PRIVATE PILOT LICENCE

THEORETICAL KNOWLEDGE SYLLABUS

CONTENTS

1.0 INTRODUCTION

1.1 This syllabus of training is effective in conjunction with Civil Aviation Regulations.

1.2 The syllabus is primarily concerned with ground training objectives and standards and sets out the aeronautical knowledge required for the issue of a PPL. It assumes prior satisfactory knowledge of material set out in the PPL Syllabus and all the material contained in this syllabus is examinable at the PPL level.

1.3 The syllabus is primarily directed towards air transport operations aircraft, with emphasis being placed on the knowledge required of the pilot-in-command.

010 AIR LAW

1.1 Introduction to Legislation and Regulations

The Convention on International Civil Aviation (Articles)

(a) Annexes to the Convention (ICAO Annexes)
(b) The Civil Aviation Act
(c) Overview of the Civil Aviation Regulations
(d) Circulars and Guidance Material
(e) Aeronautical Information Publication Overview

1.2 Operation of Aircraft (Operation of Aircraft; Instruments and Equipment)

1.2.1 General Requirements

a) documents to be carried on board
b) production and preservation of documents
c) reporting of incidents (occurrences)

1.2.2 Aircraft nationality and registration marks

a) definitions
b) aircraft registration marks
c) certificate of registration
d) identification plate

1.2.3 Certificate of airworthiness

a) continuing airworthiness
b) validity of certificate of airworthiness
c) instruments and equipment
d) aircraft limitations and information

1.3 Rules of the Air (Rules of the air and air traffic control)

a) definitions
b) applicability
c) general rules
d) visual flight rules
e) signals
f) interception of civil aircraft

1.4 Air Traffic Regulations and Air Traffic Services

a) objectives of air traffic services
b) classification of airspace
c) flight information regions, control areas and control zones
d) air traffic control services
e) flight information services
f) alerting service
g) visual meteorological conditions
h) instrument meteorological conditions

i) in-flight contingencies
j) aerodrome and heliport data
- definitions
- conditions of the movement area and related facilities

k) Visual aids for navigation
- indicators and signalling devices
- markings
- lights
- Signs
- Markers
- signal area

l) Visual aids for denoting obstacles
- marking of objects
- lighting of objects

m) Visual aids for denoting restricted use of areas

n) Emergency and other services
- fire and rescue service
- apron management service

o) Aerodrome ground lights and surface marking colours
- colours for aeronautical ground lights
- colours for surface markings

1.5 Air Traffic Services

1.5.1 General
a) air traffic service systems
b) flight plan clearance and information
c) control of air traffic flow
d) altimeter setting procedures
e) wake turbulence information
f) meteorological information
g) air reports (AIREP)

1.5.2 Area control service
a) separation of controlled traffic in the various classes of airspace
b) pilots, responsibility to maintain separation in VMC
c) emergency and communications failure procedures by the pilot
d) interception of civil aircraft

1.5.3 Approach control service

a) departing and arriving aircraft procedures in VMC
b) special Procedures for TCA

1.5.4 Aerodrome control service
a) function of aerodrome control towers
b) VFR operations
c) traffic and circuit procedures
d) information to aircraft
e) control of aerodrome traffic
f) procedures at unmanned aerodromes

1.5.5 Flight information and alerting service
a) air traffic advisory service
b) objectives and basic principle

1.6 Crew Licences (Personnel Licensing)

1.6.1 Flight Crew Licensing
a) General requirement
b) Validity of licences and ratings
c) Medical fitness
d) Decrease in medical fitness
e) Crediting of flight time

1.6.2 Student pilot
a) Requirements
b) Minimum Age
c) Medical fitness

1.6.3 Private pilot licence
a) Minimum Age
b) Medical fitness
c) Privileges and conditions
d) Ratings for special purposes
e) Experience and Crediting
f) Training requirements
g) Theoretical knowledge examination
h) Skill test

1.6.4 Category, Class and Type Ratings
a) Division of category
b) Division of class ratings
c) Circumstances in which type or class ratings are required
d) Validity, revalidation and renewal

