



GOVERNMENT OF INDIA

OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION

TECHNICAL CENTER, OPPOSITE SAFDARJUNG AIRPORT, NEW DELHI

**CIVIL AVIATION REQUIREMENT
SECTION 7- FLIGHT CREW STANDARDS**

TRAINING AND LICENSING

SERIES 'B' PART IX

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F. No. CEO/Pilot Syllabus/ 2011

Subject: TRAINING SYLLABUS FOR ISSUE OF HELICOPTER
PILOT LICENCES

1. INTRODUCTION

Sections B, F, K and N of Schedule II of the Aircraft Rules, 1937 stipulate, amongst other requirements, that for issuance of Student Pilot's License (SPL), Private Pilot's License (PPL), Commercial Pilot's License (CPL) and Airline Transport Pilot's License (ATPL) for Helicopters, the applicant shall have to pass an oral and/or written examination as per the syllabus prescribed by the DGCA.

This CAR lays down the main topics of the syllabus for ground training and examination for issuance of the licenses for helicopters, as required under clause 1 of sections B, F, K and N of Schedule II. The provisions of this CAR must be read in conjunction with schedule II of the aircraft Rules 1937. These topics of syllabus are in conformity with the knowledge requirements prescribed in ICAO Annex 1.

This CAR is issued under the provisions of Scheduled II and Rule 133A of the Aircraft Rules, 1937.

2. SYLLABUS - GROUND TRAINING/ EXAMINATION OF HELICOPTER PILOT LICENCES

2.1. Syllabus for issue of Student Pilot's License for Helicopters [SPL(H)] is given in Appendix A.

2.2. Syllabus for issue of Private Pilot's License for Helicopters [PPL(H)] is given in Appendix B.

2.3. Syllabus for issue of Commercial Pilot's License [CPL(H)] and Instrument rating (IR) for Helicopters is given in Appendix C.

- 2.4. Syllabus for issue of Airline Transport Pilot's License for Helicopters [ATPL(H)] is given in Appendix D.
- 2.5 Technical specific paper (concern to particular helicopter and its related system)
- 2.6 Technical performance Paper (Performance of the Helicopter and its Systems)
Performance paper is applicable to heavy aircraft having MTOW more than 5700 kg or Twin Engine Helicopter

3. SYLLABUS - FLYING TRAINING OF HELICOPTER PILOTS

- 3.1 Flying training syllabus for issue of Private Pilot's License for Helicopters [PPL(H)] is given in Appendix E.
- 3.2 Flying training syllabus for issue of Commercial Pilot's License for Helicopters [CPL(H)] is given in Appendix F.
- 3.3 Flying training syllabus for issue of Airline Transport Pilot's License for Helicopters [ATPL(H)] shall be same as in Appendix G.
- 3.4. Flying Training Syllabus for pilots holding CPL (Aeroplane) with minimum 500 hrs PIC experience is given in Appendix H.



(EK BHARAT BHUSHAN)
Director General of Civil Aviation

SYLLABUS FOR STUDENT PILOT LICENCE EXAMINATION

Helicopter

1. Air Regulations

- Knowledge of terms used in Aviation such as aircraft, aeroplane, aerodrome, balloon, co-pilot, Director General, flight time, solo time, dual flight time, log book, flight crew member, helicopter, prohibited area, take-off, landing, Air Traffic Control, Mayday, PAN, etc. (2 hours).
- The different categories of Pilots' licenses and their privileges. Requirements for issue, renewal, validity and privileges of Student Pilot Licence (1 hour).
- Visual Flight Rules (1 hour)
- Ground markings, visual and light signals with specific reference to visual flights and circuit flying (1 hour).

2. Air Navigation

- Basic knowledge of form of earth and the method of representing sphere (Earth) on a flat surface mapping. (2 hours)
- Basic knowledge of various units of measure such as
 - nautical miles, kilometer, statute mile,
 - Fahrenheit and Celsius, millibars (hectopascal)
 - lbs, kilogram, US and Imperial gallons, litres and conversion from one to other. (1 hour)
- Elementary knowledge of some navigational instruments such as Magnetic Compass. Air Speed Indicator, altimeter and basic knowledge of magnetism. (3 hours)
- Use of Radio Telephony, VHF etc. Elementary understanding of Radio Navigational Aids such as NDB, VOR, and their uses in aviation (appreciation only). (2 hours)

3. Aviation Meteorology

- Elementary knowledge different types of clouds and precipitation. Basic understanding of hazards associated with certain types of clouds. (1 hour)
- Basic knowledge of temperature, pressure and density and their relationship
- Elementary knowledge of relationship between pressure and wind, variation of wind with height and sea breeze and land breeze. (1 hour)
- Elementary knowledge of different types of clouds and precipitation
 - Basic understanding of hazards associated with certain types of clouds. (1 hour)
- Elementary knowledge of the terms – Visibility, Fog, Mist and Haze. (1 hour)
- Elementary knowledge of variation of pressure with height, and the Q codes – QNH, QFE and QNE, etc. (1 hour)
- Basic understanding of METAR, SPECI and aerodrome warnings and their importance in aviation. (1 hour)
- Elementary knowledge of the uses of Anemometer, Aneroid Barometer, Win Stock etc. (1 hour)

4. Aircraft and Engines

- Elementary knowledge of – density, pressure, temperature, humidity and the relationship between them. (1 hour)
- Understanding of the terms – thrust, drag, lift, weight, aerofoil, angle of attack, centre of lift, stalling, range endurance etc. (2 hours)
- Elementary knowledge of the forces acting on an aerofoil in level flight understanding of Bernoulli's Theorem. (1 hour)
- Elementary knowledge of the primary controls, understanding of the uses of aileron, rudder, elevator, stabilizer, trimming devices, flaps, landing gear etc. (1 hour)
- General knowledge of the principle of operation of a piston engine and associated systems. (2 hours)
- Elementary knowledge of the principle of a fixed pitch propeller / main rotor, tail rotor (1 hour)
- Elementary knowledge of weight and balance. (1 hour)
- Basic knowledge of first-aid, the use of generally available first-aid-kits. (1 hour)
- Elementary knowledge of
 - t) Certificate of Airworthiness
 - ii) Certificate of Registration
 - t) Flight Release / Certificate of Release to Service (1 hour)
- Main rotor, tail rotor, clutch, gear box, flying controls, landing gears (2 hours)
- Electrical system, heating and ventilating system (1 hour)
- Adequate knowledge of the instrumentation and radio navigation aids pertaining to the helicopter (2 hours)
- Basic handling and care of aircraft

APPENDIX 'B'

**SYLLABUS FOR PRIVATE PILOT LICENSE
EXAMINATION**

HELICOPTER

**Appendix B-1: Private Pilot Licence Examination
(Composite)**

**AppendixB-2 : Private Pilot Licence Examination (Helicopter &
Engines – Technical General**

APPENDIX B-1

PRIVATE PILOT LICENCE EXAMINATION

(COMPOSITE)

HELICOPTER

THE SYLLABUS OF PRIVATE PILOT LICENCE (COMPOSITE) – HELICOPTER IS AS FOLLOWS

1. Air Navigation

1.1 Form of the Earth

- axis, poles
- meridians of longitude
- parallels of latitude
- great circle, small circle, rhumb line
- hemispheres, north/south, east/west

1.2 Mapping

- aeronautical maps and charts (topographical)
- projections and their properties
- conformality
- equivalence
- scale
- great circles and rhumb lines

1.3 Conformal orthomorphic projection (ICAO 1:500,000 chart)

- main properties
- construction
- convergence of meridians
- presentation of meridians, parallels, great circles and rhumb lines
- scale, standard parallels
- depiction of height

1.4 Direction

- true north
- earth's magnetic field, variation – annual change
- magnetic north
- vertical and horizontal components
- isogonals, agonic lines

1.5 Helicopter magnetism

- magnetic influences within the helicopter
- compass deviation
- turning, acceleration errors
- avoiding magnetic interference with the compass

1.6 Distances

- units
- measurement of distance in relation to map projection

1.7 Charts in practical navigation

- plotting positions
- latitude and longitude
- bearing and distance
- use of navigation protractor
- measurement of tracks and distances

1.8 Chart reference material/map reading

- map analysis
- topography relief
- cultural features
- permanent features (e.g. line features, spot 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

2. Flight Performance and Planning

2.1 Mass and Balance

Weight and Balance

- limitations on maximum mass
- forward and aft limitations of centre of gravity, normal and utility operation
- mass and centre of gravity calculations – Helicopter manual and balance sheet

2.2 Performance

Take-off

- take-off distance available
- take-off and initial climb
- effects of mass, wind and density altitude

- effects of ground surface and gradient
- use of flaps, effect of altitude

Landing

- effects of mass, wind, density altitude and approach speed
- use of flaps, effect of altitude
- ground surface and gradient

