website. The curriculum is found in the document under the reference AMC1 to FCL.215.

There is no internal classification of topics in the AMC1 to FCL.215 since the syllabus is not numerically referenced in the documents provided by the authority.

To ensure compliance and identify deficiencies the syllabus is referenced by me in the course.

Here is the numbering used:

S1 AIR LAW AND ATC PROCEDURES
International law: conventions, agreements and organisations
The Convention on international civil aviation (Chicago) Doc. 7300/6
1 Part I Air Navigation: relevant parts of the following chapters:
1.1 (a) general principles and application of the convention;
1.2 (b) flight over territory of Contracting States;
1.3 (c) nationality of aircraft;
1.4 (d) measures to facilitate air navigation;
1.5 (e) conditions to be fulfilled on aircraft;
1.6 (f) international standards and recommended practices;
1.7 (g) validity of endorsed certificates and licences;
1.8 (h) notification of differences.
1.9 Part II The International Civil Aviation Organisation (ICAO): objectives and composition

2 Annex 8: Airworthiness of aircraft
2.1 Foreword and definitions
2.2 Certificate of airworthiness

3 Annex 7: Aircraft nationality and registration marks
3.1 Foreword and definitions
3.2 Common- and registration marks
3.3 Certificate of registration and aircraft nationality

4 Annex 1: Personnel licensing
4.1 Definitions
4.2 Relevant parts of Annex 1 connected to Part- FCL and Part-Medical

5 Annex 2: Rules of the air
5.1 Essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight rules, signals and interception of civil aircraft

Procedures for air navigation: aircraft operations doc. 8168-ops/611, volume 1

6 Altimeter setting procedures (including IACO doc. 7030 – regional supplementary procedures)
6.1 Basic requirements (except tables), procedures applicable to operators and pilots (except tables)

7 Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – regional supplementary procedures)
7.1 Operation of transponders
7.2 Phraseology

8 Annex 11: Doc. 4444 air traffic management
8.1 Definitions
8.2 General provisions for air traffic services
8.3 Visual separation in the vicinity of aerodromes
8.4 Procedures for aerodrome control services
8.5 Radar services
8.6 Flight information service and alerting service
8.7 Phraseologies
8.8 Procedures related to emergencies, communication failure and contingencies

9 Annex 15: Aeronautical information service
9.1 Introduction, essential definitions
9.2 AIP, NOTAM, AIRAC and AIC

10 Annex 14, volume 1 and 2: Aerodromes
10.1 Definitions
10.2 Aerodrome data: conditions of the movement area and related facilities
Visual aids for navigation:
10.3 (a) indicators and signalling devices;
10.4 (b) markings;
10.5 (c) lights;
10.6 (d) signs;

10.7 (e) markers.
Visual aids for denoting obstacles:
10.8 (a) marking of objects;
10.9 (b) lighting of objects.
10.10 Visual aids for denoting restricted use of areas

11 Emergency and other services:
11.1 (a) rescue and fire fighting;
11.2 (b) apron management service.

12 Annex 12: Search and rescue
12.1 Essential definitions
Operating procedures:
12.2 (a) procedures for PIC at the scene of an accident;
12.3 (b) procedures for PIC intercepting a distress transmission;
12.4 (c) search and rescue signals.

13 Search and rescue signals:
13.1 (a) signals with surface craft;
13.2 (b) ground or air visual signal code;
13.3 (c) air or ground signals.

14 Annex 17: Security
14.1 General: aims and objectives

15 Annex 13: Aircraft accident investigation
15.1 Essential definitions
15.2 Applicability

16 National law
16.1 National law and differences to relevant ICAO Annexes and relevant EU regulations.

S2 HUMAN PERFORMANCE
Human factors: basic concepts
T1 Human factors in aviation
1.1 Becoming a competent pilot

Basic aviation physiology and health maintenance
2 The atmosphere:
2.1 (a) composition;

2.2 (b) gas laws.

3 Respiratory and circulatory systems:
3.1 (a) oxygen requirement of tissues;
3.2 (b) functional anatomy;
3.3 (c) main forms of hypoxia (hypoxic and anaemic):
3.4 (1) sources, effects and counter-measures of carbon monoxide;
3.5 (2) counter measures and hypoxia;
3.6 (3) symptoms of hypoxia.
3.7 (d) hyperventilation;
3.8 (e) the effects of accelerations on the circulatory system;
3.9 (f) hypertension and coronary heart disease.