1.7 Contravention of Aviation Regulations

1.7.1 Offences

1.7.2 Penalties

020 AIRCRAFT GENERAL KNOWLEDGE

2.1 Airframe/Rotors

2.1.1 Airframe structure
- (a) helicopter configuration (single, tandem, co-axial,
- (b) side by side rotors, directional controls)
- (c) fuselage (type of construction, structural
- (d) components, materials)
- (e) rotors (types, components, materials)
- (f) blades (aerodynamic profiles, construction,
- (g) materials)
- (h) control surfaces (vertical fin, horizontal plane,
- (i) construction, material)
- (j) primary flying control systems (type, components)
- (k) cockpit and cabin
- (l) landing gear (types, wheels and tyres, braking
- (m) system, shock absorbers)

2.1.2 Airframe loads
- (a) limiting loads
- (b) safety factor
- (c) control and rotor locks and use
- (d) ground/flight precautions

2.2 Powerplant

2.2.1 Piston engine – causes of pre-ignition and detonation

2.2.2 General
- (a) design types
- (b) principles of the 4-stroke internal combustion engine
- (c) Mechanical components

2.2.3 Lubrication system
- (a) function
- (b) schematic construction
- (c) monitoring instruments and indicators
- (d) lubricants

2.2.4 Air cooling
- (a) system monitoring
- (b) cylinder head temperature
- (c) cowl flaps

2.2.5 Ignition
- (a) schematic construction and function
- (b) types of ignition
- (c) magneto check

2.2.6 Engine fuel supply
- (a) carburettor (construction and mode of operation, carburettor icing)
- (b) fuel injection (construction and mode of operation)
- (c) alternate air

2.2.7 Engine performance
- (a) pressure/density altitude
- (b) performance as a function of pressure and
- (c) temperature

2.2.8 Power augmentation devices - Turbocharger, supercharger (construction and effect on engine performance)

2.2.9 Fuel
- (a) types, grades
- (b) detonation characteristics, octane rating
- (c) colour coding
- (d) additives
- (e) water content, ice formation
- (f) fuel density
- (g) alternate fuels, differences in specifications, limitations

2.2.10 Mixture
- (a) rich and lean mixture
- (b) maximum power and fuel economy mixture setting

2.2.11 Engine handling and manipulation
- (a) power setting, power range
- (b) mixture setting
- (c) operational limitations

2.2.11 Operational criteria
- (a) maximum and minimum RPM
- (b) induced) engine vibration and critical RPM
- (c) remedial action by abnormal engine start, run-up and in flight
- (d) type related items

2.3 Systems

2.3.1 Electrical system
- (a) installation and operation of alternators/generators
- (b) direct current supply
- (c) batteries, capacity and charging
- (d) voltmeters and ammeters
- (e) circuit breakers and fuses
- (f) electrically operated services and instruments
- (g) recognition of malfunctions
- (h) procedure in the event of malfunctions

2.3.2 Hydraulic systems
- (a) components, fluids
- (b) operation, indication, warning systems
- (c) auxiliary systems

2.4 Flight Instruments

2.4.1 Pitot/static System
- a) pitot tube, function
- b) pitot tube, principles and construction
- c) static source
- d) alternate static source
- e) position error
- f) system drains
- g) heating element
- h) errors caused by blockage or leakage

2.4.2 Airspeed Indicator
- a) principles of operation and construction
- b) relationship between pitot and static pressure
- c) definitions of indicated, calibrated and true airspeed
- d) instrument errors
- e) airspeed indications, colour coding
- f) pilot’s serviceability checks

2.4.3 Altimeter
- a) principles of operation and construction
- b) function of the sub-scale
- c) effects of atmospheric density
- d) pressure altitude
- e) true altitude
- f) international standard atmosphere
- g) flight level

h) presentation (three needle)
i) instrument errors
j) pilot's service ability checks

2.4.4 Vertical Speed Indicator

a) principles of operation and construction
b) function
c) inherent lag
d) instantaneous VSI
e) presentation
f) pilot's serviceability checks

2.4.5 Gyroscopes

a) principles
b) rigidity
c) precession

2.4.6 Turn Indicator

a) rate gyro
b) purpose and function
c) effect of speed
d) precession
e) turn co-ordinator
f) limited rate of turn indications
g) power source
h) balance indicator
- principle
- presentation

i) pilot's serviceability checks

2.4.7 Attitude Indicator

a) earth gyro
b) purpose and function
c) precession
d) interpretation
e) operating limitations
f) power source
g) pilot's serviceability checks