In-flight

- relationship between power required and power available
- performance diagram
- maximum rate and maximum angle of climb
- range and endurance
- effects of configuration, mass, temperature and altitude
- reduction of performance during climbing turns
- autorotation
- adverse effects
 - icing, rain
 - condition of the airframe
 - altitude

3 Aviation Meteorology

3.1 The Atmosphere

- Composition and structure
- vertical divisions

3.2 Pressure, density and temperature

- barometric pressure, isobars
- changes of pressure, density and temperature with altitude
- altimetry terminology
- solar and terrestrial energy radiation, temperature
- diurnal variation of temperature
- adiabatic process
- temperature lapse rate
- stability and instability
- effects of radiation, advection subsidence and convergence

3.3 Humidity and precipitation

- water vapour in the atmosphere
- vapour pressure
- dew point and relative humidity
- condensation and vaporization
- precipitation

3.4 Pressure and wind

- high and low pressure areas
- motion of the atmosphere, pressure gradient
- vertical and horizontal motion, convergence, divergence
- surface and geostrophic wind
- effect of wind gradient and windshear on take-off and landing
- relationship between isobars and wind, Buys Ballot's law
- turbulence and gustiness
- local winds, fohn, land and sea breezes

3.5 Clouds formation

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

3.6 Fog, mist, haze

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

3.7 Air Masses

- description of and factors affecting the properties of air masses
- classification of air masses, region of origin
- modification of air masses during their movement
- development of low and high pressure system
- weather associated with pressure systems

3.8 Frontology

- formation of cold and warm fronts
 - boundaries between air masses
 - development of a warm front
 - associated clouds and weather
 - weather in the warm sector
 - development of a cold front
 - associated clouds and weather
 - occlusions
 - associated clouds and weather
 - stationary fronts
 - associated clouds and weather

3.9 Ice accretion

- conditions conducive to ice formation
- effects of hoar frost, rime ice, clear ice
- effects of icing on helicopter performance

- precautions and avoidance of icing conditions
- power plant icing
- precautions, prevention and clearance of induction and carburetor icing

3.10 Thunderstorms

- formation – air mass, frontal, orographic
- conditions required
- development process
- recognition of favourable conditions for formation
- hazards for aeroplanes
- effects of lightning and severe turbulence
- avoidance of flight in the vicinity of thunderstorms

3.11 Flight over hilly or mountainous areas

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

3.12 Indian Climatology

- general seasonal circulation in the troposphere
- local seasonal weather and winds

3.13 Altimetry

- operational aspects of pressure settings,
- pressure altitude, density altitude
- height, altitude, flight level
- ICAO standard atmosphere
- QNH, QFE, standard setting
- transition altitude, layer and level

3.14 The meteorological organization

- aerodrome meteorological offices
- aeronautical meteorological stations
- forecasting service
- meteorological services at aerodromes
- availability of periodic weather forecasts

3.15 Weather analysis and forecasting

- weather charts, symbols, signs
- significant weather charts
- prognostic charts for general aviation

3.16 Weather information for flight planning

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

3.17 Meteorological broadcasts for aviation

- VOLMET, ATIS, SIGMET

4. Radio Navigation

- Ground D/F
 - application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- ADF, including associated beacons (NDBs) and use of the radio magnetic indicator (RMI)
 - application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- VOR/DME
 - application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- GPS/DGPS
 - application
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy
- Ground Radar
 - principles
 - presentation and interpretation
 - coverage
 - errors and accuracy
 - factors affecting range and accuracy

- Secondary Surveillance Radar
 - principles (transponders)
 - application
 - presentation and interpretation
 - modes and codes

5. Communications

Radio Telephony and Communications

- use of AIP and frequency selection
- microphone technique
- phonetic alphabet
- station/helicopter call signs/abbreviation
- transmission technique
- use of standard words and phrases
- listening out
- required 'readback' instructions

Departure procedures

- radio checks
- taxi instructions
- holding on ground
- departure clearance

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

Arrival and traffic pattern procedures

- arrival clearance
- calls and ATC instructions during the:
 - circuit
 - approach and landing
 - vacating runway or landing site

Communication failure

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

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 call heard
- cancellation of distress/urgency

6. Instrumentation – Helicopters

6.1 Flight Instruments

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

Airspeed indicator

- principles of operation
- relationship between pitot and static pressure
- definitions of indicated, calibrated and true airspeed
- instrument errors,
- airspeed indications, colour coding
- pilot's serviceability checks

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

Vertical Speed Indicator (VSI)

- principles of operation and construction
- function
- inherent lag
- instantaneous VSI
- presentation

-pilot's serviceability checks

Gyroscopes

- principles
- rigidity
- precession

Turn indicator

- rate gyro
- purpose and function
- effect of speed
- precession
- turn coordinator
- limited rate of turn indications
- power source
- balance indicator
- principle
- pilot's serviceability checks

Altitude indicator

- earth gyro
- purpose and function
- precession
- interpretation
- operating limitations
- power source
- pilot's serviceability checks

Heading Indicator

- directional gyro
- purpose and function
- precession
- use with magnetic compass
- setting mechanism
- apparent drift
- operating limitations
- power source
- pilot's serviceability checks

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

Engine Instruments

- principles, presentation and operational use of:
 - oil temperature gauge
 - oil pressure gauge
 - cylinder head temperature gauge
 - exhaust gas gauge
 - manifold pressure gauge
 - fuel pressure gauge
 - fuel flow gauge
 - fuel quantity gauge (s)
 - tachometer

Other Instruments

- principles, presentation and operational use of:
 - voltmeter and ammeter
 - warning indicators (audio or visual)
 - others relevant to helicopter type

7.2 Airworthiness

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

8 Air Regulations

8.1 Legislation

- The Convention of International Civil Aviation
- The International Civil Aviation Organization

- Articles of the Convention
 - Sovereignty
 - Territory
 - Flight over territory of Contracting States
 - Landing at customs airports

- Applicability of air regulations

- Rules of the Air

- Entry and clearance regulations of Contracting States
- Search of aircraft
- Facilitation of formalities
- Customs and immigration procedures
- Customs duty
- Documents to be carried in aircraft
- Use of aircraft radio equipment
- Certificate of airworthiness
- Licences of personnel
- Recognition of certificates and licences
- Journey log books
- Cargo restrictions
- Restrictions on use of photographic equipment
- Adoption of international standards and procedures
- Endorsement of certificates and licences
- Validity of endorsed certificates and licences

- Annexes to the Convention ('ICAO Annexes')

Annex 7 Aircraft Nationality and Registration Marks

- definitions
- aircraft registration marks
- certificate of registration
- identification plate

Annex 8 Airworthiness of aircraft

- definitions
- certificate of airworthiness
- continuing airworthiness
- validity of certificate of airworthiness
- instruments and equipment
- aircraft limitations and information

8.2 Rules of the Air

Annex 2 Rules of the Air

- definitions
- applicability
- general rules
- visual flight rules – signals (Appendix 1)
- interception of civil aircraft (Appendix 2)

8.3 Air Traffic regulations and Air Traffic Services

Annex 11 Air Traffic Regulations and Air Traffic Services

- definitions
- objectives of air traffic services
- classification of airspace
- flight information regions, control areas and control zones
- air traffic control services
- alerting service
- visual meteorological conditions
- instrument meteorological conditions
- in-flight contingencies

Annex 14 Aerodrome Data

- definitions
- conditions of the movement area and related facilities

Visual aids for navigation

- indicators and signaling devices
- markings
- lights
- signs
- markers
- signal area

Visual aids for denoting obstacles

- marking of objects
- lighting of objects

Visual aids for denoting restricted use of areas

Emergency and other services

- fire and rescue services
- apron management service

Aerodrome ground lights and surface marking colours

- colours for aeronautical ground lights
- colours for surface markings

ICAO Document 4444 – Rules of the Air and Air Traffic Services

General provisions

- definitions
- ATS operating practices
- Flight plan clearance and information
- Control of air traffic flow
- Altimeter setting procedures
- Wake turbulence information
- Meteorological information
- Air reports (AIREP)
-
- Area control service
 - Separation of controlled traffic in the various classes of airspace
 - Pilots, responsibility to maintain separation in VMC
 - Emergency and communications failure procedures by the pilot
 - Interception of civil aircraft

Approach control service

- Departing and arriving aircraft procedures in VMC

Aerodrome control service

- Function of aerodrome control towers
- VFR operations
- Traffic and circuit procedures
- Information to aircraft

Flight information and alerting service

- Air traffic advisory service
- Objectives and basic principles

8.4 Aircraft Rules and Civil Aviation Requirements

Indian aircraft act 1934-section 1,2,8,10,11A,11B, 17&18(3/9)

Aircraft Rule 1937- Rule No. 1-19,21-29A,30,33,37A,38-48,50,52,53,55,65,67,67A,67B,68-70,76,79-89,133A,134,140, 140(AB&C)15&161