4 Man and environment
4.1 Central, peripheral and autonomic nervous systems

5 Vision:
5.1 (a) functional anatomy;
5.2 (b) visual field, foveal and peripheral vision;
5.3 (c) binocular and monocular vision;
5.4 (d) monocular vision cues;
5.5 (e) night vision;
5.6 (f) visual scanning and detection techniques and importance of ‘look-out’;
5.7 (g) defective vision.

6 Hearing:
6.1 (a) descriptive and functional anatomy;
6.2 (b) flight related hazards to hearing;
6.3 (c) hearing loss.
Equilibrium:
6.4 (a) functional anatomy;
6.5 (b) motion and acceleration;
6.6 (c) motion sickness.

7 Integration of sensory inputs:
7.1 (a) spatial disorientation: forms, recognition and avoidance;
7.2 (b) illusions: forms, recognition and avoidance:
7.3 (1) physical origin;
7.4 (2) physiological origin;
7.5 (3) psychological origin.
7.6 (c) approach and landing problems.

8 Health and hygiene

8.1 Personal hygiene: personal fitness
9 Body rhythm and sleep:
9.1 (a) rhythm disturbances;
9.2 (b) symptoms, effects and management.
Problem areas for pilots:
9.3 (a) common minor ailments including cold, influenza and gastro-intestinal upset;
9.4 (b) entrapped gases and barotrauma, (scuba diving);
9.5 (c) obesity;
9.6 (d) food hygiene;
9.7 (e) infectious diseases;
9.8 (f) nutrition;
9.9s (g) various toxic gases and materials.

10 Intoxication:
10.1 (a) prescribed medication;
10.2 (b) tobacco;
10.3 (c) alcohol and drugs;
10.4 (d) caffeine;
10.5 (e) self-medication.

Basic aviation psychology
Human information processing
11 Attention and vigilance:
11.1 (a) selectivity of attention;
11.2 (b) divided attention.

12 Perception:
12.1 (A) perceptual illusions;
12.2 (B) subjectivity of perception;
12.3 (C) processes of perception

13 Memory:
13.1 (a) sensory memory;
13.2 (b) working or short term memory;
13.3 (c) long term memory to include motor memory (skills).

14 Human error and reliability
14.1 Reliability of human behaviour
14.2 Error generation: social environment (group, organisation)

Decision making
15 Decision-making concepts:
15.1 (a) structure (phases);

15.2 (b) limits;
15.3 (c) risk assessment;
15.4 (d) practical application.

Avoiding and managing errors: cockpit management

16 Safety awareness:
16.1 (a) risk area awareness;
16.2 (b) situational awareness.
16.3 Communication: verbal and non-verbal communication

Human behaviour

17 Personality and attitudes:
17.1 (a) development;
17.2 (b) environmental influences.
17.3 Identification of hazardous attitudes (error proneness)

18 Human overload and underload
18.1 Arousal

Stress:

18.2 (a) definition(s);
18.3 (b) anxiety and stress;
18.4 (c) effects of stress.

Fatigue and stress management:

18.5 (a) types, causes and symptoms of fatigue;
18.6 (b) effects of fatigue;
18.7 (c) coping strategies;
18.8 (d) management techniques;
18.9 (e) health and fitness programmes;

S3 METEOROLOGY

The atmosphere

1 Composition, extent and vertical division

1.1 Structure of the atmosphere

1.2 Troposphere

2 Air temperature

2.1 Definition and units

2.2 Vertical distribution of temperature

2.3 Transfer of heat

2.4 Lapse rates, stability and instability

2.5 Development of inversions and types of inversions

2.6 Temperature near the earth's surface, surface effects, diurnal and seasonal

2.7 variation, effect of clouds and effect of wind

3 Atmospheric pressure

3.1 Barometric pressure and isobars

3.2 Pressure variation with height

3.3 Reduction of pressure to mean sea level

3.4 Relationship between surface pressure centres and pressure centres aloft

4 Air density

4.1 Relationship between pressure, temperature and density

4.2 ISA

ICAO standard atmosphere

5 Altimetry

5.1 Terminology and definitions

5.2 Altimeter and altimeter settings

5.3 Calculations

5.4 Effect of accelerated airflow due to topography

6 Wind

6.1 Definition and measurement of wind

6.2 Definition and measurement

7 Primary cause of wind

7.1 Primary cause of wind, pressure gradient, coriolis force and gradient wind
7.2 Variation of wind in the friction layer
7.3 Effects of convergence and divergence