2.4.8 Heading Indicator

a) directional gyro
b) purpose and function
c) precession
d) use with magnetic compass
e) setting mechanism
f) apparent drift

g) operating limitations
h) power source
i) pilot's serviceability checks

2.4.9 Magnetic Compass

a) construction and function
b) earth's magnetic field
c) variation and deviation
d) turning, acceleration errors
e) precautions when carrying magnetic items
f) pilot's service ability checks

2.4.10 Engine Instruments

Principles, presentation and operational use of:

a) oil temperature gauge
b) oil pressure gauge
c) cylinder head temperature gauge
d) exhaust gas meter
e) manifold pressure gauge
f) fuel pressure gauge
g) fuel flow gauge
h) fuel quantity gauge(s)
i) tachometer

2.4.11 Other Instruments

Principles, presentation and operational use of:

a) vacuum gauge
b) voltmeter and ammeter
c) warning indicators
d) others relevant helicopter type

2.4.12 Airworthiness

a) certificate to be in force
b) compliance with requirements
c) periodic maintenance inspections
d) compliance with flight manual (or equivalent), eg. H/V diagram instructions, limitations, placards
e) flight manual supplements
f) provision and maintenance of documents
    - helicopter, engine and propeller log books
    - recording of defects
g) permitted maintenance by pilots

030 FLIGHT PERFORMANCE AND PLANNING

3.1 Mass and Balance

a) Limitations on maximum mass
b) Forward and aft limitations of centre of gravity, normal and utility operation
c) Mass and centre of gravity calculations – Helicopter manual and balance sheet

3.2 Performance

3.2.1 Take-off

a) take-off run and distance available
b) take-off and initial climb
c) effects of mass, wind and density altitude
d) effects of ground surface and gradient
e) use of flaps

3.2.2 Landing

a) effects of mass, wind, density altitude and approach speed
b) use of flaps
c) ground surface and gradient

3.2.3 In-Flight

a) relationship between power required and power available
b) performance diagram
c) maximum rate and maximum angle of climb
d) range and endurance
e) effects of configuration, mass, temperature and altitude
f) reduction of performance during climbing turns
g) gliding
h) adverse effects
- icing, rain
- condition of the airframe
- effect of flap

040 HUMAN PERFORMANCE AND LIMITATIONS

4.1 Basic Physiology

4.1.1 Concepts

a) composition of the atmosphere
b) the gas laws
c) respiration and blood circulation

4.1.2 Effects of Partial Pressure

a) effect of increasing altitude
b) gas transfer
c) hypoxia
- symptoms

- prevention

d) hyperventilation
   - symptoms
   - avoidance

e) effects of accelerations

4.1.3 Vision

a) physiology of vision
b) limitations of the visual system
   - vision defects
   - optical illusions

c) spatial disorientation
d) avoidance of disorientation

4.1.4 Hearing

a) physiology of hearing
b) inner ear sensations
c) effects of altitude change
d) noise and hearing loss
   - protection of hearing

e) spatial disorientation
   - conflicts between ears and eyes
   - prevention of disorientation

4.1.4 Motion Sickness

a) causes
b) symptoms
c) prevention

4.1.5 Flying and Health

a) medical requirements
b) effect of common ailments and cures
   - colds
   - stomach upsets
   - drugs, medicines, and side effects
   - alcohol
   - fatigue

c) personal fitness
d) scuba diving – precautions before flying

4.1.7 Toxic Hazards

a) dangerous goods
b) carbon monoxide from heaters

4.2 Basic Psychology

4.2.1 The Information Process

a) concepts of sensation
b) cognitive perception
    - expectancy
    - anticipation
    - habits

4.2.2 The Central Decision Channel

a) mental workload, limitations
b) information sources
    - stimuli and attention
    - verbal communication
c) memory and its limitations
d) causes of misinterpretation

4.2.3 Stress

a) causes and effects
b) concepts of arousal
c) effects on performance
d) identifying and reducing stress

4.2.4 Judgement and Decision Making

a) concepts of pilots' judgement
b) psychological attitudes
    - behavioural aspects
c) risk assessment
    - development of situational awareness