Schedule I, II, VI, & XI

INDIAN AIRCRAFT RULES 1920-RULE NO 53-64

AIRCRAFT RULES 1954 (Public Health Rules)

AIRCRAFT RULES 2003 (Carriage of Dangerous Goods)

9. Human Performance & Limitations

9.1 Basic Physiology

Concepts

- composition of the atmosphere
- the gas laws
- respiration and blood circulation

Effects of partial pressure

- effect of increasing altitude
- gas transfer
- hypoxia
 - symptoms
 - prevention
- Cabin pressurization
- Effects of rapid decompression
 - time of useful consciousness
- the use of oxygen masks and rapid descent
- hyperventilation
- symptoms
 - avoidance
 - effects of acceleration

Vision

- physiology of vision
- limitations of the visual system
 - vision defects
 - optical illusions
 - spatial disorientation
 - avoidance of disorientation

Hearing

- Physiology of vision
- inner ear sensations

- effects of altitude change
- noise and hearing loss
 - protection of hearing
- spatial disorientation
- conflicts between ears and eyes
- prevention of disorientation

Motion sickness

- causes
- symptoms
- prevention

Flying and health

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

- personal fitness
- passenger care
- scuba diving – precautions before flying

Toxic hazards

- dangerous goods
- carbon monoxide from heaters

9.2 Basic psychology

The information process

- concepts of sensation
- cognitive perception
- expectancy
- anticipation
- habits

The central decision channel

- mental workload, limitations
- information sources
 - stimuli and attention
 - verbal communication
- memory and its limitations – causes of misinterpretation

Stress

- causes and effects
- concepts of arousal
- effects on performance
- identifying and reducing stress

Judgment and decision making

- concepts of pilots' judgment
- psychological attitudes
 - behavioural aspects
- risk assessment
- development of situational awareness

10. Operational Procedures

a) ICAO Annex 6, Parts II – Operation of Helicopters

- 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

b) ICAO Annex 12 – Search and Rescue

- definitions
- alerting phases
- procedures for pilot-in-command (paragraphs 5.8 and 5.9)
- search and rescue signals (paragraph 5.9 and Appendix A)

c) ICAO Annex 13 – Aircraft Accident Investigation

- definitions

-national procedures

d) ICAO Annex 16 – Environmental Protection –

Noise limitation
Noise abatement

- general procedures
- application to take-off and landing
- criteria
- limits
- noise limitations certificate

e) Contravention of aviation regulations

- offences
- penalties

11. Radio Telephony

- a) radiotelephony procedures (1 hr):
- b) phraseology as applied to VFR operations (1 hr);
- c) action to be taken in case of communication failure(1 hr).

APPENDIX B-2

**PRIVATE PILOT LICENCE EXAMINATION
(HELICOPTER & ENGINES – TECHNICAL GENERAL)**

1. General Knowledge

1.1 Airframe

Airframe Structure

- helicopter configuration (single, tandem, co-axial, side by side rotors, directional controls)
- fuselage (type of construction, structural components, materials)
- rotors (types, components, material)
- blades (aerodynamic profiles, construction, materials)
- control surfaces (vertical fin, horizontal plane, construction, material)
- primary flying control systems (type, components)
- cockpit and cabin
- landing gear types, wheels and tyres, braking system, shock absorbers)

Airframe Loads

- limiting loads
- safety factor
- control and rotor locks and use
- ground/flight precautions

1.2 Power Plant

Piston Engine

- causes of pre-ignition and detonation

General

- design types
- principles of the 4-stroke internal combustion engine
- mechanical components

Lubrication System

- Function

- Schematic construction
- Monitoring instruments and indicators

Air Cooling

- system monitoring
- cylinder head temperature
- cowl flaps

Ignition

- schematic construction and function
- types of ignition
- magneto check

Engine Fuel Supply

- carburetor (construction and mode of operation, carburetor icing)
- fuel injection (construction and mode of operation)
- alternate air

Engine Performance

- pressure/density altitude
- performance as a function of pressure and temperature

Power augmentation devices

- turbocharger, supercharger (construction and effect on engine performance)

Fuel

- types, grades
- detonation characteristics, octane rating
- colour coding
- additives
- water content, ice formation
- fuel density
- alternate fuels, differences in specifications, limitations

Mixture

- rich and lean mixture
- maximum power and fuel economy mixture setting

Engine Handling and Manipulation

- power setting, power range
- mixture setting
- operational limitations

Operational Criteria

- maximum and minimum RPM
- (induced) engine vibration and critical RPM
- remedial action by abnormal engine start, run-up and in flight
- type related items (see AMC FCL 2.261(a), paragraphs 1.2 to 1.2.4)

1.3 Systems

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
 - hydraulic systems
 - components, fluids
- operation, indication, warning systems
- auxiliary systems

2. Principles of Flight – Helicopters

2.1 The Atmosphere

- composition and structure
- ICAO standard atmosphere
- Atmospheric pressure

2.2 Airflow around a body, sub-sonic

- air resistance and air density
- boundary layer
- friction forces
- laminar and turbulent flow
- Bernoulli's principle – Venturi effect

2.3 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

2.4 Three dimensional flow about an aerofoil

- aerofoil shapes and wing platforms
- induced drag
 - downwash angle, vortex drag, ground effect
 - aspect ratio
- parasite (profile) drag
 - form, skin friction and interference drag
- lift/drag ratio

2.5 Rotor Aerodynamics

- blade movement (feathering, flapping, dragging)
 - forces acting on rotors (blades lift/drag, weight, rotor thrust, H-force)
 - forces acting on entire helicopter (M.R. thrust, helicopter weight, fuselage drag, tail rotor thrust)
 - finite blade element and momentum theory
 - advancing blade high mach, retreating blade high incident
 - distribution of lift
 - autorotation anti-torque

2.6. Flying Controls

- the three planes
 - pitching about the lateral axis
 - rolling about the longitudinal axis
 - yawing about the normal axis

- effects of cyclic, collective and rudder pedal inputs
- stabilizer and rudder
- control in pitch, roll and yaw
- cross coupling, roll and yaw
- effect of rotor configuration on control power

2.7 Stability

- Definitions of static and dynamic stability
- Longitudinal stability
- Centre of gravity effect on control in pitch
- Lateral and directional stability
- Inter-relationship, lateral and directional stability

2.8 Load factor and manoeuvres

- Structural considerations
- Manoeuvring and gust envelope
- Limiting load factors
- Changes in load factor in turns and pull-ups
- Vibrations, controls feed back
- In-flight precautions
- H/V diagram, take-off and landing

- Stress loads on the landing gear
- Landing
- Taxiing, precautions during turns

2.9 Helicopter specific hazards

- ground resonance
- blade stall
- mast bumping
- vortex ring (main and tail rotor)
- settling with power
- dynamic and static rollover

3. General Flight Safety

HELICOPTER

- 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
- re-fuelling precautions
- flammable goods/pressurized container

Operational

- wake turbulence
- aquaplaning
- windshear, take-off, approach and landing
- passenger briefings
- emergency exits
- evacuation from the helicopter
- forced landings
- gear-up landing
- ditching

APPENDIX 'C'

SYLLABUS FOR COMMERCIAL PILOT LICENSE EXAMINATION

- HELICOPTERS

- 1. Appendix C-1 : Air Navigation**
- 2. Appendix C-2 : Aviation Meteorology**
- 3. Appendix C-3 : Air Regulation**
- 4. Appendix C-4 : Helicopter & Engine – Technical
General**

APPENDIX C-1

AIR NAVIGATION

THE SYLLABUS OF AIR NAVIGATION IS AS FOLLOWS:

1. General Navigation

a) Basics of Navigation

- The solar system
 - seasonal and apparent movements of the sun

- The earth
 - great circle, small circle, rhumb line
 - convergency, conversion angle
 - latitude, difference of latitude
 - longitude, difference of longitude
 - use of latitude and longitude co-ordinates to locate any specific position

- Time and time conversions
 - apparent time
 - UTC
 - LMT
 - standard times
 - dateline
 - determination of sunrise, sunset and civil twilight

- Directions
 - terrestrial magnetism: declination, deviation and compass variations
 - magnetic poles, isogonals, relationship between true and magnetic
 - gridlines, isogrives

- Distance
 - units of distance and height used in navigation: nautical miles, statute miles, kilometers, metres, yards and feet
 - conversion from one unit to another
 - relationship between nautical miles and minutes of latitude

b) Magnetism and Compasses

- General principles
 - terrestrial magnetism
 - resolution of the earth's total magnetic force into vertical and horizontal components

- the effects of change of latitude on these components
- directive force
- magnetic dip
- variation

- Aircraft magnetism
 - hard iron and vertical soft iron
 - the resulting magnetic fields
 - the variation in directive force