8 Clouds and Precipitation
8.1 Formation of cloud
8.2 Principle cloud types
8.3 Precipitation

9 Visibility
9.1 Fog and mist
9.2 Haze and smoke
9.3 Visibility in precipitation

10 Air Masses
10.1 Characteristics of air masses

11 Low Pressure Systems
11.1 The warm sector depression
11.2 The warm front
11.3 The cold front
11.4 Occluded fronts
11.5 Troughs and convergence

12 High Pressure Systems
12.1 Anticyclones
12.2 Ridges
12.3 Cols

13 Hazardous Weather Conditions: Icing
13.1 Airframe icing
13.2 Rain ice
13.3 Frost
13.4 Piston engine icing

14 Hazardous Weather Conditions: Thunderstorms
14.1 Formation of thunderstorms
14.2 Hazards for aircraft

Other Hazardous Weather Conditions:
15 Mountainous areas
15.1 Turbulence

15.2 Wind shear
15.3 Strong winds

16 Meteorological Information
16.1 Synoptic charts
16.2 Satellite imagery
16.3 Ground based weather radar
16.4 Area and significant weather forecasts
16.5 TAFs and METARs
16.6 Sources of meteorological information
16.7 Forecast and observation parameters and tolerances

17 National Procedures
17.1 National procedures

S4 COMMUNICATIONS
VFR COMMUNICATIONS
1 Definitions
1.1 Meanings and significance of associated terms
1.2 ATS abbreviations
1.3 Q-code groups commonly used in RTF air-ground communications
1.4 Categories of messages

2 General operating procedures
2.1 Transmission of letters
2.2 Transmission of numbers (including level information)
2.3 Transmission of time
2.4 Transmission technique
2.5 Standard words and phrases (relevant RTF phraseology included)
2.6 R/T call signs for aeronautical stations including use of abbreviated call signs
2.7 R/T call signs for aircraft including use of abbreviated call signs
2.8 Transfer of communication
2.9 Test procedures including readability scale
2.10 Read back and acknowledgement requirements

3 Relevant weather information terms (VFR)
3.1 Aerodrome weather
3.2 Weather broadcast
3.3 Action required to be taken in case of communication failure

4 Distress and urgency procedures

4.1 Distress (definition, frequencies, watch of distress frequencies, distress signal and distress message)
4.2 Urgency (definition, frequencies, urgency signal and urgency message)

5.1 General principles of VHF propagation and allocation of frequencies

5 PRINCIPLES OF FLIGHT
PRINCIPLES OF FLIGHT: AEROPLANE
Subsonic aerodynamics
Basics concepts, laws and definitions
1 Laws and definitions:
1.1 (a) conversion of units;
1.2 (b) Newton´s laws;
1.3 (c) Bernoulli's equation and venture;
1.4 (d) static pressure, dynamic pressure and total pressure;
1.5 (e) density;
1.6 (f) IAS and TAS.

2 Basics about airflow:
2.1 (a) streamline;
2.2 (b) two-dimensional airflow;
2.3 (c) three-dimensional airflow.

3 Aerodynamic forces on surfaces:
3.1 (a) resulting airforce;
3.2 (b) lift;
3.3 (c) drag;
3.4 (d) angle of attack.

4 Shape of an aerofoil section:
4.1 (a) thickness to chord ratio;
4.2 (b) chord line;
4.3 (c) camber line;
4.4 (d) camber;
4.5 (e) angle of attack.

5 The wing shape:
5.1 (a) aspect ratio;
5.2 (b) root chord;
5.3 (c) tip chord;
5.4 (d) tapered wings;
5.5 (e) wing planform.

