

# TRAINING PROGRAM (Syllabus) IN THE FIELD OF THEORETICAL KNOWLEDGE FOR PPL(A) LICENSE

## 1. AIR LAW AND AIR TRAFFIC CONTROL PROCEDURES - number of lectures / time: 16 hours (+2 hours online session)

### International law: conventions, agreements and organizations

#### Convention on International Civil Aviation (Chicago Convention) Doc. 7300/6

##### Part I - Air navigation:

Relevant parts of the following chapters:

- (a) the general principles and application of the Convention;
- (b) a flight over the territory of the Contracting States;
- (c) nationality of aircraft;
- (d) measures to facilitate air navigation;
- (e) conditions for aircraft;
- (f) International Standards and Recommended Practices;
- (g) the validity of certificates and licenses with additional entries;
- (h) notification of differences.

##### Part II - Organization of International Civil Aviation (ICAO):

objectives and composition

##### Annex 8 ICAO - Airworthiness of aircraft

Introduction and definitions

Certificate of airworthiness

##### ICAO Annex 7 - Aircraft nationality and registration marks

Introduction and definitions

Signs of nationality, joint and registration

Certificate of registration and nationality marks

##### ICAO Annex 1 - Personnel licensing

definitions

Relevant parts of ICAO Annex 1 regarding Part-FCL and Part-Medical

##### ICAO Annex 2 - Rules of the air traffic

Basic definitions, application of air traffic rules, general rules (except operations surface), visibility regulations, signals and interception of civilian airships

##### Altimeter setting procedure (including Doc ICAO 7030 - Regional procedures supplementary)

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

##### Secondary surveillance radar

##### Procedures for operation of transponders (including Doc ICAO 7030 - Regional supplementary procedures)

Operation of transponders

Phraseology

##### ICAO Annex 11: Doc 4444 - Air Traffic Management

Definitions

General provisions on air traffic services

Visual separation in the vicinity of airports

Procedures for airport control service

Radar services

Flight information service and emergency service

Phraseology

Procedures related to emergency situations, communication failure and emergency plans

##### ICAO Annex 15: Aeronautical information service

Introduction, basic definitions of AIP, NOTAM, AIRAC and AIC

##### Annex 14 ICAO, Vol. 1 and 2: Airports

Definitions

Airport data: requirements for the terrestrial traffic field and related devices

Visual navigation aids:

- (a) indicators and signaling devices;
- (b) designations;
- (c) lighting;
- (d) characters;
- (e) markers.

Visual aids to mark obstacles:

- (a) object marking;
- (b) light marking of obstacles.

Visual aids for marking restricted areas.

Airport operational services:

- (a) emergency and fire services;
- (b) disk management service.

### **Annex 12 ICAO: Search and rescue**

Basic definitions

Operating procedures:

- (a) procedure for the pilot-in-command at the scene of the incident;
- (b) the procedure for the pilot-in-command who took over the correspondence regarding the danger;
- (c) search and rescue signals.

Search and rescue signals:

- (a) signals used to communicate with vehicles and ground units;
- (b) the code of visual signals "earth-air";
- (c) "air-to-air" signals.

### **ICAO Annex 17: Protection of international civil aviation against unlawful acts interference**

General information: purpose and assumptions

### **ICAO Annex 13: Investigation of aviation accidents and incidents**

Basic definitions

Application

### **National law**

National law and differences in relation to the ICAO Annexes and relevant EU regulations.

## **2. HUMAN PERFORMANCE AND LIMITATIONS - number of lectures / time: 4 hours. (+1 hour online session)**

Human factor in aviation

Shaping the competence of the pilot

Basics of physiology and maintaining health in aviation

Atmosphere:

- (a) composition;
- (b) laws of physics of gases (gas laws).

Respiratory system and cardiovascular system:

- (a) oxygen requirements of tissues;
- (b) functional anatomy;
- (c) the main forms of hypoxia (from oxygen deficiency and anemic):
  - (1) Sources, effects and countermeasures against carbon monoxide;
  - (2) remedies to prevent hypoxia;
  - (3) symptoms of hypoxia.
- (d) hyperventilation;
- (e) the impact of acceleration on the cardiovascular system;
- (f) hypertension and ischemic heart disease.