- Change of deviation with change of latitude and with change in helicopter's heading
- turning and acceleration errors
- keeping magnetic materials clear of the compass

- knowledge of the principles, standby and landing or main compasses and remote reading compasses
 - detailed knowledge of the use of these compasses
 - serviceability tests
 - advantages and disadvantages of the remote indicating compasses
 - adjustment and compensation of direct reading magnetic compass

c) Charts

- General properties of miscellaneous type of projections
 - mercator
 - lambert conformal conic
 - polar stereographic
 - transverse mercator
 - oblique mercator

- The representation of meridians, parallels, great circles and rhumb lines
 - direct mercator
 - lambert conformal conic
 - polar stereographic

- The use of current aeronautical charts
 - plotting positions
 - methods of indicating scale and relief
 - conventional signs
 - measuring tracks and distances
 - plotting bearings

d) Dead Reckoning Navigation (DR)

- Basics of dead reckoning
- track
 - heading (compass, magnetic, true, grid)
 - wind velocity
 - airspeed (IAS, CAS, TAS, Mach number)
 - ground speed

- ETA
- drift, wind correction angle
- DR-position, fix

- Use of the navigational computer
 - speed
 - time
 - distance
 - fuel consumption
 - conversions
 - heading
 - airspeed
 - wind velocity

 - The triangle of velocities, methods of solution for the determination of
 - heading
 - ground speed
 - wind velocity
 - track and drift angle, track error
 - time and distance problems

- Determination of DR position
 - need for DR
 - confirmation of flight progress (mental DR)
 - lost procedures
 - heading and TAS vector since last confirmed position
 - application of wind velocity vector
 - last known track and ground speed vector
 - assessment of accuracy of DR position

- Measurement of DR elements
 - calculation of altitude, adjustments, corrections, errors
 - determination of temperature
 - determination of appropriate speed
 - determination of mach number

- Measurement of
 - maximum range
 - radius of action
 - point-of-safe-return and point-of-equal-time

 - Miscellaneous DR uncertainties and practical means of correction

e) In-flight Navigation

- Use of visual observations and application to in-flight navigation – magnetic influences within the helicopter

- Navigation in climb descent
 - average airspeed
 - average wind velocity
- ground speed/distance covered during climb or descent
- Navigation in cruising flight, use of fixes to revise navigation data as
 - ground speed revision
 - off-track corrections
 - calculation of wind speed and direction
- ETA revisions
- Flight log (including navigation records)
- Purposes of FMS (Flight Management Systems)

2. Mass and Balance

a) Introduction to Mass and Balance

- Centre of gravity (cg): Definition, importance in regard to aircraft stability (Helicopter); importance in regard to helicopter stability (cyclic stick – travel/limitations) (Helicopter)
- Mass and balance
- consult helicopter flight manual for: cg limits for take-off, landing, cruise configurations
- maximum floor load
- maximum ramp and taxi mass (Helicopter); maximum taxi mass (Helicopter)
- factors determining maximum permissible mass : structural limitations, performance limitations such as – runway available for take-off and landing, weather conditions (temperature, pressure, wind, precipitation); rate-of-climb and altitude requirements for obstacle clearance; engine-out performance requirements
- factors determining cg limits: helicopter stability, stability of flight controls and surfaces to overcome mass and lift pitching moments under all flight conditions
- changes in cg location during flight due to consumption of fuel, raising and lowering of undercarriage, and intentional relocation of passengers or cargo, transfer of fuel
- movement of centre of lift because of changes in position of hoist and external load operation (Helicopter)

b) Loading

- Terminology: empty mass, dry operating mass (empty mass + crew + operating items + unusable fuel), zero fuel mass, standard mass – crew, passengers and baggage, fuel, oil water (volume/mass conversion factors), carry-on luggage, useful load (traffic load + usable fuel)
 - Helicopter mass checks
 - procedure (in general terms, details not necessary)
 - requirements for re-weighing of aircraft
 - equipment lists
 - Procedures for determining helicopter mass and balance documentation; procedures for determining helicopter mass and balance documentation
 - determine dry operating mass (crew, equipment etc)
 - add mass of passengers and cargo (including passengers baggage (standard mass))
 - add mass of fuel
 - check that applicable maximum gross mass limits are not exceeded (mass within legal limits)

 - Effects of overloading: higher take-off and safety speeds, longer take-off and landing distances, lower rate-of-climb, influence on range and endurance (Helicopter), decreased engine-out performance, possible structural damage in extreme cases
- c) Centre of Gravity (cg)
- basic of cg calculations (load and balance documentation)
 - Datum – explanation of term, location, use in cg calculation
 - Moment arm – explanation of term, determination of algebraic signs, use
 - Moment – explanation, moment = mass x moment arm
 - Expression of distance from Datumline

 - Calculation of cg (Helicopter); Calculation of cg longitudinal and lateral (including computer calculations) (Helicopter)
 - Cg at empty mass
 - determined when helicopter is weighed;
 - recorded in helicopter documentation cg at Dry Operating Mass
 - movement of cg with addition of fuel, load and Ballast
 - practical methods of calculation

- computation method using either mathematical computations or specially designed slide rule
- graph method
- table method
- intentional relocation of passengers or cargo re remain within cg limits

3. Performance – Helicopters

a) Airworthiness – Requirements

- definitions of terms and speeds used in CARs

b) Definition of Terms

- masses
- velocities: V_{LE} , V_{LO} , V_X , V_Y , V_{toss} : (1) V_{NE} AND V_{mini}
- velocity of best range and maximum endurance
- power limitations AEO OEI
- altitudes
- performance class 1, 2, 3 operations
(see ICAO Annex 6 Part III and CARs)

c) Take-off – Cruise – Landing Performance

- Use and interpretation of diagrams and tables associated with CAT A, CAT B, procedures in order to select and develop class 1, 2, 3 performance profiles according to available heliport size and location (surface or elevated)

d) Performance of Helicopters

- applicability – Performance Class 1, 2 and 3
- General
 - helicopter mass
 - approved performance data in Helicopter Flight Manual
- Terminology

e) Performance Class 1

- General and Applicability
 - take-off from surface level heliports
 - take-off from elevated heliports/helidecks
 - critical power unit failure prior to TDP and after TDP
- Account of
 - take-off mass
 - pressure altitude
 - ambient temperature
 - take-off technique
 - head-wind component

- tail-wind component

- Take-off flight path
 - critical power unit inoperative take-off flight path
 - obstacle vertical and lateral margins and change of direction clearance margins

- En-route critical power unit inoperative
 - en-route flight path
 - out of sight of the surface
 - areas of mountainous terrain
 - visual meteorological conditions and, insight of surface
 - flight path altitudes
 - effects of winds on the flight path
 - fuel jettisons
 - width margins flight path reductions

- Landing: to surface level heliports; to elevated heliports/helidecks; with critical power failure prior LDP and after LDP
 - Account of:
 - landing mass
 - pressure altitude
 - ambient temperature
 - take-off technique
 - head-wind component
 - tail-wind component

f) Performance Class 2

- General and Applicability
- Take-off
 - surface level heliports
 - elevated heliports/helidecks
 - take-off flight path
 - critical power unit failure prior and/or after DPATO

- En-route – critical power unit inoperative

- Landing
 - critical power unit failure prior to/or after DPBL
- Landing mass
 - surface level heliports
 - elevated heliports and helidecks

g) Performance Class 3

- General applicability helicopter certified in either Category A or B
- operation conducted only from aerodromes
 - heliports and route areas and diversions that permit a safe forced landing in the event of a power unit failure
 - Operations – ceiling and visibility limits

- over-water in a hostile environment limits
- Operations with exposure time

- Take-off
- En-route
- Landing

4. Flight Planning and Monitoring – Helicopters

a) Flight Plans for Cross Country Flights

-Navigation Plan

- selection of routes, speeds, heights (altitudes) and alternate airfield/landing sites
 - terrain and obstacle clearance
 - cruising levels appropriate for direction of flight
 - navigation check points, visual or radio
- measurement of tracks and distances
- obtaining wind velocity forecast for each leg
- computations of headings, ground speeds, and time en-route from tracks, true airspeed and wind velocities
- completion of pre-flight portion of navigation flight log

- Fuel Plan

- computation of planned fuel usage for each leg and total fuel usage for the flight
 - flight manual figures for fuel flow during climb, en-route and during descent
 - navigation plan for times en-route
- fuel for holding and diversion to alternate airfield
- reserves
- total fuel requirements for flight
- completion of pre-flight portion of fuel log
- Flight monitoring and in-flight re-planning
 - in-flight fuel computations
 - recording of fuel quantities remaining at navigational checkpoints
- calculation of actual consumption rate
 - comparison of actual and planned fuel consumption and fuel state
- Revision of fuel reserve estimates

- in-flight re-planning in case of problems
 - selection of cruise altitude and power settings for new destination

