

FLIGHT TRAINING
(AEROPLANE)
BASED ON JAR FCL - PPL(A)
THEORETICAL KNOWLEDGE
Syllabus

for

MARSPOLAR - DUBAI, UAE

<u>AIRCRAFT GENERAL KNOWLEDGE</u>
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Airframe

- 1 Airframe structure
 - components
 - fuselage, wings, tailplane, fin
 - primary flying controls
 - trim and flap/slat systems
 - landing gear
 - nose wheel, including steering
 - tyres, condition
 - braking systems and precautions in use
 - retraction systems

- 2 Airframe loads
 - static strength
 - safety factor
 - control locks and use
 - ground/flight precautions

Powerplant

- 3 Engines – general
 - principles of the four stroke internal combustion engine
 - basic construction
 - causes of pre-ignition and detonation
 - power output as a function of RPM

- 4 Engine cooling
 - air cooling
 - cowling design and cylinder baffles
 - design and use of cowl flaps
 - cylinder head temperature gauge

- 5 Engine lubrication
 - function and methods of lubrication
 - lubrication systems
 - methods of oil circulation
 - oil pump and filter requirements
 - qualities and grades of oil
 - oil temperature and pressure control
 - oil cooling methods
 - recognition of oil system malfunctions

- 6 Ignition systems
 - principles of magneto ignition
 - construction and function
 - purpose and principle of impulse coupling
 - serviceability checks, recognition of malfunctions
 - operational procedures to avoid spark plug fouling

- 7 Carburation
- principles of float type carburettor
 - construction and function
 - methods to maintain correct mixture ratio
 - operation of metering jets and accelerator pump
 - effect of altitude
 - manual mixture control
 - maintenance of correct mixture ratio
 - limitation on use at high power
 - avoidance of detonation
 - idle cut-off valve
 - operation and use of primary controls
 - air induction system
 - alternate induction systems
 - carburettor icing, use of hot air
 - injection systems, principles and operation
- 8 Aero engine fuel
- classification of fuels
 - grades and identification by colour
 - quality requirements
 - inspection for contamination
 - use of fuel strainers and drains
- 9 Fuel systems
- fuel tanks and supply lines
 - venting system
 - mechanical and electrical pumps
 - gravity feed
 - tank selection
 - system management
- 10 Propellers
- propeller nomenclature
 - conversion of engine power to thrust
 - design and construction of fixed pitch propeller
 - forces acting on propeller blade
 - variation of RPM with change of airspeed
 - thrust efficiency with change of speed
 - design and construction of variable pitch propeller
 - constant speed unit operation
 - effect of blade pitch changes
 - windmilling effect
- 11 Engine handling
- starting procedures and precautions
 - recognition of malfunctions
 - warming up, power and system checks
 - oil temperature and pressure limitations
 - cylinder head temperature limitations
 - ignition and other system checks
 - power limitations
 - avoidance of rapid power changes
 - use of mixture control

Systems

- 12 Electrical system

- installation and operation of alternators/generators
 - direct current supply
 - batteries, capacity and charging
 - voltmeters and ammeters
 - circuit breakers and fuses
 - electrically operated services and instruments
 - recognition of malfunctions
 - procedure in the event of malfunctions
- 13 Vacuum system
- components
 - pumps
 - regulator and gauge
 - filter system
 - recognition of malfunction
 - procedures in the event of malfunctions

Instruments

- 14 Pitot/static system
- pitot tube, function
 - pitot tube, principles and construction
 - static source
 - alternate static source
 - position error
 - system drains
 - heating element
 - errors caused by blockage or leakage
- 15 Airspeed indicator
- principles of operation and construction
 - relationship between pitot and static pressure
 - definitions of indicated, calibrated and true airspeed
 - instrument errors
 - airspeed indications, colour coding
 - pilot's serviceability checks
- 16 Altimeter
- principles of operation and construction
 - function of the sub-scale
 - effects of atmospheric density
 - pressure altitude
 - true altitude
 - international standard atmosphere
 - flight level
 - presentation (three needle)
 - instrument errors
 - pilot's service ability checks
- 17 Vertical speed indicator
- principles of operation and construction
 - function
 - inherent lag
 - instantaneous VSI
 - presentation
 - pilot's serviceability checks