### **Man and environment**

Central, peripheral and autonomic nervous system

Vision:

- (a) functional anatomy;
- (b) field of view, central vision and peripheral vision;
- (c) binocular and monocular vision;
- (d) one-eyed vision;
- (e) night vision;
- (f) techniques of visual scanning and detection and the meaning of 'external observation';
- (g) eye defects.

Hearing:

- (a) functional and descriptive anatomy;
- (b) hearing hazards related to the operation of flights;
- (c) hearing loss.

Balance:

- (a) functional anatomy;
- (b) movement and acceleration;
- (c) kinetosis.

Integration of sensory elements:

- (a) spatial disorientation: form, recognition and avoidance;

## **Health and hygiene**

Personal hygiene: personal condition

Body rhythm and sleep

- (a) arrhythmias;
- (b) symptoms, effects and management.

Problem areas for pilots:

- (a) common non-serious conditions including cold, flu and upset stomach;
- (b) flatulence and barotrauma (as a result of scuba diving);
- (c) obesity;
- (d) food hygiene;
- (e) contagious diseases,
- (f) nutrition;
- (g) various gases and toxic substances.

Intoxication:

- (a) prescribed medicines;
- (b) tobacco;
- (c) alcohol and drugs;
- (d) caffeine;
- (e) self-treatment.

## **Basics of aeronautical psychology**

### **Information processing by a human**

Attention and vigil:

- (a) attention selective;
- (b) divisibility of attention.

Perception:

- (a) perceptual illusions;
- (b) the subjectivity of perception;
- (c) perceptual processes.

Memory:

- (a) sensory memory;
- (b) working memory or short-term memory;
- (c) long-term memory including motor memory (skills).

### **Human error and credibility**

The credibility of human behavior

Error generation: social environment (group, organization)

### **Decision-making**

Decision making concepts:

- (a) structure (phase);
- (b) limits;
- (c) risk assessment,
- (d) practical application.

### **Avoiding mistakes and managing errors: cockpit management**

Security awareness:

- (a) awareness of risk areas;
- (b) situational awareness.

Communication: verbal and non-verbal communication

Human behavior

Personality and attitudes:

- (a) development;
- (b) environmental influences.

Identification of dangerous attitudes (tendency to make mistakes)

### **Overload and underload of man**

The awakening

Stress:

- (a) definition / definitions;
- (b) anxiety and stress;
- (c) the effects of stress.

Management of fatigue and stress:

- (a) types, causes and symptoms of fatigue;
- (b) fatigue effects;
- (c) remediation strategies;
- (d) management techniques;
- (e) health and fitness programs.

### **3. METEOROLOGY - number of lectures / time: 10 hours (+2 hours online session)**

#### **Atmosphere**

##### **Composition, construction and vertical division**

Atmosphere structure

Troposphere

##### **Air temperature**

Definitions and units

Vertical temperature distribution

The propagation of heat

Temperature gradients, stability and temperature instability

The development of inversion and types of inversion

The temperature at the surface of the earth, the impact of the surface, day and periodic changes, the effect of cloudiness and the influence of wind

##### **Atmospheric pressure**

Barometric pressure and isobars

Pressure change with height

Bringing the pressure down to the mean sea level

The relationship between the distribution of the baric field near the earth's surface and the bar field on the upper levels.

##### **Air density**

The relationship between pressure, temperature and density

ISA

##### **The standard atmosphere of ICAO**

###### **Setting the altimeter**

Terminology and definitions

Altimeter and altimeter setting

Calculations

The effect of terrain on the increase of air flow velocity

##### **Wind**

Definition and measurement of wind

###### **The main cause of wind formation**

The primary cause of wind formation, pressure gradient, Coriolis force and gradient wind

Changes in wind direction and force in the ground level

The phenomenon of convergence and divergence

### **4. COMMUNICATIONS - number of lectures / time: 3 hours (+1 hour online session)**

#### **VFR COMMUNICATION**

Definitions

Meanings and importance of related terms

Abbreviations ATS

Q-code groups commonly used in air-ground RTF communications

Types of messages

##### **General operational procedures**

Letters transmission

Number transmission (including level information)

Time transmission

Transmission technology

Standard words and expressions (including appropriate radiotelephone phraseology)