- time to new destination
- fuel state, fuel requirements, fuel reserves
- Radio communication and navigation aids
 - communication frequencies and call signs for appropriate control agencies and in-flight service facilities such as weather stations
 - radio navigation and approach aids, if appropriate
 - type
 - frequencies
 - identification

b) ICAO ATC Flight Plan

- types of flight plan
- ICAO flight plan – format
 - information included in completed plan
 - repetitive flight plan
- completing the flight plan
 - information for flight plan obtained from
 - navigation flight plan
 - fuel plan
 - operator's records for basic helicopter information
 - mass and balance records
- Filling the flight plan
- procedures for filing
 - agency responsible for processing the flight plan
 - requirements of the State concerning when a flight plan must be filed
- Closing the flight plan
 - responsibilities and procedures
 - processing agency
 - check slot time
- Adherence to flight plan
 - tolerances allowed by the State for various types of flight plans
 - in-flight amendment of flight plan
 - conditions under which a flight plan must be amended
 - pilot's responsibilities and procedures for filing an amendment
 - agency to which amendments are submitted

c) Practical Flight Planning -

- Chart preparation

- Plot tracks and measure directions and distances
- Navigation plans
 - Completing the navigation plan using:
 - tracks and distances from prepared charts
 - wind velocities as provided
 - true airspeeds as appropriate
- Simple fuel plans
 - Preparation of fuel logs showing planned values for:
 - fuel used on each leg
 - fuel remaining at the end of each leg
 - endurance, based on fuel remaining and planned consumption rate, at end of each leg
- Radio planning practice
 - Communications
 - frequencies and call signs of air traffic control agencies and facilities and for in-flight services such as weather information
- Navigation aids
 - frequencies and identifiers of en-route terminal facilities, if appropriate

d) Practical Completion of a 'Flight Plan' (flight plan, flight log, nav log ATC plan, etc.)

- Extraction of data
 - extraction of navigational data
 - extraction of meteorological data
 - extraction of performance data
 - completion of navigation flight plan
 - completion of fuel plan
 - time and fuel to top-of-climb
 - cruise sector times and fuel used
 - total time and fuel required to destination
 - fuel required for missed approach, climb en-route altitude, and cruise alternate
- reserve fuel
 - Computation of PET (point-of-equal-time), including equi-fuel and equi-time points, and PSR (point-of-safe-return)
 - Completion of air traffic flight plan

e) Offshore or Remote Area Operation

- Additional flight planning aspects for offshore or remote area operation
- Fuel planning
 - en-route contingency fuel
 - destination holding and diversion fuel
 - destination onshore reserve

- use of performance chart to plan fuel usage of and requirements based on planned climb en-route cruise and descent
- reserve fuel requirements
- one engine inoperative considerations
 - Computation of point-of-equal-time (PET) and point-of-safe-return (PSR)
- Computerized Flight Planning
- General principles of present systems
- advantages
- shortcomings and limitations

5. Radio Navigation

a) Radio Aids

- Ground D/F (including classification of bearings)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- ADF (including associated beacons and use of the radio magnetic indicator)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- VOR and Doppler – VOR (including the use of the radio magnetic indicator)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- DME (distance measuring equipment)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy

b) Basic Radar Principles

- Pulse techniques and associated terms – latitude and longitude
- Ground radar

- principles
- presentation and interpretation
- coverage
- range
- errors and accuracy
- factors affecting range and accuracy

- SSR secondary surveillance radar and transponder
- principles
- presentation and interpretation
- modes and codes, including mode S

- Use of radar observations and application to in-flight navigation

c) Area Navigation Systems

- Flight director and autopilot coupling

d) Self-contained and External-Referenced Navigation Systems

- Loran – C
- principle of operation

- Decca navigation system
- principle of operation

- Satellite assisted navigation: GPS / GLONASS/DGPS
- principle of operation
- advantages and disadvantages

6 Instrumentation – Helicopters

6.1 Flight Instruments

- a) Air data instruments
- pitot and static system
 - pitot tube, construction and principles of operation
 - static source
 - malfunction
 - heating
 - alternate static source

 - Altimeter
 - construction and principles of operation
 - display and setting
 - errors
 - correction tables
 - tolerances

 - Airspeed indicator
 - construction and principles of operation
 - speed indications (IAS)
 - meaning of coloured sectors
 - maximum speed indicator, V_{mo}, M_{mo} pointer

- errors

- Vertical Speed Indicator (VSI)
 - aneroid and instantaneous VSI (IVSI)
 - construction and principles of operation
 - display

b) Gyroscopic instruments

- Gyro fundamentals
 - theory of gyroscopic forces (stability, precession)
 - types, and principles of operation:
 - vertical gyro
 - directional gyro
 - rate gyro
 - rate integrating gyro
 - single degree-of-freedom gyro / tied gyro
 - ring laser gyro
 - apparent drift
 - random drift
 - mountings
 - drive types, monitoring

- Directional gyro
 - construction and principles of operation
 - Slaved gyro compass
 - construction and principles of operation
 - components
 - mounting and modes of operation
 - turn and acceleration errors
 - application, uses of output data

- Attitude indicator (vertical gyro)
 - construction and principles of operation
 - display types
 - turn and acceleration errors
 - application, uses of output data

- Turn and bank indicator (rate gyro)
 - construction and principles of operation
 - display types
 - application errors
 - application, uses of output data
 - turn coordinator

- Gyro stabilized platform (gimbaled platform)
 - types in use
 - accelerometer, measurement system
 - construction and principles of operation
 - platform alignment
 - applications, uses of output data

- Fixed installations (strap down systems)

- construction and principles of operation
- types in use
- input signals
- application, uses of output data

- c) Magnetic Compass
 - construction and principles of operation
 - errors (deviation, effect of inclination)
- d) Radio Altimeter
 - components
 - frequency band
 - principle of operation
 - displays
 - errors
- e) Electronic Flight Instrument System (EFIS)
 - information display types
 - data input
 - control panel, display unit
 - example of typical aircraft installation
- f) Flight Management System (FMS)
 - general principles
 - inputs and outputs of data

6.2 Automatic Flight Control Systems

- a) Flight Director
 - function and application
 - block diagram, components
 - mode of operation
 - operation set-up for various flight phases
 - command modes (bars)
 - mode indicator
 - system monitoring
 - limitations, operational restrictions
- b) Autopilot
 - autoland, sequence of operation
 - system concepts for autoland, go around, take-off, fail passive, fail operational (redundant)
- c) Flight envelope protection
 - function
 - input, signals
 - output data, signals
 - system monitoring
- d) Yaw Damper / Stability augmentation system
 - function
 - block diagram, components
 - signal interfacing to vertical stabilizer

6.3 Warning and Recording Equipment

- a) Warnings general
 - classification of warning
 - display, indicator systems
- b) Altitude alert system
 - function
 - block diagram, components
 - operation and system monitoring
- c) Ground Proximity Warning System (GPWS)
 - function
 - block diagram, components
 - input data, signals
 - warning modes
 - system integrity test
- d) Traffic Collision Avoidance System (TCAS)
 - function
 - warning modes
- e) Flight Data Recorder
 - Function
 - block diagram, components
 - operation
 - system monitoring
- f) Cockpit Voice Recorder
 - Function
 - block diagram, components
 - operation
- g) Rotors and engine over/under speed warning
 - function
 - input data, signals
 - display, indicators
 - function test
 - effects on operation in case of failure

6.4 Powerplant and System Monitoring Instruments

- Pressure Gauge
 - sensors
 - pressure indicators
 - meaning of coloured sectors
- Temperature Gauge
 - ram rise, recover factor
- RPM Indicator
 - interfacing of signal pick-up to RPM gauge
 - RPM indicators, piston and turbine engines
 - meaning of coloured sectors

- Consumption Gauge
 - high pressure line fuel flowmeter (function, indications, failure warnings)

- Fuel Gauge
 - measurement of volume/mass, units
 - measuring sensors
 - content, quantity indicators
 - reasons for incorrect indications

- Torque Meter
 - indicators, units
 - meaning of coloured sectors

- Flight Hour Meter
 - drive source
 - indicators

- Remote (signal) transmission system
 - mechanical

- Electronic Displays
 - EFIS
 - EICAS
 - ECAM

- Chip detection
 - indicators
 - principles

APPENDIX C-2

AVIATION METEOROLOGY

THE SYLLABUS OF AVIATION METEOROLOGY IS AS FOLLOWS :

1. **Meteorology**

1.1 **The Atmosphere**

b) Composition, extent, vertical division : composition, extent, vertical division

c) Temperature

- vertical distribution of temperature
- transfer of heat : solar and terrestrial radiation, conduction, convection, advection and turbulence
- lapse rate, stability and instability
- development of inversions, types of inversions
- temperature near the earth's surface, surface effects, diurnal variation, effect of clouds, effect of wind

d) Atmospheric pressure

- barometric pressure, isobars
- pressure variation with height, contours (isohypses)
- reduction of pressure to mean sea level, QFF
- surface low/upper-air low, surface high/upper-air high-precipitation

e) Atmospheric density : interrelationship of pressure, temperature and density

f) International Standard Atmosphere (ISA)

g) Altimetry

- pressure altitude, true altitude
- height, altitude, flight level
- altimeter settings: QNH, QFE, 1013.25 hPa
- effect of accelerated airflow due to topography