6 The two-dimensional airflow about an aerofoil
6.1 Streamline pattern
6.2. Stagnation point
6.3 Pressure distribution
6.4 Centre of pressure
6.5 Influence of angle of attack
6.6 Flow separation at high angles of attack
6.7 The lift – α graph

7 The coefficients
7.1 The lift coefficient Cl: the lift formula
7.2 The drag coefficient Cd: the drag formula

The three-dimensional airflow round a wing and a fuselage
8 Streamline pattern:
8.1 (a) span-wise flow and causes;
8.2 (b) tip vortices and angle of attack;
8.3 (c) upwash and downwash due to tip vortices;
8.4 (d) wake turbulence behind an aeroplane (causes, distribution and duration of the phenomenon).

9 Induced drag:
9.1 (a) influence of tip vortices on the angle of attack;
9.2 (b) the induced local α;
9.3 (c) influence of induced angle of attack on the direction of the lift vector;
9.4 (d) induced drag and angle of attack.

Drag
10 The parasite drag:
10.1 (a) pressure drag;
10.2 (b) interference drag;
10.3 (c) friction drag.
10.4 The parasite drag and speed
10.5 The induced drag and speed
10.6 The total drag

11 The ground effect
11.1 Effect on take off and landing characteristics of an aeroplane

The stall
12 Flow separation at increasing angles of attack:
12.1 (a) the boundary layer:

12.2 (1) laminar layer;
12.3 (2) turbulent layer;
12.4 (3) transition.
12.5 (b) separation point;
12.6 (c) influence of angle of attack;
(d) influence on:
12.7 (1) pressure distribution;
12.8 (2) location of centre of pressure;
12.9 (3) CL;
12.10 (4) CD;
12.11 (5) pitch moments.
12.12 (e) buffet;
12.13 (f) use of controls.

13 The stall speed:
13.1 (a) in the lift formula;
13.2 (b) 1g stall speed;
(c) influence of:
13.3 (1) the centre of gravity;
13.4 (2) power setting;
13.5 (3) altitude (IAS);
13.6 (4) wing loading;
(5) load factor n:
13.7 (i) definition;
13.8 (ii) turns;
13.9 (iii) forces.

14 The initial stall in span-wise direction:
14.1 (a) influence of planform;
14.2 (b) geometric twist (wash out);
14.3 (c) use of ailerons.

15 Stall warning:
15.1 (a) importance of stall warning;
15.2 (b) speed margin;
15.3 (c) buffet;
15.4 (d) stall strip;
15.5 (e) flapper switch;
15.6 (f) recovery from stall.

16 Special phenomena of stall:
161 (a) the power-on stall;
16.2 (b) climbing and descending turns;

16.3 (c) t-tailed aeroplane;
(d) avoidance of spins:
16.4 (1) spin development;
16.5 (2) spin recognition;
16.6 (3) spin recovery.
(e) ice (in stagnation point and on surface):
16.7 (1) absence of stall warning;
16.8 (2) abnormal behaviour of the aircraft during stall.

CL augmentation
17 Trailing edge flaps and the reasons for use in take-off and landing:
17.1 (a) influence on CL - α-graph;
17.2 (b) different types of flaps;
17.3 (c) flap asymmetry;
17.4 (d) influence on pitch movement.
17.5 Leading edge devices and the reasons for use in take- off and landing

The boundary layer
18 Different types:
18.1 (a) laminar;
18.2 (b) turbulent.

Special circumstances
19 Ice and other contamination:
19.1 (a) ice in stagnation point;
19.2 (b) ice on the surface (frost, snow and clear ice);
19.3 (c) rain;
19.4 (d) contamination of the leading edge;
19.5 (e) effects on stall;
19.6 (f) effects on loss of controllability;
19.7 (g) effects on control surface moment;
19.8 (h) influence on high lift devices during take-off, landing and low speeds.

Stability
20 Condition of equilibrium in steady horizontal flight
20.1 Precondition for static stability
Equilibrium:
20.2 (a) lift and weight;
20.3 (b) drag and thrust.

21 Methods of achieving balance
21.1 Wing and empennage (tail and canard)
21.2 Control surfaces

21.3 Ballast or weight trim

Static and dynamic longitudinal stability

Basics and definitions:

21.4 (a) static stability, positive, neutral and negative;

21.5 (b) precondition for dynamic stability;

21.6 (c) dynamic stability, positive, neutral and negative.

Location of centre of gravity:

21.7 (a) aft limit and minimum stability margin;

21.8 (b) forward position;

21.9 (c) effects on static and dynamic stability.