R / T call signs for airports, including the use of short call signs

Call signs R / T for aircraft, including the use of abbreviated call signs

Connection transfer

Test procedures including readability scale

Requirements for repetition and confirmation

### **Specific terms related to meteorological information (VFR)**

Weather at the airport

Distribution of meteorological information

### **Activities to take in the event of a communication failure**

#### **Procedures in dangerous and urgent situations**

Dangerous situation (definition, frequency, listening frequency in dangerous situations, signals in dangerous situations and messages in dangerous situations)

Urgent situation (definition, frequencies, signals in urgent situations and dispatches in urgent situations)

### **General principles of propagation of VHF waves and frequency assignment**

## **5. PRINCIPLES OF FLIGHT - number of lectures / time: 12 hours (+2 hours online session)**

### **5.1 PRINCIPLES OF FLIGHT - AIRPLANE**

#### **Aerodynamics of subsonic velocity**

##### **Basic concepts, laws and definitions**

Rights and definitions:

- (a) conversion of units of measurement;
- (b) Newton's dynamics principles,
- (c) Bernoulli's equation and the Venturi effect;
- (d) static pressure, dynamic pressure and total pressure;
- (e) density;
- (f) IAS and TAS.

Basics of air flow:

- (a) laminar flow;
- (b) two-dimensional flow;
- (c) three-dimensional flow.

Aerodynamic forces acting on surfaces:

- (a) the resultant of forces;
- (b) lift force;
- (c) resistance;
- (d) angle of attack.

The shape of the airfoil profile:

- (a) the relative thickness of the profile;
- (b) the chord of the profile
- (c) a profile backbone;
- (d) profile curvature;
- (e) angle of attack.

The shape of the wing:

- (a) elongation;
- (b) the chord of the profile at the base of the wing;
- (c) the chord of the wing tip profile;
- (d) trapezoidal wings;
- (e) the outline of the wing.

#### **Two-dimensional air flow around the airfoil profile**

Laminar flow (stratified)

Stagnation point

Pressure distribution

The center of the profile pressure

Influence of the angle of attack

Separation of the flow (separation of boundary layer) at large angles of attack

Supporting force - a graph as a function of the angle of attack

#### **Coefficients**

Coefficient of lift  $C_L$ : design for lift

Coefficient of resistance  $C_d$ : resistance pattern

#### **Three-dimensional air flow around the wing and fuselage**

Laminar flow (stratified)

- (a) flow in the direction of spans and causes;
- (b) eddy eddies and angle of attack;
- (c) tilting up (upwash) and downwash due to eddy eddies;
- (d) turbulence in the aerodynamic path behind the airplane (causes, distribution and duration of the phenomenon).

Induced (excited) resistance:

- (a) the influence of eddy eddies on the angle of attack;
- (b) local induced angle of attack;
- (c) the effect of the induced angle of attack on the direction of the lift vector;
- (d) induced resistance and angle of attack.

### Resistance

Harmful resistance:

- (a) pressure resistance;
- (b) interference resistance;
- (c) friction resistance.

Harmful resistance and speed

Induced resistance and speed

Total resistance

### The impact of land

Impact on the characteristics of the takeoff and landing of the aircraft

### The stall

Separation of the flow (separation of boundary layer) at increasing angles of attack:

- (a) boundary layer;
  - (1) laminar boundary layer;
  - (2) turbulent layer;
  - (3) transitional stage.
- (b) the point of detachment;
- (c) impact of the angle of attack;
- (d) impact on:
  - (1) pressure distribution;
  - (2) location of the pressure medium;
  - (3)  $C_L$ ;
  - (4)  $C_D$ ;
  - (5) tilting moments.
- (e) flutter (buffeting);
- (f) use of controls.

### The stall speed:

- (a) in the load bearing formula;
- (b) stall speed for an overloaded 1g flight;
- (c) impact:
  - (1) the center of gravity;
  - (2) power settings;
  - (3) height (IAS);
  - (4) sash loading;
  - (5) load factor  $n$ :
    - (i) definition;
    - (ii) bends;
    - (iii) strength.

Initial stalling phase towards the span:

- (a) impact of the contour;
- (b) geometrical lateral buckling (lateral torsional buckling);
- (c) the use of ailerons.