1.2 **Wind**

a) Definition and measurement

b) Primary cause of wind

- primary cause of wind, pressure gradient, coriolis force, gradient wind

- relationship between isobars and wind
- effects of convergence and divergence

- c) General circulation
 - general circulation around the globe

- d) Turbulence
 - Turbulence and gustiness, types of turbulence
 - origin and location of turbulence

- e) Variation of wind with height
 - variation of wind in the friction layer
 - variation of the wind caused by fronts

- f) Local winds: Anabatic and katabatic winds, land and sea breezes, Venturi effects

- g) standing waves

- h) origin of standing waves

1.3 Thermodynamics

- a) Humidity
 - water vapour in the atmosphere
 - temperature/dew point, mixing ratio, relative humidity

- b) Change of state of aggregation
 - condensation, evaporation, sublimation, freezing and melting, latent heat

- c) Adiabatic processes

1.4 Clouds and Fog

- a) Clouds formation and description
 - cooling by adiabatic expansion and by advection
 - cloud types, cloud classification
 - influence of inversions on cloud development

- b) Fog, mist, haze
 - radiation fog
 - advection fog
 - steaming fog

- frontal fog
- orographic fog

1.5 Precipitation

- a) Development of precipitation
 - development of precipitation
 - types of precipitation
 - type of precipitation, relationship with cloud types

1.6 Airmasses and Fronts

- a) Types of airmasses
 - description, factors, affecting the properties of an airmass
 - classification of airmasses, modifications of airmasses, areas of origin

- b) Fronts
 - boundaries between airmasses (fronts), general situation, geographic differentiation

 - warm front, associated clouds and weather
 - cold front, associated clouds and weather
 - Warm sector, associated clouds and weather
 - weather behind the cold front
 - occlusions, associated clouds and weather
 - stationary front, associated clouds and weather
 - movement of fronts and pressure systems, life cycle

1.7 Pressure Systems

- a) Location of the principal pressure areas

- b) Anticyclone: Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence

- c) Non frontal depressions
 - thermal, orographic – and secondary depressions, cold air pools, trough

- d) Tropical revolving storms
 - development of tropical revolving storms
 - origin and local names, location and period of occurrence

1.8 Climatology

- a) Climatic Zones

- General seasonal circulation in the troposphere and lower stratosphere
- tropical rain climate, dry climate, mid-latitude climate, subarctical climate with cold winter, snow climate

b) Tropical Climatology

- cause and development of tropical showers : humidity, temperature, tropopause
- seasonal variations of weather and wind, typical synoptic situations
- intertropical convergence zone (ITCZ), weather in the ITCZ, general seasonal movement
- climatic elements relative to the area (monsoon, tradewinds, sandstorms, cold air outbreaks)
- easterly waves

c) Typical weather situations in mid-latitudes

- westerly waves
- high pressure area
- uniform pressure pattern
- cold pool

e) Local seasonal weather and wind

- local seasonal weather and wind
- Fohn, Mistral, Bora, Scirocco
- Khamsin, Harmattan, Ghibbli and Pampero

1.9 Flight Hazards

a) Icing

- weather conditions for ice accretion, topographical effects
- types of ice accretion
- hazards of ice accretion, avoidance

b) Turbulence

- effects on flight, avoidance
- CAT : effects on flight

c) Windshear

- definition of windshear
- weather conditions for windshear

-effects on flight

d) Thunderstorms

- structure of thunderstorms, squall lines, life history, storm cells, electricity in the atmosphere, static charges
- conditions for and process of development, forecast, location, type specification
- Thunderstorm avoidance, ground/airborne radar, storm scope
- development and effect of down bursts
- development of lightning discharge and effect of lightning strike on aircraft and flight execution

e) Tornados

-occurrence

f) Low and high level inversions: Influence on helicopter performance

g) Stratopheric conditions

- tropopause influence on helicopter performance

h) Hazards in mountainous areas

- influence of terrain on clouds and precipitation, frontal passage
- vertical movements, mountain waves, windshear, turbulence, ice accretion
- development and effect of valley inversions

i) Visibility reducing phenomena

- reduction of visibility caused by mist, smoke, dust, sand and precipitation
- reduction of visibility caused by low drifting and blowing snow
- micro meteorology

1.10. Meteorological Information

a) Observation

- on the ground – surface wind, visibility and runway visual range, transmissometers; Clouds – type, amount, height of base and tops, movement; Weather – including all types of precipitation, air temperature, relative humidity, dew point, atmospheric pressure
- upper air observations
- satellite observations, interpretation
- weather radar observations ground and airborne, interpretation
- aircraft observations and reporting, data link systems, PIREPS
-
- b) Weather Charts
 - significant weather charts
 - surface charts
 - upper air charts
 - symbols and signs on analysed and prognostic charts
- c) Information for Flight Planning
 - aeronautical codes: METAR, TAF, SPECI, SIGMET, SNOWTAM, runway report
 - meteorological broadcasts for aviation: VOLMET, ATIS, HFVOLMET, ACARS
 - content and use of pre-flight meteorological documents
 - meteorological briefing and advice
 - measuring and warning systems for low level windshear, inversion
 - special meteorological warnings
 - information for computer flight planning

APPENDIX C-3

AIR REGULATION

THE SYLLABUS OF AIR REGULATION IS AS FOLLOWS:

1. Air Law

1.1 International Agreements and Organizations

- a) The Convention of Chicago
- b) Air Navigation
 - General principles and application: sovereignty, territory
 - Flight over territory of Contracting states: right of non-scheduled flight, scheduled air services, sabotage, landing at customs airports, applicability of air regulations, rules of the air, search of aircraft.
 - Measures to facilitate air navigation: customs duty, conditions to be fulfilled with respect to helicopter: certificates of airworthiness, licences of personnel, recognition of certificates and licences, cargo restriction, photographic apparatus: documents to be carried in aircraft.
 - International standards and recommended practices: adoption of international standards and procedures, endorsement of certificates and licenses, validity of endorsed certificates and licenses: departure from international standards and procedures (notification of differences)
- c) The International Civil Aviation Organization
 - objective and composition
 - regional structure and offices
 - duties in relation to – annexes to the convention, standards and recommended practices, procedures for air navigation services, regional supplementary procedures, regional air navigation, manuals and circulars
- d) Other International Agreements
 - The International Air Transport Agreement – the five freedoms
 - The Convention of Tokyo, La Haye, Montreal – Jurisdiction, authority of pilot-in-command of the aircraft
 - DGCA India: Organization and Structure – Indian organizations name, composition, objectives and relevant documents (Aircraft Act 1934, Indian Aircraft Rules 1937)
 - Indian Civil Aviation Conference
 - Including Civil Aviation Requirements
 - Warsaw Convention
- e) PIC authority and responsibility regarding safety and security
- f) Operators and pilots liabilities towards persons and goods on the ground, in case of damage and injury caused by the operations of the aircraft
- g) Commercial practices and associated rules (leasing)

- dry lease
- wet lease

1.2 Annex 8 – Airworthiness of Aircraft

- applicability

1.3 Annex 7 – Aircraft Nationality and Registration Marks

- applicability

1.4 Annex 1 – Personnel Licensing

- applicability
- relation between Annex 1 and CAR

1.5 Rules of the Air (Based on Annex 2)

- Annex 2: essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight flights, instrument flight rules, signals, interception of civil aircraft, table of cruising levels

1.6 Procedures for Air Navigation – Aircraft Operations Doc. 8168-Ops/611, Volume 1

- a) Foreword – introduction
- b) Definitions and abbreviations (see general statements)
- c) Departure procedures – general criteria, standard instrument departures, omnidirectional departures, published information, simultaneous operations on parallel or near-parallel instrument runways, area navigation (RNAV) departure procedures based on VOR/DME, use of FMS/RNAV equipment to follow conventional departure procedures
- d) Approach procedures
 - general criteria (except tables)
 - approach procedures design : instrument approach areas, accuracy of fixes (only intersection fix tolerance factors, other fix tolerance factors, accuracy of facility providing track, approach area splays, descent gradient)
 - arrival and approach segments : general, standard instrument arrival, initial approach segment (only general), intermediate approach segment, final approach segment (except tables), missed approach segment (only general)
 - visual manoeuvring (circling) in the vicinity of the aerodrome: general, the visual manoeuvring (circling) area (except table), visual manoeuvring (circling) area not considered for obstacle clearance (except table), minimum descent altitude/height, visual flight manoeuvre, missed approach whilst circling.
 - Simultaneous ILS operations on parallel or near-parallel runways
 - Area navigation (RNAV) approach procedures based on VOR/DME
 - Use of FMS/RNAV equipment to follow conventional non-precision approach procedures