4.2.4 Managing Threat and Error

a) Identification of error
b) Decision making
c) Communication
d) procedures

050 METEOROLOGY

5.1 The Atmosphere

a) composition and structure
b) vertical divisions

5.2 Pressure, Density and Temperature

a) barometric pressure, isobars
b) changes of pressure, density and temperature with altitude
c) altimetry terminology
d) solar and terrestrial energy radiation, temperature
e) diurnal variation of temperature
f) adiabatic process
g) temperature lapse rate

h) stability and instability
i) effects of radiation, advection subsidence and convergence

5.3 Humidity and Precipitation

a) water vapour in the atmosphere
b) vapour pressure
c) dew point and relative humidity
d) condensation and vaporisation
e) precipitation

5.4 Pressure and Wind

a) high and low pressure areas
b) motion of the atmosphere, pressure gradient
c) vertical and horizontal motion, convergence, divergence
d) surface wind
e) effect of wind gradient and windshear on take-off and landing
f) relationship between isobars and wind, Buys Ballot's law
g) turbulence and gustiness
h) local winds, land and sea breezes

5.5 Cloud Formation

a) cooling by advection, radiation and adiabatic expansion
b) cloud types
    - convection clouds
    - orographic clouds
c) stratiform and cumulus clouds
    - flying conditions in each cloud type

5.6 Fog, Mist and Haze

a) radiation, advection, frontal, freezing fog
b) formation and dispersal
c) reduction of visibility due to mist, snow, smoke, dust and sand
d) assessment of probability of reduced visibility
e) hazards in flight due to low visibility, horizontal and vertical

5.7 Ice Accretion

a) conditions conducive to ice formation
b) effects of hoar frost, rime ice, clear ice
c) effects of icing on helicopter performance

5.8 Thunderstorms

a) formation – airmass, frontal, orographic
b) conditions required
c) development process
d) recognition of favourable conditions for formation
e) hazards for aeroplanes

f) effects of lightning and severe turbulence
g) avoidance of flight in the vicinity of thunderstorms

5.9 Flight over hilly or Mountainous Areas

a) hazards for helicopters
b) influence of terrain on atmospheric processes
c) mountain waves, windshear, turbulence, vertical movement, rotor effects, valley winds

5.10 Climatology

Local seasonal weather and winds

5.11 Altimetry

a) operational aspects of pressure settings
b) pressure altitude, density altitude
c) height, altitude, flight level
d) ICAO standard atmosphere
e) QNH, QFE, standard setting
f) transition altitude, layer and level

5.12 The Meteorological Organization

a) aerodrome meteorological offices
b) aeronautical meteorological stations
c) forecasting service
d) meteorological services at aerodromes
e) availability of periodic weather forecasts

5.13 Weather Analysis

a) weather charts, symbols, signs
b) significant weather charts
c) prognostic charts for general aviation

5.14 Weather Information for Flight Planning

a) reports and forecasts for departure, en-route, destination and alternate(s)
b) interpretation of coded information (METAR, TAF)
c) availability of ground reports for surface wind, windshear, visibility

060 NAVIGATION

6.1 Form of the Earth

a) axis, poles
b) meridians of longitude
c) parallels of latitude
d) great circles, small circles, rhumb lines
e) hemispheres, north/south, east/west

6.2 Mapping

a) aeronautical maps and charts (topographical)

b) projections and their properties
c) conformality
d) equivalence
e) scale
f) great circles and rhumb lines

6.3 Lambert Conical Orthomorphic (1:1000000)/ ONC 5

a) main properties
b) construction
c) convergence of meridians
d) presentation of meridians, parallels, great circles and rhumb lines
e) scale, standard parallels
f) depiction of height

6.4 Direction

a) true north
b) earth's magnetic field, variation – annual change
c) magnetic north
d) vertical and horizontal components
e) isogonals, agonic lines

6.5 Helicopter Magnetism

a) magnetic influences within the helicopter
b) compass deviation
c) turning, acceleration errors
d) avoiding magnetic interference with the compass

6.6 Distances

a) units
b) measurement of distance in relation to map projection

6.7 Charts in Practical Navigation

a) plotting positions
b) latitude and longitude
c) bearing and distance
d) use of navigation protractor
e) measurement of tracks and distances