Stal warning!:

- (a) importance of stall symptoms;
- (b) the speed margin;
- (c) flutter (buffeting);
- (d) elements at the leading edge that cause separation of the flow stream (stall strip);
- (e) a stall sensor (flapper switch);

(f) recovery from stall.

Specific stall phenomena:

- (a) dynamic stumping;
- (b) bends in rising and falling flight;
- (c) a T-tailed tail plane;
- (d) preventing the entry into the corkscrew:

(1) the formation of a spin;

(2) corkscrew recognition;

(3) getting out of the corkscrew.

(e) icing (at the point of stagnation (stagnation) and at the surface):

- (1) no stuttering symptoms;
- (2) abnormal behavior of the aircraft during the stall.

### **Increasing the lift factor ( $C_L$ )**

Trailing edge flaps and their use during take-off and landing

- (a) diagram of the lift force coefficient (CL) as a function of the angle of attack;
- (b) types of flaps;
- (c) flap asymmetry;
- (d) effects on the tilting of the airplane.

Leading edge elements and their use during takeoff and landing

### **The boundary layer**

Various kinds of:

- (a) laminar;
- (b) disturbed (turbulent).

### **Special circumstances**

Icing and other impurities

- (a) icing at the point of concentration (stagnation);
- (b) icing on the surface (frost, snow and clear ice);
- (c) rain;
- (d) contamination of the leading edge;
- (e) impact on the stall;
- (f) effects on the loss of steerability;
- (g) impact on the deflection of the control system;
- (h) Impact on devices that increase lift when taking off, landing or flying at low altitudes.

### **Stability**

#### **Balance conditions in a fixed horizontal flight**

Prerequisite for static stability

Balance:

- (a) lift and weight;
- (b) Resistance and thrust.

#### **Methods of achieving balance**

Wing and tail section (classic layout and duck)

Steering surfaces

Trimmer

#### **Static and dynamic longitudinal stability**

Basic information and definitions:

- (a) static stability, stability, inert stability and instability;
- (b) a prerequisite of dynamic stability;
- (c) dynamic stability, stability, inert stability and instability.

Location of the center of gravity:

- (a) shifted back and a minimum stability margin;
- (b) extended forward;
- (c) effects on static and dynamic stability.

#### **Dynamic lateral or directional stability**

Dive spiral and steps to output

#### **Steering control**

General information

Basic information, three planes and three axes

Changing the angle of attack

Pitch control

Elevator

Downwash effects

Location of the center of gravity

Controlling the deviation

Football control panel or rudder

Tilting control

Ailerons: functions in various flight phases

Aileron thrust moment

Ways of avoiding the thrust moment of ailerons:

(a) ailerons

(b) deviation of the aileron.

Means to reduce control forces

Aerodynamic balance:

(a) unloading flap and balancing flap;

(b) control flap.

Mass balance

Reasons for balancing: ways

trim

Reasons for trimming

Balance flaps (trimmers)

limitations

Operating restrictions

flutter

$V_{fe}$ ,  $V_{no}$ ,  $V_{ne}$

Manoeuvring envelope

Manoeuvring load diagram:

(a) overload factor;

(b) accelerated stall speed;

(c)  $V_a$ ;

(d) acceptable overload factor or certification category.

Contribution of mass

**The gust envelope**

Graph of the load from gusts

Factors contributing to wind loads

**Propellers**

Converting engine torque to string

The importance of tilt

Dislocation of the shoulder blade

The effect of icing on the propeller

**Engine failure or engine stop**

Resistance caused by propeller fanning

**Moments associated with the operation of the propeller**

Torque reaction

The impact of an asymmetric supersonic stream

The impact of the asymmetric propeller blade chain

**Flight mechanics**

**Forces operating on the plane**

Fixed flight levels in a straight line

Established climb on a straight line

Set descended by a straight line

Fixed sliding flight along a straight line

Fixed cornering:

(a) bank angle;

(b) overload factor;

(c) turn radius;



(d) standard turn.