- e) Holding procedures
 - in-flight procedures (except table), entry, holding
 - obstacle clearance (except table)
- f) Altimeter setting procedures (including ICAO Doc. 7030-Regional Supplementary Procedures) – basic requirements (except tables), procedures
- g) Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – Regional Supplementary Procedures)
 - operation of transponders
 - operation of ACAS equipment
 - phraseology

1.7 Air Traffic Services (based on Annex 11 and Doc. 4444)

- 1. Air Traffic Services – Annex 11 : Definitions (see general statements)
- 2. General
 - objectives of ATS, divisions of ATS, designation of the portions of the airspace and controlled aerodromes where ATS will be provided, classification of airspaces (appendix 4 of Annex 11), required navigation performance (RNP), establishment and designation of the units providing ATS, specifications for flight information regions, control areas and control zones, minimum flight altitudes, priority in the event of an aircraft in emergency, in-flight contingencies, time in ATS
- 3. Air Traffic Control
 - application
 - provision of air traffic control service, operations of air traffic control service, separation minima, contents of clearances, co-ordination of clearances, control of persons and vehicles at aerodromes
- 4. Flight Information Service
 - application
 - scope of flight information service
 - operational flight information service broadcasts
- 5) Alerting Service: application, notification of rescue co-ordination centres (only INCERFA, ALERFA, DETRESFA), information to aircraft operating in the vicinity of an aircraft in a state of emergency

- 6) Principles governing the identification of RNP types and the identification of ATS routes other than standard departure and arrival routes (Appendix 1)

- 7) Rules of the Air and Air Traffic Services (ICAO Doc. 4444 – RAC/501/11 and ICAO Doc. 7030 – Regional Supplementary Procedures)
 - definitions (See general statements)
 - relationship to other document

8. General provisions
 - general air traffic services operating practices: submission of a flight plan, change from IFR to VFR flight, clearances and information, control of air traffic flow, altimeter setting procedures, indication of heavy wake turbulence category and MLS capacity, position reporting, air traffic incident report, procedures in regard to aircraft equipped with airborne collision avoidance systems (ACAS)

 - Appendix 1

9. Area Control Service
 - general provisions for the separation of control traffic
 - vertical separation : vertical separation application, vertical separation minimum, minimum cruising level, assignment of cruising level, vertical separation during ascent or descent
 - horizontal separation: lateral separation application, lateral separation application, longitudinal separation application (except between supersonic aircraft)
 - reduction in separation minima
 - air traffic control clearances: contents, description of air traffic control clearances, clearance to fly maintaining own separations while in visual meteorological conditions, essential traffic information, clearance of a requested change in flight plan
 - emergency and communication failure: emergency procedures (only general priority, emergency descent, action by pilot-in-command), air-ground communication failure (only concerning the actions by pilot-in-command), interception of civil aircraft

10. Approach Control Service

- departing aircraft: general procedures for departing aircraft, clearances for departing aircraft to climb maintaining own separation while in visual meteorological conditions, information for departing aircraft
- arriving aircraft: general procedures for arriving aircraft, clearance to descend subject to maintaining own separation in visual meteorological conditions, visual approach, instrument approach, holding, approach sequence, expected approach time, information for arriving aircraft

11. Aerodrome Control Service

- functions of aerodrome control towers: general, alerting service provided by aerodrome control towers, suspension of VFR operations by aerodrome control towers
- traffic and taxi circuits: selection of runway-in-use
- information to aircraft by aerodrome control towers: information related to the operation of the aircraft, information on aerodrome conditions
- control of aerodrome traffic: order of priority for arriving and departing aircraft, control of departing and arriving aircraft, wake turbulence categorization of aircraft and increased longitudinal separation minima, authorization of special VFR flights

12. Flight Information Service and Alerting Service

- Flight information service
- Alerting service

13. Use of radar in Air Traffic Services

- general provisions: limitations in the use of radar, identification procedures (only establishment of radar identity), position information, radar vectoring
- use of radar in the air traffic control service

1.8 Aeronautical Information Service (based on Annex 15 and AIP, India)

- essential definitions
- applicability

1.9 (Based on Annex 14, Vol 1 & 2)

- a) Annex 14
 - definitions
 - aerodrome data
 - conditions of the movement area and related facilities

- b) Visual aids for navigation
 - indicators and signaling devices
 - markings
 - lights
 - signs
 - markers

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

- d) Visual aids for denoting restricted use of areas
- e) Emergency and other services : rescue and fire fighting, apron management service, ground servicing of aircraft
- f) Attachment A to Annex 14
 - calculation of declared distances
 - radio altimeter operating areas
 - approach lighting systems

1.10 Facilitation (based on Annex 9)

- definitions
- entry and departure of aircraft – description, purpose and use of aircraft documents general declaration
- entry and departure of persons and their baggage – entry requirement and procedures crew and other operator's personnel

1.11 Search and Rescue (based on Annex 12)

- a) Annex 12 – definitions
- b) Organization

- establishment and provision of SAR service
- establishment of SAR regions
- establishment and designation of SAR services units

c) Co-operation

- co-operation between States
- co-operation with other services

t) Operating procedures

- procedures for pilots-in-command at the scene of an accident
- procedures for pilot-in-command intercepting a distress transmission
- search and rescue signals

e) Search and Rescue Signals

- signals with surface craft
- ground/air visual signal code
- air/ground signals

1.12 Security (based on Annex 17)

- a) General – aims and objectives
- b) Organization – co-operations and co-ordination
- c) Operators: operators security programme

1.13 Aircraft Accident Investigation (based on Annex 13)

- a) Annex 13 – definitions, applicability

1.14 CARs

1.15 National Law – National Law and differences to relevant ICAO Annexes and CARs

Indian aircraft act 1934-section 1,2,8,10,11A,11B, 17&18(3/9)

Aircraft Rule 1937- Rule No. 1-19,21-29A.30,33,37A,38-48,50,52,53,55,65,67,67A,67B,68-70,76,79-89,133A,134,140, 140(AB&C)15&161

Schedule I, II, VI, & XI

INDAIN AIRCRAFT RULES 1920-RULE NO 53-64

AIRCRAFT RULES 1954 (Public Health Rules)

AIRCRAFT RULES 2003 (Carriage of Dangerous Goods)

2. Human Performance & Limitations

2.1 Human Factors : Basic Concepts

- a) Human Factors in aviation
 - competence and limitations
 - becoming a competent pilot – the traditional approach towards 'proficiency', the human factors approach towards 'professionalism'
- b) Accident statistics
- c) Flight Safety concepts

2.2 Basic Aviation Physiology and Health Maintenance

- a) Basics of flight physiology
 - the atmosphere : composition, gas laws, oxygen requirements of tissues
 - Respiratory and circulatory systems: pressurization, decompression, rapid decompression, entrapped gases, barotraumas, counter measures, hypoxia, symptoms, time of useful consciousness, hyperventilation, accelerations
- b) Man an Environment the sensory system
 - Central and peripheral nervous system
 - sensory threshold, sensitivity, adaptation
 - habituation
 - reflexes and biological control systems
 - Vision
 - functional anatomy
 - visual field, foveal and peripheral vision
 - binocular and monocular vision
 - monocular vision cues
 - night vision motion sickness
 - Hearing
 - functional anatomy
 - flight related hazards to hearing
 - Equilibrium
 - functional anatomy
 - flight related hazards to hearing

- integration of sensory inputs : spatial disorientation, illusions, physical origin, physiological origin, psychological origin, approach and landing problems

Health and Hygiene

- personal hygiene
- common minor ailments: cold, influenza, gastro-intestinal upset
- problem areas for pilots : hearing loss, defective vision, hypotension, hypertension, coronaric disease, obesity, nutrition hygiene, tropical climates – epidemic diseases
- intoxication: tobacco, alcohol, drugs and self-medication, various toxic materials
- incapacitation : symptoms and causes, recognition

2.3 Basic Aviation Psychology

a) Human information processing

- attention and vigilance: selectivity of attention, divided attention
- perception: perceptual illusions, subjectivity of perception, 'bottom-up' / 'top-down' processing
- memory : sensory memory, working memory, long term memory, motor memory (skills)
- Response selection: learning principles and techniques, drives, motivation and performance

b) Human error and reliability

- reliability of human behaviour
- hypotheses on reality
- similarity, frequency
- completion causality

- theory and model of human error
- error generation
- internal factors (cognitive styles)
- external factors
 - ergonomics
 - economics
- social environment (group, organization)

c) Decision making

- decision-making concepts: structure (phases), limits, risk assessment, practical application

d) Avoiding and managing errors : Cockpit Management

- safety awareness
- risk area awareness

- identification of error proneness (oneself)
- identification of error sources (others)
- situational awareness stress