6.8 Chart Reference Material/Map Reading

a) map analysis
b) topography
c) relief
d) cultural features
    - permanent features (e.g. line features, spot features, unique or special features)
    - features subject to change (e.g. water)

e) preparation
f) folding the map for use
g) methods of map reading
h) map orientation
i) checkpoint features
j) anticipation of checkpoints
    - with continuous visual contact
    - without continuous visual contact
    - when uncertain of position
k) aeronautical symbols
l) aeronautical information
m) conversion of units

6.9 Principles of Navigation

a) IAS, CAS and TAS
b) track, true and magnetic
c) wind velocity, heading and groundspeed
d) triangle of velocities
e) calculation of heading and groundspeed
f) drift, wind correction angle
g) ETA
h) dead reckoning, position, fix

6.10 The Navigation Computer

a) Use of the circular slide rule to determine:
b) TAS, time and distance
c) conversion of units
d) fuel required
e) pressure, density and true altitude
f) time en-route and ETA
g) use of the computer to solve triangle of velocities
h) application of TAS and wind velocity to track
i) determination of heading and ground speed
j) drift and wind correction angle

6.11 Time

a) relationship between universal co-ordinated (standard) (UTC) time and local time
b) definition of sunrise and sunset times
c) Sunrise/Sunset Tables (AIP)

6.12 Flight Planning

a) selection of charts
b) route and aerodrome weather forecasts and reports
c) assessing the weather situation
d) plotting the route

e) considerations of controlled/regulated airspace, airspace restrictions, danger areas, etc.
f) use of AIP and NOTAMS
g) ATC liaison procedures in controlled/regulated airspace
h) fuel considerations
i) en-route safety altitude(s)
j) alternate aerodromes
k) communications and radio/navaid frequencies
l) compilation of flight log
m) compilation of ATC flight plan
n) selection of check points, time and distance marks
o) mass and balance calculations
p) mass and performance calculations

6.13 Practical Navigation

a) compass headings, use of deviation card
b) organisation of in-flight workload
c) departure procedure, log entries, altimeter setting and establishing IAS
d) maintenance of heading and altitude
e) use of visual observations
f) establishing position, checkpoints
g) revisions to heading and ETA
h) arrival procedures, ATC liaison
i) completion of flight log and aeroplane log entries

6.14 Radio Navigation (Basic Concepts)

6.14.1 Ground D/F

a) application
b) principles
c) presentation and interpretation
d) coverage
e) errors and accuracy
f) factors affecting range and accuracy

6.14.2 ADF, including associated beacons (NDBs) and use of the RMI

a) application
b) principles
c) presentation and interpretation
d) coverage
e) errors and accuracy
f) factors affecting range and accuracy

6.14.3 VOR/DME

a) application
b) principles
c) presentation and interpretation

d) coverage
e) errors and accuracy
f) factors affecting range and accuracy

6.14.4 Introduction to GPS

a) application
b) principles
c) presentation and interpretation
d) coverage
e) errors and accuracy
f) factors affecting reliability and accuracy

6.14.5 Introduction to Ground Radar

a) application
b) principles
c) presentation and interpretation
d) coverage
e) errors and accuracy

6.14.6 Introduction to Secondary Surveillance Radar

a) principles (transponders)
b) application
c) presentation and interpretation
d) modes and codes

6.14.7 Search and Rescue

a) Definitions
b) Alerting Phases
c) Procedures for pilot in command
d) Search and Rescue Signals
e) Procedures

070 Operational Procedures

7.1 Civil Aviation (Operations of Aircraft) Regulations

a) foreword
b) definitions
c) general statement
d) flight preparation and in-flight procedures
e) performance and operating limitations
f) instruments and equipment - communications and navigation equipment
g) maintenance
h) flight crew
i) lights to be displayed

7.2 ICAO Annex 12 – Search and Rescue

(a) definitions

(b) alerting phases
(c) procedures for pilot-in-command intercepting a distress transmission
(d) search and rescue signals