## **6. OPERATIONAL PROCEDURES - number of lectures / time: 5 hours. (+1 hour online session)**

### **General Regulations**

#### **Operation of aircraft: ICAO Annex 6, General requirements**

definitions

Application

Special operating procedures and risks (general aspects)

#### **Noise reduction**

Procedures to reduce noise

Impact of the flight procedure (departure, flight, landing approach)

Awareness of unauthorized incursions to the runway (the importance of marking surfaces and signals)

#### **Fire or smoke**

Carburetor fire

Engine fire

Cabin and cockpit fire (selection of extinguishing agents according to fire classification and use of fire extinguishers)

Smoke in the cockpit (effects and actions to be taken) and smoke in the cockpit and in the cabin (effects and activities to be performed)

#### **Windshear and microburst**

Effects and recognition during departure and approach to landing

Actions to avoid and actions to be taken in the event of occurrence

#### **Turbulence in the wind track**

Cause

List of relevant parameters

Actions to be performed in case of intersecting movement, during take-off and landing

#### **Landing in emergency situations and preventive landing**

definitions

Cause

Information for passengers

Evacuation

Activities after landing

#### **Contaminated runways**

Types of pollution

Predicted surface friction and coefficient of friction

## **7. FLIGHT PERFORMANCE AND PLANNING - number of lectures / time: 5 hours. (+1 hour online session)**

### **7.1. MASS AND BALANCE**

The purpose of considering mass and balance

Weight restrictions

The importance of construction constraints

The importance of performance limitations

CG limitations

The importance of stability and steerability

The importance of performance

Load

Terminology

Deadlines for weight

Deadlines for charges (incl

terms regarding fuel)

Weight restrictions

Construction restrictions

Limitations due to performance

Limits of the luggage compartment

Mass calculation

Maximum weights for take-off and landing

The use of standard masses for passengers, luggage and crew

Basics of center of gravity calculation (CG)

Definition of center of gravity

Conditions for maintaining balance (balance of forces and balance of moments)

Basic calculations of the center of gravity

Detailed information on the mass and balance of the aircraft

Content of mass and balance documentation  
Reference base and torque arm  
Position of the center of gravity as the distance from the reference base  
Extract of basic mass and balance data from aircraft documentation  
BEM  
Position of the center of gravity or torque in BEM  
Deviation from the standard configuration  
Determining the position of the center of gravity  
methods  
Arithmetic method  
Graphic method  
Loading and balancing sheet  
General conditions  
Loading sheet and CG for light aircraft

## 7.2 PERFORMANCES - AIRPLANES

Introduction  
Performance classes  
Flight phases  
Influence of airplane mass, wind, altitude, runway inclination and runway conditions  
gradients  
Single-engine airplanes  
Definitions of terms and speeds  
Performance during takeoff and landing  
Use of flight instructions  
Performance during climb and flight  
Use of aircraft usage data on the fly  
Influence of density height and mass of an airplane  
Maximum flight duration and effect of various power or thrust settings  
Flight range at various power and thrust settings

## 7.3 FLIGHT PLANNING AND FLIGHT MONITORING

### Planning of VFR flights

#### VFR navigation plan

Routes, airports, relative and absolute altitudes on VFR maps  
Odds and distances on VFR maps  
Airport maps and airport database  
Data for communication planning and radio navigation  
Completing the navigation plan

#### Fuel planning

General knowledge

#### Pre-flight calculations for the required fuel

Calculation of additional fuel  
Filling the fuel part in the navigation plan and calculating the total fuel  
Preparation before the flight

#### Information AIP and NOTAM

Equipment and ground services  
Departure, destination and alternate airports  
Airways routes and the structure of the airspace  
Meteorological information  
Extract and analysis of relevant data from meteorological documents

#### ICAO flight plan (ATS flight plan)

Individual flight plan  
Flight plan format  
Completion of the flight plan  
Submission of the flight plan

#### Flight monitoring and re-planning during the flight

##### Flight monitoring

Monitoring of the required road and time line  
Fuel management during the flight  
Re-planning during the flight in case of deviations from planned data

## **8. GENERAL KNOWLEDGE ABOUT THE AIRCRAFT - number of lectures / time: 19 hours. (+4 hours online session)**

### **8.1 PAYMENT CONSTRUCTION, ELECTRICITY, MOTOR ASSEMBLY AND EMERGENCY EQUIPMENT**

System design, load, stress, maintenance

Loads and combined loads applied to the aircraft structure

Airframe construction

Wings, tail surfaces and control surfaces

Design and construction

Elements and construction materials

Stresses

Construction restrictions

Hull, door, floor, windshield and windows

Design and construction

Elements and construction materials

Stresses

Construction restrictions

Control and steering surfaces

Design and construction

Elements and construction materials

Stresses

Construction restrictions

Hydraulics

Hydromechanics: general principles

Plumbing installations

Hydraulic fluids:

types and characteristics, limitations

Installation elements: design, operation, limited modes of operation, indications and warnings

