PROGRAM OF TRAINING (Syllabus) OF THEORETICAL KNOWLEDGE FOR THE PPL(A) LICENSE (shortened)

1. AIR LAW AND AIR TRAFFIC CONTROL PROCEDURES - **honorized on the basis of your license**
2. MAN - POSSIBILITIES AND RESTRICTIONS - **honorized on the basis of your license**
3. METEOROLOGY - **honorized on the basis of your license**
4. COMMUNICATIONS - **honorized on the basis of your license**

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 C1: design for lift
Coefficient of resistance Cd: 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 warningl:
(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 stomping;
(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
flatter
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: 18 hours. (+3 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
Volatile and steer 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. 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 locks
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