22 Dynamic lateral or directional stability

22.1 Spiral dive and corrective actions

Control

23 General

23.1 Basics, the three planes and three axis

23.2 Angle of attack change

24 Pitch control

24.1 Elevator

24.2 Downwash effects

24.3 Location of centre of gravity

25 Yaw control

25.1 Pedal or rudder

26 Roll control

26.1 Ailerons: function in different phases of flight

26.2 Adverse yaw

Means to avoid adverse yaw:

26.3 (a) frise ailerons;

26.4 (b) differential ailerons deflection.

Means to reduce control forces

27 Aerodynamic balance:

27.1 (a) balance tab and anti-balance tab;

27.2 (b) servo tab.

28 Mass balance

28.1 Reasons to balance: means

29 Trimming

29.1 Reasons to trim
29.2 Trim tabs

Limitations

30 Operating limitations
30.1 Flutter
30.2 vfe
30.3 vno, vne
30.4 Manoeuvring envelope

31 Manoeuvring load diagram:
31.1 (a) load factor;
31.2 (b) accelerated stall speed;
31.3 (c) va;
31.4 (d) manoeuvring limit load factor or certification category.
31.5 Contribution of mass

32 Gust envelope
32.1 Gust load diagram
32.2 Factors contributing to gust loads

Propellers

33 Conversion of engine torque to thrust
33.1 Meaning of pitch
33.2 Blade twist
33.3 Effects of ice on propeller

34 Engine failure or engine stop
34.1 Windmilling drag

35 Moments due to propeller operation
35.1 Torque reaction
35.2 Asymmetric slipstream effect
35.3 Asymmetric blade effect

Flight mechanics

36 Forces acting on an aeroplane
36.1 Straight horizontal steady flight
36.2 Straight steady climb
36.3 Straight steady descent
36.4 Straight steady glide

Steady coordinated turn:

36.5 (a) bank angle;

36.6 (b) load factor;

36.7 (c) turn radius;

36.8 (d) rate one turn.

S6 OPERATIONAL PROCEDURES

General

1 Operation of aircraft: ICAO Annex 6, General requirements

1.1 Definitions

1.2 Applicability

22.1 Special operational procedures and hazards (general aspects)

2 Noise abatement

2.1 Noise abatement procedures

2.2 Influence of the flight procedure (departure, cruise and approach)

2.3 Runway incursion awareness (meaning of surface markings and signals)

3 Fire or smoke

3.1 Carburettor fire

3.2 Engine fire

3.3 Fire in the cabin and cockpit, (choice of extinguishing agents according to fire

3.4 classification and use of the extinguishers)

3.5 Smoke in the cockpit and (effects and action to be taken) and smoke in the

3.6 cockpit and cabin (effects and actions taken)

4 Windshear and microburst

4.1 Effects and recognition during departure and approach

4.2 Actions to avoid and actions taken during encounter

5 Wake turbulence

5.1 Cause

5.2 List of relevant parameters

5.3 Actions taken when crossing traffic, during take-off and landing

6 Emergency and precautionary landings

6.1 Definition

6.2 Cause

6.3 Passenger information

6.4 Evacuation

6.5 Action after landing

7 Contaminated runways
7.1 Kinds of contamination
7.2 Estimated surface friction and friction coefficient

S7 FLIGHT PERFORMANCE AND PLANNING

MASS AND BALANCE: AEROPLANES OR HELICOPTERS

Purpose of mass and balance considerations

1 Mass limitations
1.1 Importance in regard to structural limitations
1.2 Importance in regard to performance limitations

2 CG limitations
2.1 Importance in regard to stability and controllability
2.2 Importance in regard to performance

Loading

3 Terminology
3.1 Mass terms
3.2 Load terms (including fuel terms)

4 Mass limits
4.1 Structural limitations
4.2 Performance limitations
4.3 Baggage compartment limitations

5 Mass calculations
5.1 Maximum masses for take-off and landing
5.2 Use of standard masses for passengers, baggage and crew

6 Fundamentals of CG calculations
6.1 Definition of centre of gravity
6.2 Conditions of equilibrium (balance of forces and balance of moments)

6.3 Basic calculations of CG

Mass and balance details of aircraft
7 Contents of mass and balance documentation
7.1 Datum and moment arm
7.2 CG position as distance from datum