- 18 Gyroscopes
–principles
–rigidity
–precession
- 19 Turn indicator
–rate gyro
–purpose and function
–effect of speed
–presentation
–turn co-ordinator
–limited rate of turn indications
–power source
–balance indicator
– principle
– presentation
–pilot’s serviceability checks
- 20 Attitude indicator
–earth gyro
–purpose and function
–presentations
–interpretation
–operating limitations
–power source
–pilot’s serviceability checks
- 21 Heading indicator
–directional gyro
–purpose and function
–presentation
–use with magnetic compass
–setting mechanism
–apparent drift
–operating limitations
–power source
–pilot’s serviceability checks
- 22 Magnetic compass
–construction and function
–earth’s magnetic field
–variation and deviation
–turning, acceleration errors
–precautions when carrying magnetic items
–pilot’s service ability checks
- 23 Engine instruments
–principles, presentation and operational use of:
–oil temperature gauge
–oil pressure gauge
–cylinder head temperature gauge
–exhaust gas meter
–manifold pressure gauge
–fuel pressure gauge

- fuel flow gauge
 - fuel quantity gauge(s)
 - tachometer
- 24 Other instruments
- principles, presentation and operational use of:
 - vacuum gauge
 - voltmeter and ammeter

 - warning indicators
 - others relevant to aeroplane type features, unique or special features)
 - features subject to change (e.g. water)
 - preparation
 - folding the map for use
 - methods of map reading
 - map orientation
 - checkpoint features
 - anticipation of checkpoints
 - with continuous visual contact
 - without continuous visual contact
 - when uncertain of position
 - aeronautical symbols
 - aeronautical information
 - conversion of units
- 25 Principles of navigation
- IAS, CAS and TAS
 - track, true and magnetic
 - wind velocity, heading and groundspeed
 - triangle of velocities
 - calculation of heading and groundspeed
 - drift, wind correction angle
 - ETA
 - dead reckoning, position, fix
- 26 The navigation computer
- use of the circular slide rule to determine
 - TAS, time and distance
 - conversion of units
 - fuel required
 - pressure, density and true altitude
 - time en-route and ETA
 - use of the computer to solve triangle of velocities
 - application of TAS and wind velocity to track
 - determination of heading and ground speed
 - drift and wind correction angle
- 27 Time
- relationship between universal co-ordinated (standard) (UTC) time and local mean time (LMT)

 - definition of sunrise and sunset times
- 28 Flight planning
- selection of charts

- route and aerodrome weather forecasts and reports
- assessing the weather situation
- plotting the route
- considerations of controlled/regulated airspace, airspace restrictions, danger areas, etc.
- use of AIP and NOTAMS
- ATC liaison procedures in controlled/regulated airspace
- fuel considerations
- en-route safety altitude(s)
- alternate aerodromes
- communications and radio/navaid frequencies
- compilation of flight log
- compilation of ATC flight plan
- selection of check points, time and distance marks
- mass and balance calculations
- mass and performance calculations

- 29 Practical navigation
- compass headings, use of deviation card
 - organisation of in-flight workload
 - departure procedure, log entries, altimeter setting and establishing IAS
 - maintenance of heading and altitude
 - use of visual observations
 - establishing position, checkpoints
 - revisions to heading and ETA
 - arrival procedures, ATC liaison
 - completion of flight log and aeroplane log entries

Radio navigation

- 30 Ground D/F
- application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- 31 ADF, including associated beacons (NDBs) and use of the RMI
- application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- 32 VOR/DME
- application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- 33 GPS
- application
 - principles
 - presentation and interpretation
 - coverage

- errors and accuracy
 - factors affecting reliability and accuracy
- 34 Ground radar
- application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting reliability and accuracy
- 35 Secondary surveillance radar
- principles (transponders)
 - application
 - presentation and interpretation
 - modes and codes

OPERATIONAL PROCEDURES

- 36 ICAO Annex 6, Part II – Operation of aircraft
- foreword
 - definitions
 - general statement
 - flight preparation and in-flight procedures
 - performance and operating limitations
 - instruments and equipment
 - communications and navigation equipment
 - maintenance
 - flight crew
 - lights to be displayed
- 37 ICAO Annex 12 – Search and rescue
- definitions
 - alerting phases
 - procedures for pilot-in-command (para 5.8 and 5.9)
 - search and rescue signals (para 5.9 and Appendix A)
- 38 ICAO Annex 13 – Aircraft accident investigation
- definitions
 - national procedures
- 39 Noise abatement
- general procedures
 - application to take-off and landing
- 40 Contravention of aviation regulations
- offences
 - penalties