Chassis, wheels, tires and brakes

Chassis

Types and materials

Front wheel control: construction and operation

brakes

Types and materials

System components: structure, principles of operation, indications and warnings

Wheels and tires

Types and operational restrictions

Flight control system

Mechanical or driving

Steering systems

System components: design, operating principles, reduced operating modes, indications and warnings

Secondary flight control systems

System components: design, operating principles, reduced operating modes, indications and warnings

Anti-icing systems

Types and principles of operation (pitot tube and windshield)

Fuel installation

Piston engine

System components: design, operating principles, reduced operating modes, indications and warnings

Electrical installation

Electrical installation: general information and definitions

Constant current: voltage, current, resistance, conductivity, Ohm's law, power and operation

Alternating current: voltage, current, amplitude, phase, frequency and resistance

Circuits: serial and parallel

Magnetic field: effects on electrical circuits

Batteries

Types, characteristics and limitations

Battery charging devices, characteristics and limitations

Static electricity: general information

Basic principles

Static discharges

Protection against interference

The influence of atmospheric discharges

Generators: production, distribution and application

DC generator: construction, operating principles, reduced operating modes, indications and warnings

Alternating current generator: construction, operating principles, reduced operating modes, indications and warnings

Elements of electrical installation

Basic elements:

basic principles of switches, switches and relays

Distribution (distribution)

General information:

(a) busbar, common grounding and priority

(b) comparison of alternating current and direct current.

Piston engines

General information

Types of internal combustion engines

internal combustion: basic principles and definitions

Engine: construction, operating principles, components and materials

### **Fuel**

Types, classes, characteristics and limitations

Spare fuel: characteristics and limitations

Carburettor or injection system

Carburetor: construction, operating principles, reduced operating modes, indications and warnings

Injection: construction, operating principles, reduced operating modes, indications and warnings

### **Icing**

Air cooling systems

Construction, operating principles, reduced work modes, indications and warnings

Lubrication systems

Lubricants: types, characteristics and limitations

Construction, operating principles, reduced work modes, indications and warnings

Ignition systems

Construction, operating principles, reduced work modes

Blend

Definition, characteristic mixes, controls, levers and indicators

### **Propellers**

Definitions and general information:

(a) aerodynamic parameters;

(b) types;

(c) work modes.

Fixed speed propeller: construction, operating principles and components

Propeller operation: levers, reduced operating modes, indications and warnings

Engine performance and service

Performance: the impact of engine parameters, the impact of weather conditions, limitations and power amplification systems

Engine handling: power and mix settings during different flight phases and operational limitations

## **8.2 INSTRUMENTATION**

Instrument and display systems

Pressure gauge

Different types, construction, principles of operation, characteristics and accuracy

Thermometer

Different types, construction, principles of operation, characteristics and accuracy

Fuel gauge

Different types, construction, principles of operation, characteristics and accuracy

Flowmeter

Different types, construction, principles of operation, characteristics and accuracy

Position transmitter

Different types, construction, principles of operation, characteristics and accuracy

Momentometr

Construction, principles of operation, characteristics and accuracy

Tachometer

Construction, principles of operation, characteristics and accuracy

Measurement of aerodynamic parameters

Pressure Measurement

Static pressure, dynamic pressure, density and definitions

Construction, principles of operation, errors and accuracy

Temperature measurement: airplanes

Construction, principles of operation, errors and accuracy

Display

Altimeter

Standard atmosphere

Different barometric references (QNH, QFE and 1013.25)