8 Extraction of basic mass and balance data from aircraft documentation
8.1 BEM
8.2 CG position or moment at BEM
8.3 Deviations from standard configuration

Determination of CG position
9 Methods
9.1 Arithmetic method
9.2 Graphic method

10 Load and trim sheet
10.1 General considerations
10.2 Load sheet and CG envelope for light aeroplanes and for helicopters

PERFORMANCE: AEROPLANES
11 Introduction
11.1 Performance classes
11.2 Stages of flight
11.3 Effect of aeroplane mass, wind, altitude, runway slope and runway conditions
11.4 Gradients

12 SE aeroplanes
12.1 Definitions of terms and speeds

13 Take-off and landing performance
13.1 Use of aeroplane flight manual data

14 Climb and cruise performance
14.1 Use of aeroplane flight data
14.2 Effect of density altitude and aeroplane mass
14.3 Endurance and the effects of the different recommended power or thrust settings
14.4 Still air range with various power or thrust settings

FLIGHT PLANNING AND FLIGHT MONITORING
Flight planning for VFR flights

15 VFR navigation plan
15.1 Routes, airfields, heights and altitudes from VFR charts
15.2 Courses and distances from VFR charts
15.3 Aerodrome charts and aerodrome directory
15.4 Communications and radio navigation planning data
15.5 Completion of navigation plan

16 Fuel planning
16.1 General knowledge

17 Pre-flight calculation of fuel required
17.1 Calculation of extra fuel
17.2 Completion of the fuel section of the navigation plan (fuel log) and calculation of total fuel

Pre-flight preparation
18 AIP and NOTAM briefing
18.1 Ground facilities and services
18.2 Departure, destination and alternate aerodromes
18.3 Airway routings and airspace structure

19 Meteorological briefing
19.1 Extraction and analysis of relevant data from meteorological documents

ICAO flight plan (ATS flight plan)
20 Individual flight plan
20.1 Format of flight plan
20.2 Completion of the flight plan
20.3 Submission of the flight plan

Flight monitoring and in-flight re-planning
21 Flight monitoring
21.1 Monitoring of track and time
21.2 In-flight fuel management
21.3 In-flight re-planning in case of deviation from planned data

S8 AIRCRAFT GENERAL KNOWLEDGE
AIRFRAME AND SYSTEMS, ELECTRICS, POWERPLANT AND EMERGENCY EQUIPMENT
1 System design, loads, stresses, maintenance
1.1 Loads and combination loadings applied to an aircraft’s structure

Airframe

2 Wings, tail surfaces and control surfaces

2.1 Design and constructions

2.2 Structural components and materials

2.3 Stresses

2.4 Structural limitations

3 Fuselage, doors, floor, wind-screen and windows

3.1 Design and constructions

3.2 Structural components and materials

3.3 Stresses

3.4 Structural limitations

4 Flight and control surfaces

4.1 Design and constructions

4.2 Structural components and materials

4.3 Stresses and aero elastic vibrations

4.4 Structural limitations

5 Hydraulics

Hydromechanics: basic principles

Hydraulic systems

5.1 Hydraulic fluids: types and characteristics, limitations

4.2 System components: design, operation, degraded modes of operation, indications and warnings

Landing gear, wheels, tyres and brakes

6 Landing gear

6.1 Types and materials

6.2 Nose wheel steering: design and operation

7 Brakes

7.1 Types and materials

7.2 System components: design, operation, indications and warnings

8 Wheels and tyres

8.1 Types and operational limitations

9 Flight controls

9.1 Mechanical or powered

9.2 Control systems and mechanical

9.3 System components: design, operation, indications and warnings, degraded modes of operation and jamming

10 Secondary flight controls
10.1 System components: design, operation, degraded modes of operation, indications and warnings

11.0 Anti-icing systems
11.1 Types and operation (pitot and windshield)

Fuel system
12 Piston engine
12.1 System components: design, operation, degraded modes of operation, indications and warnings

Electrics
13 Electrics: general and definitions
13.1 Direct current: voltage, current, resistance, conductivity, Ohm's law, power and work
13.2 Alternating current: voltage, current, amplitude, phase, frequency and resistance
13.3 Circuits: series and parallel
13.4 Magnetic field: effects in an electrical circuit