7.3 ICAO Annex 13 – Aircraft Accident Investigation - definitions

080 PRINCIPLES OF FLIGHT

8.1 The Atmosphere

a) composition and structure
b) ICAO standard atmosphere
c) atmospheric pressure

8.2 Airflow Around a Body

a) air resistance and air density
b) boundary layer
c) friction forces
d) laminar and turbulent flow
e) Bernoulli's principle – venturi effect

8.3 Airflow about a Two Dimensional Aerofoil

a) airflow around a flat plate
b) airflow around a curved plate (aerofoil)
c) description of aerofoil cross section
d) lift and drag
e) C_l and C_d and their relationship to angle of attack

8.4 Three dimensional flow of an aerofoil

a) aerofoil shapes and wing planforms
b) induced drag
c) downwash angle, vortex drag, ground effect
d) aspect ratio
e) parasite (profile) drag
f) form, skin friction and interference drag
g) lift/drag ratio

9.5 General helicopter aerodynamics

a) Rotor thrust
b) Rotor drag
c) Total reaction
d) Relative airflow
e) Rotational airflow
f) Induced airflow
g) Centrifuge reaction
h) Rotor disc
i) Coning angle
j) Hovering

8.6 Distribution of the Four Forces

a) balance and couples
b) lift and mass
c) thrust and drag
d) methods of achieving balance

8.7 Flying Controls

a) the three planes
    - pitching about the lateral axis
    - rolling about the longitudinal axis
    - yawing about the normal axis
b) effects of the elevators, ailerons and rudder
c) control in pitch, roll and yaw
d) cross coupling, roll and yaw
e) mass and aerodynamic balance of control surfaces

8.8 Trimming Controls

a) basic trim tab, balance tab and anti-balance tab
b) purpose and function
c) method of operation
d) **(H)** blade twist and blade taper
e) Rotor blade freedom of movement

8.9 Flaps and Slats

a) simple, split, slotted and Fowler flaps
b) purpose and function
c) operational use

8.10 The Stall

a) stalling angle of attack
b) disruption of smooth airflow
c) reduction of lift, increase of drag
d) movement of centre of pressure
e) symptoms of development
f) aeroplane characteristics at the stall
g) factors affecting stall speed and aeroplane behaviour at the stall
h) stalling from level, climbing, descending and turning flight
i) inherent and artificial stall warnings
j) recovery from the stall

8.11 Avoidance of Spins

a) wing tip stall
b) the development of roll
c) recognition at the incipient stage
d) immediate and positive stall recovery

8.12 Stability

a) definitions of static and dynamic stability
b) longitudinal stability
c) centre of gravity effect on control in pitch
d) lateral and directional stability
e) interrelationship, lateral and directional stability

8.13 Load Factor and Manoeuvres

a) structural considerations
b) manoeuvring and gust envelope
c) limiting load factors, with and without flaps
d) changes in load factor in turns and pull-ups
e) manoeuvring speed limitations
f) in-flight precautions

8.14 Stress Loads on the Ground

a) side loads on the landing gear
b) landing
c) taxying, precautions during turns

090 RADIO TELEPHONY

9.1 English Proficiency Requirements

9.2 Radio Telephony and Communications

a) use of AIP and frequency selection
b) microphone technique
c) phonetic alphabet
d) station/aeroplane callsigns/abbreviations
e) transmission technique
f) use of standard words and phrases
g) listening out
h) required ‘readback’ instructions

9.3 Departure Procedures

a) radio checks
b) taxi instructions
c) holding on ground
d) departure clearance

9.4 En-route Procedures

a) frequency changing
b) position, altitude/flight level reporting
c) flight information service
d) weather information
e) weather reporting
f) procedures to obtain bearings, headings, position
g) procedural phraseology

h) height/range coverage

9.5 Arrival and Traffic Pattern Procedures

a) arrival clearance
b) calls and ATC instructions during the:
    - circuit
    - approach and landing
    - vacating runway

9.6 Communications Failure

a) Action to be taken
    - alternate frequency
    - serviceability check, including microphone and headphones
b) in-flight procedures according to type of airspace

9.7 Distress and Urgency Procedures

a) distress (Mayday), definition and when to use
b) frequencies to use
c) contents of Mayday message
d) urgency (Pan), definition and when to use
e) frequencies to use
f) relay of messages
g) maintenance of silence when distress/urgency calls heard
h) cancellation of distress/urgency