PRINCIPLES OF FLIGHT

- 41 The atmosphere
- composition and structure
 - ICAO standard atmosphere

- atmospheric pressure
- 42 Airflow around a body, sub-sonic
 - air resistance and air density
 - boundary layer
 - friction forces
 - laminar and turbulent flow
 - Bernoulli's principle – venturi effect
- 43 Airflow about a two dimensional aerofoil
 - airflow around a flat plate
 - airflow around a curved plate (aerofoil)
 - description of aerofoil cross section
 - lift and drag
 - C_l and C_d and their relationship to angle of attack
- 44 Three dimensional flow about an aerofoil
 - aerofoil shapes and wing planforms
 - induced drag
 - downwash angle, vortex drag, ground effect
 - aspect ratio
 - parasite (profile) drag
 - form, skin friction and interference drag
 - lift/drag ratio
- 45 Distribution of the four forces
 - balance and couples
 - lift and mass
 - thrust and drag
 - methods of achieving balance
- 46 Flying controls
 - the three planes
 - pitching about the lateral axis
 - rolling about the longitudinal axis
 - yawing about the normal axis
 - effects of the elevators (stabilators), ailerons and rudder
 - control in pitch, roll and yaw
 - cross coupling, roll and yaw
 - mass and aerodynamic balance of control surfaces
- 47 Trimming controls
 - basic trim tab, balance tab and anti-balance tab
 - purpose and function
 - method of operation
- 48 Flaps and slats
 - simple, split, slotted and Fowler flaps
 - purpose and function
 - operational use
 - slats, leading edge
 - purpose and function
 - normal/automatic operation
- 49 The stall
 - stalling angle of attack
 - disruption of smooth airflow
 - reduction of lift, increase of drag

- movement of centre of pressure
 - symptoms of development
 - aeroplane characteristics at the stall
 - factors affecting stall speed and aeroplane behaviour at the stall
 - stalling from level, climbing, descending and turning flight
 - inherent and artificial stall warnings
 - recovery from the stall
- 50 Avoidance of spins
- wing tip stall
 - the development of roll
 - recognition at the incipient stage
 - immediate and positive stall recovery
- 51 Stability
- definitions of static and dynamic stability
 - longitudinal stability
 - centre of gravity effect on control in pitch
 - lateral and directional stability
 - interrelationship, lateral and directional stability
- 52 Load factor and manoeuvres
- structural considerations
 - manoeuvring and gust envelope
 - limiting load factors, with and without flaps
 - changes in load factor in turns and pull-ups
 - manoeuvring speed limitations
 - in-flight precautions
- 53 Stress loads on the ground
- side loads on the landing gear
 - landing
 - taxying, precautions during turns

COMMUNICATIONS

- 54 Radio telephony and communications
- use of AIP and frequency selection
 - microphone technique
 - phonetic alphabet
 - station/aeroplane callsigns/abbreviations
 - transmission technique
 - use of standard words and phrases
 - listening out
 - required ‘readback’ instructions
- 55 Departure procedures
- radio checks
 - taxi instructions
 - holding on ground
 - departure clearance
- 56 En-route procedures
- frequency changing
 - position, altitude/flight level reporting
 - flight information service

- weather information
 - weather reporting
 - procedures to obtain bearings, headings, position
 - procedural phraseology
 - height/range coverage
- 57 Arrival and traffic pattern procedures
- arrival clearance
 - calls and ATC instructions during the:
 - circuit
 - approach and landing
 - vacating runway
- 58 Communications failure
- Action to be taken
 - alternate frequency
 - serviceability check, including microphone and headphones
 - in-flight procedures according to type of airspace
- 59 Distress and urgency procedures
- distress (Mayday), definition and when to use
 - frequencies to use
 - contents of Mayday message
 - urgency (Pan), definition and when to use
 - frequencies to use
 - relay of messages
 - maintenance of silence when distress/urgency calls heard
 - cancellation of distress/urgency

General flight safety

- 60 Aeroplane
- seat adjustment and security
 - harnesses and seat belts
 - emergency equipment and its use
 - fire extinguisher
 - engine/cabin fires
 - de-icing systems
 - survival equipment, life jackets, life rafts
 - carbon monoxide poisoning
 - refuelling precautions
 - flammable goods/pressurised containers
- 61 Operational
- wake turbulence
 - aquaplaning
 - windshear, take-off, approach and landing
 - passenger briefings
 - emergency exits
 - evacuation from the aeroplane
 - forced landings
 - gear-up landing
 - ditching