14 Batteries
14.1 Types, characteristics and limitations
14.2 Battery chargers, characteristics and limitations

15 Static electricity: general
15.1 Basic principles
15.2 Static dischargers
15.3 Protection against interference
15.4 Lightning effects

16 Generation: production, distribution and use
16.1 DC generation: types, design, operation, degraded modes of operation, indications and warnings
16.2 AC generation: types, design, operation, degraded modes of operation, indications and warnings

17 Electric components
17.1 Basic elements: basic principles of switches, circuit- breakers and relays

18 Distribution
General:
18.1 (a) bus bar, common earth and priority;

18.2 (b) AC and DC comparison.

Piston engines

19 General

19.1 Types of internal combustion engine: basic principles and definitions

19.2 Engine: design, operation, components and materials

20 Fuel

20.1 Types, grades, characteristics and limitations

20.2 Alternate fuel: characteristics and limitations

21 Carburettor or injection system

21.1 Carburettor: design, operation, degraded modes of operation, indications and warnings

21.2 Injection: design, operation, degraded modes of operation, indications and warnings

21.3 Icing

22 Air cooling systems

22.1 Design, operation, degraded modes of operation, indications and warnings

23 Lubrication systems

23.1 Lubricants: types, characteristics and limitations

23.2 Design, operation, degraded modes of operation, indications and warnings

24 Ignition circuits

24.1 Design, operation, degraded modes of operation

25 Mixture

25.1 Definition, characteristic mixtures, control instruments, associated control levers and indications

26 Propellers

26.1 Definitions and general:

26.2 (a) aerodynamic parameters;

26.3 (b) types;

26.4 (c) operating modes.

26.5 Constant speed propeller: design, operation and system components

26.6 Propeller handling: associated control levers, degraded modes of operation, indications and warnings

27 Performance and engine handling

27.1 Performance: influence of engine parameters, influence of atmospheric

conditions, limitations and power augmentation systems
27.2 Engine handling: power and mixture settings during various flight phases and operational limitations

INSTRUMENTATION
Instrument and indication systems
28 Pressure gauge
28.1 Different types, design, operation, characteristics and accuracy

29 Temperature sensing
29.1 Different types, design, operation, characteristics and accuracy

30 Fuel gauge
30.1 Different types, design, operation, characteristics and accuracy

31 Flow meter
31.1 Different types, design, operation, characteristics and accuracy

32 Position transmitter
32.1 Different types, design, operation, characteristics and accuracy

33 Tachometer
33.1 Design, operation, characteristics and accuracy

Measurement of aerodynamic parameters
34 Pressure measurement
34.1 Static pressure, dynamic pressure, density and definitions
34.2 Design, operation, errors and accuracy

35 Temperature measurement: aeroplane
35.1 Design, operation, errors and accuracy
35.2 Displays

36 Altimeter
36.1 Standard atmosphere
36.2 The different barometric references (QNH, QFE and 1013.25)
36.3 Height, indicated altitude, true altitude, pressure altitude and density altitude
36.4 Design, operation, errors and accuracy
36.5 Displays

37 Vertical speed indicator
37.1 Design, operation, errors and accuracy
37.2 Displays

38 Air speed indicator
38.1 The different speeds IAS, CAS, TAS: definition, usage and relationships
38.2 Design, operation, errors and accuracy
38.3 Displays

39 Magnetism: direct reading compass
39.1 Earth magnetic field
Direct reading compass
39.2 Design, operation, data processing, accuracy and deviation
39.3 Turning and acceleration errors

Gyroscopic instruments
40 Gyroscope: basic principles
40.1 Definitions and design
40.2 Fundamental properties
40.3 Drifts

41 Turn and bank indicator
41.1 Design, operation and errors

42 Attitude indicator
42.1 Design, operation, errors and accuracy

43 Directional gyroscope
43.1 Design, operation, errors and accuracy

Communication systems
44 Transmission modes: VHF, HF and SATCOM
44.1 Principles, bandwidth, operational limitations and use

45 Voice communication
45.1 Definitions, general and applications

Alerting systems and proximity systems
46 Flight warning systems
46.1 Design, operation, indications and alarms