Relative height, height indicated, actual height, pressure altitude and density

Construction, principles of operation, errors and accuracy imaging

Vertical speed indicator

Construction, principles of operation, errors and accuracy imaging

Speedometer

Different speeds IAS, CAS, TAS: definition, application and interdependencies

Construction, principles of operation, errors and accuracy imaging

Magnetism: compass with direct reading

Earth's magnetic field

Compass with direct reading

Construction, principles of operation, data processing, accuracy and deviation

Errors made in the corner and when accelerating

Gyroscopes

Gyroscope: basic principles

Definitions and application

Basic properties

Leeway

Turn indicator and transverse bending meter

Construction, principles of operation and errors

Spatial position indicator

Construction, principles of operation, errors and accuracy

Gyroscopic indicator of the course

Construction, principles of operation, errors and accuracy

Communication systems

Transmission modes: VHF, HF and SATCOM

Rules, bandwidth, operational limitations and application

Voice communication

Definitions, general information and applications

In-flight warning systems

Construction, operating principles, indications and alarms

Warning about dragging

Construction, operating principles, indications and alarms

Integrated instruments: electronic imaging

Imaging units

Construction, various technologies and restrictions

## **9.1 NAVIGATION - number of lectures / time: 10 hours. (+2 hours online session)**

### **9.1 GENERAL NAVIGATION**

Basics of navigation

Solar system

Seasonal and visible movements of the sun

Earth

Big circle, small circle and ring-frame

Latitude and width difference

Longitude and length difference

Use latitude and longitude coordinates to locate a specific position

Time and time conversion

Apparent time

Universal coordinated time (UTC)

Average local time (LMT)

Standard times

The date change line

Definition of sunrise, sunset and dusk

Directions

Geographical north, magnetic north, north of compass

Deviation of compass

The magnetic pole, isogons, the relationship between geographical and magnetic North

Distance

Distance units and altitudes used in navigation: nautical miles, statutory miles, kilometers, meters and feet

Conversion from one unit to another

Relationship between nautical miles and minutes latitude and longitude

Magnetism and compass

General rules

Earth magnetism

Distribution of the total magnetic force of the earth on vertical and horizontal elements

Annual change

Magnetism of the aircraft

The resulting magnetic field

Storage of magnetic field materials away from compass

Maps

General properties of different types of mappings

Mercator

Lambert cone-shaped projection

Presentation of the meridians, parallels, the great circle and the loxodromes

Mercator

Lambert cone-shaped projection

Application of current aerial maps

Applying items

Method for determining the scale and terrain (ICAO topographical maps)

Conventional signs

Measurement of the route line and distance

Applying bearings and distances

Counting navigation

Basics of counting navigation

Road line

Course (north of compass, magnetic north, north)

Wind speed

Flight speed (IAS, CAS and TAS)

Speed relative to the ground

Estimated time of arrival (ETA)

Angle of drift, correction to the wind

Counting navigation, position, navigation point

Application of a navigational computer

Speed

Time

Distance

Fuel consumption

- conversions
- Flight speed
- Wind speed
- True height
  
- Speed triangle
- Course
- Speed relative to the ground
- Wind speed
- The road line and the angle of drift
- Measurement of counting navigation elements (DR)
- Calculation of the altitude
- Determining the right speed
- Navigation during the flight
- The use of visual observation and the use of navigation in flight
- Navigating during the flight, applying a fix to revise the navigation data
- Correction of ground speed
- Off-track corrections
- Calculation of wind speed and direction
- ETA correction
- Navigation log

## 9.2 RADIO NAVIGATION

- Basics of the theory of radio wave propagation

- antennas
- Characteristic
- Propagation of waves
- Propagation with frequency ranges
- Radio aids
- Ground-based telescope (DF)
- Principles of operation
- Indications and interpretation
- Coverage area
- Range
- Errors and accuracy
- Factors affecting range and accuracy

- NDB / ADF
- Principles of operation
- Indications and interpretation
- Coverage area
- Range
- Errors and accuracy
- Factors affecting range and accuracy

- VOR
- Principles of operation
- Indications and interpretation
- Coverage area
- Range
- Errors and accuracy
- Factors affecting range and accuracy

- DME
- Principles of operation
- Indications and interpretation
- Coverage area
- Range
- Errors and accuracy
- Factors affecting range and accuracy

- Radar
- Ground radar
- Principles of operation

Indications and interpretation

Coverage area

Range

Errors and accuracy

Factors affecting range and accuracy

Secondary surveillance radar and transponder

Principles of operation

Indications and interpretation

Operating modes and codes

GNSS

GPS, GLONASS or GALILEO

Principles of operation

Action

Errors and accuracy

Factors affecting accuracy