47 Stall warning
47.1 Design, operation, indications and alarms

Integrated instruments: electronic displays
48 Display units

48.1 Design, different technologies and limitations

S9 NAVIGATION

GENERAL NAVIGATION

Basics of navigation

T1 The solar system

1.1 Seasonal and apparent movements of the sun

2 The earth

2.1 Great circle, small circle and rhumb line

2.2 Latitude and difference of latitude

2.3 Longitude and difference of longitude

2.4 Use of latitude and longitude co-ordinates to locate any specific position

3 Time and time conversions

3.1 Apparent time

3.2 UTC

3.3 LMT

3.4 Standard times

3.5 Dateline

3.6 Definition of sunrise, sunset and civil twilight

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4 Directions

4.1 True north, magnetic north and compass north

4.2 Compass deviation

4.3 Magnetic poles, isogonals, relationship between true and magnetic

5 Distance

5.1 Units of distance and height used in navigation: nautical miles, statute miles, kilometres, metres and ft

5.2 Conversion from one unit to another

5.3 Relationship between nautical miles and minutes of latitude and minutes of longitude

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Magnetism and compasses

6 General principles

6.1 Terrestrial magnetism

6.2 Resolution of the earth's total magnetic force into vertical and horizontal components

6.3 Variation-annual change

7 Aircraft magnetism

7.1 The resulting magnetic fields

7.2 Keeping magnetic materials clear of the compass

Charts

8 General properties of miscellaneous types of projections

8.1 Direct Mercator

8.2 Lambert conformal conic

9 The representation of meridians, parallels, great circles and rhumb lines

9.1 Direct Mercator

9.2 Lambert conformal conic

10 The use of current aeronautical charts

10.1 Plotting positions

10.2 Methods of indicating scale and relief (ICAO topographical chart)

10.3 Conventional signs

10.4 Measuring tracks and distances

10.5 Plotting bearings and distances

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DR navigation

11 Basis of DR

11.1 Track

11.2 Heading (compass, magnetic and true)

11.3 Wind velocity

11.4 Air speed (IAS, CAS and TAS)

11.5 Groundspeed

11.6 ETA

11.7 Drift and wind correction angle

11.8 DR position fix

12 Use of the navigational computer

12.1 Speed

12.2 Time

12.3 Distance

12.4 Fuel consumption

12.5 Conversions

12.6 Air speed

12.7 Wind velocity

12.8 True altitude

13 The triangle of velocities

13.1 Heading

13.2 Ground speed

13.3 Wind velocity

13.4 Track and drift angle

14 Measurement of DR elements

14.1 Calculation of altitude

14.2 Determination of appropriate speed

15 In-flight navigation

15.1 Use of visual observations and application to in- flight navigation

16 Navigation in cruising flight, use of fixes to revise navigation data

16.1 Ground speed revision

16.2 Off-track corrections

16.3 Calculation of wind speed and direction

16.4 ETA revisions

16.5 Flight log

RADIO NAVIGATION

Basic radio propagation theory

17 Antennas

17.1 Characteristics

18 Wave propagation

18.1 Propagation with the frequency bands

Radio aids

19 Ground DF

19.1 Principles

19.2 Presentation and interpretation

19.3 Coverage

19.4 Range

19.5 Errors and accuracy

19.6 Factors affecting range and accuracy

20 NDB/ADF

20.1 Principles

20.2 Presentation and interpretation

20.3 Coverage

20.4 Range

20.5 Errors and accuracy

20.5 Factors affecting range and accuracy

21 VOR

21.1 Principles

21.2 Presentation and interpretation
21.3 Coverage
21.4 Range
21.5 Errors and accuracy
21.6 Factors affecting range and accuracy

22 DME
22.1 Principles
22.2 Presentation and interpretation
22.3 Coverage
22.4 Range
22.5 Errors and accuracy
22.6 Factors affecting range and accuracy

Radar
23 Ground radar
23.1 Principles
23.2 Presentation and interpretation
23.3 Coverage
23.4 Range
23.5 Errors and accuracy
23.6 Factors affecting range and accuracy

24 Secondary surveillance radar and transponder
24.1 Principles
24.2 Presentation and interpretation
24.4 Modes and codes

GNSS
25 GPS, GLONASS OR GALILEO
25.1 Principles
25.2 Operation
25.3 Errors and accuracy