- Communication
 - communication model(s)
 - verbal and non-verbal communication
 - communication barriers
 - conflict management

- e) Personality
 - Personality and attitudes : development, environmental influences
 - individual differences in personality: self-concepts (e.g. , action vs. state-orientation)
 - identification of hazardous attitudes (error proneness)

- f) Human overload and under load
 - arousal
 - stress: definitions, anxiety and stress, effects of stress
 - fatigue: types, causes, symptoms, effects of fatigue
 - body rhythm and sleep: rhythm disturbances, symptoms, effects, management
 - fatigue and stress management: coping strategies, management techniques, health and fitness programmes, relaxation techniques, religious practices, counseling techniques

- g) Advanced cockpit automation
 - advantages and disadvantages (criticalities)
 - automation complacency
 - working concepts

3. Operational Procedures

3.1 Operational Procedures – Special and Emergency Procedures

General:

- a) ICAO Annex 6, Parts I, II and III (as applicable)
 - definitions
 - applicability
 - general framework and contents

- b) CAR-OPS – Requirements
 - General requirements about
 - quality system
 - additional crew members
 - methods of carriage of persons

- admission of flight deck
- unauthorized carriage
- portable electronic devices
- endangering safety
- additional information and forms to be carried
- information retained on ground
- power to inspect
- production of documentation and records
- preservation of documentation
- leasing

- Operator certification and supervision requirements
 - general rules for Air Operator Certification
 - issue
 - variation and continued validity of an AOC
 - administrative requirements

- Operational Procedures requirements
 - operational control and supervision
 - use of Air Traffic Services
 - instrument departure and approach procedures
 - carriage of person with reduced mobility
 - carriage of inadmissible passengers, deportees, or persons in custody
 - stowage of baggage and cargo
 - passengers seating
 - security of passenger cabin and galley(s)
 - smoking on board
 - take-off conditions
 - application of take-off minimas

- All-weather Operations requirements: Low Visibility
 - Aerodrome Operating Minimas – General
 - Terminology
 - Low Visibility Operations – General operating rules
 - Low Visibility Operations – Aerodrome considerations
 - Low Visibility Operations – Training and qualifications
 - Low Visibility Operations – Operating procedures
 - Low Visibility Operations – Minimum equipment

- Instrument and safety equipment requirements
 - general introduction
 - circuit protection devices
 - windshield wipers
 - airborne weather radar equipment
 - flight crew interphone system
 - public address system
 - internal doors and curtains
 - first aid kits
 - emergency medical kit
 - first air oxygen
 - supplemental oxygen – pressurized aeroplanes
- supplemental oxygen – non-pressurized aeroplanes

- crew protective breathing equipment
- hand fire extinguishers
- crash axes and crowbars
- marking of break-in points
- means for emergency evacuation
- megaphones
- emergency lightings
- automatic emergency locator transmitter
- life jackets
- life rafts and survival ELTs for extended over-water flights
- survival equipment

- Communication and navigation equipment requirements
 - radio equipment VFR
 - communication and navigation IFR and VFR

- Aircraft maintenance
 - terminology
 - application for and approval of the operator's maintenance system
 - maintenance management
 - quality system
 - operator's maintenance management exposition
 - operator's aircraft maintenance program
 - continued validity of the Air Operator's Certificate in respect of maintenance system

- Flight crew
- flight and duty time limitations and rest requirements (Reserved)
- cabin crew

- c) Special Operational Procedures and Hazards (General Aspects)
 - Minimum equipment list
 - AFM

 - Ground de-icing
 - icing conditions
 - definition and recognition, on ground/in-flight
 - de-icing, anti-icing, types of de-icing fluids
 - performance deterioration, on ground/in-flight

 - Bird strike risk and avoidance

 - Noise abatement
 - influence by the pilot (power setting, low drag, low power)

 - Fire/smoke

- actions in case of overheated brakes after aborted take-off and landing

- Windshear, microburst
 - definition and description
 - effects and recognition during departure and approach
 - actions to avoid and actions taken during encounter

- Wake turbulence
 - cause
 - influence of speed and mass, wind
 - actions taken when crossing traffic, during take-off and landing

- Security
 - unlawful events
 - Emergency and precautionary landings operations in various terrain – water (i.e. slopes, mountains, jungle, offshore)
 - definition
 - cause
 - factors to be considered (wind terrain, preparation, flight tactics, landing in various terrain and water)
 - passenger information
 - evacuation
 - action after landing

- Fuel jettisoning
 - safety aspects
 - legal aspects

- Transport of dangerous goods
 - Annex 18
 - practical aspects

- Contaminated runways
 - kinds of contamination
 - braking action, brake co-efficient
 - performance correction and calculations

- Rotor Downwash

- operation
influence by meteorological conditions i.e. : icing, white out, strong winds,
windshear, microburst, downwash

d) Emergency Procedures

Influenced by technical problems i.e.

- engine failure
- fire in cabin cockpit engine
- tail/rotor/directional control failure
- ground/resonance
- blade/stall
- setting with power (vortex ring)
- overpitch
- over speed
- sudden stoppage
- dynamic rollover/mast bumping

3.2 Communications

3.2.1 VFR Communications

a) Definitions

- Meaning and signification of associated terms
- Air Traffic Services abbreviations
- Q-code groups commonly used in RTF air-ground communications
- Categories of messages

b) General Operating Procedures

- Transmission of letters
- Transmission of numbers (including level information)
- Transmission of time
- Transmission of technique
- Standard work and phrases (relevant RTF phraseology included)
- Radiotelephony call signs for aeronautical stations including use of abbreviated call signs
- Radiotelephone call signs for aircraft including use of abbreviated call signs
- Transfer of communication
- Test procedures including readability scale
- Read back and acknowledgement requirements
- Radar procedural phraseology

c) Relevant Weather information terms (VFR)

- Aerodrome weather
- Weather broadcast

d) Action required to be taken in case of communication failure

- e) Distress and urgency procedures
 - Distress (definition – frequencies – watch of distress frequencies – distress signal – distress message)
 - Urgency (definition – frequencies – urgency signal – urgency message)
- f) General Principles of VHF Propagation and Allocation of Frequencies

3.2.2 IFR Communications

- a) Definitions
 - Meaning and significance of associated terms
 - Air Traffic Control abbreviations
 - Q-code groups commonly used in RTF air-ground communications
- b) General Operating Procedures
 - Transmission of letters
 - Transmission of numbers (including level information)
 - Transmission of time
 - Transmission of technique
 - Standard words and phrases (relevant RTF phraseology included)
 - Radiotelephony call signs for aeronautical stations including use of abbreviated call signs
 - Radiotelephone call signs for aircraft including use of abbreviated call signs
 - Transfer of communication
 - Test procedures including readability scale; establishment of RTF communications
 - Read back and acknowledgement requirements
 - Radar procedural phraseology
 - Level changes and reports categories of messages
- c) Action required to be taken in case of communication failure
- d) Distress and Urgency Procedures
 - PAN medical
 - Distress (definition – frequencies – watch of distress frequencies – distress signal – distress message)
 - Urgency (definition – frequencies – urgency signal – urgency message)
- e) Relevant Weather Information Terms (IFR)

- Aerodrome weather
- Weather broadcast

- f) General Principles of VFH propagation and allocation of frequencies
- g) Morse Code

3.2.3. Radio Telephony

- a) radiotelephony procedures (1 hr):
- b) phraseology as applied to VFR operations (1 hr);
- c) action to be taken in case of communication failure(1 hr).

APPENDIX C-4

HELICOPTER & ENGINE - TECHNICAL GENERAL

The syllabus of Helicopter & Engine – Technical General is as follows :

1. Helicopter General Knowledge

1.1 Airframe and Systems – Helicopter

- a) Helicopter configurations
 - single rotor
 - tandem rotor
 - coaxial rotor
 - side by side rotor

- b) Controls and rotors
 - Control systems
 - types
 - components
 - adjustments
 - primary controls (cyclic, collective, directional)

 - Rotorheads
 - types
 - components
 - material

 - Tailrotors/ Notor
 - types
 - components
 - material

 - Blades
 - types
 - section
 - construction
 - material
 - adjustment

 - Control surfaces
 - vertical horizontal
 - construction
 - material

- c) Fuselage
 - types of construction
 - structural components, materials, limitations

- d) Cockpit and Cabin
 - construction
 - structural limitations

- e) Landing Gear
 - types e.g. floats, skids, wheels, etc.
 - construction

- locking devices and emergency extension systems
- accidental retraction prevention devices
 - position, movement lights and indicators
 - braking systems
 - construction
 - parking brake
 - operation, indications and warning systems

- f) Transmission systems
 - Drive shafts
 - types
 - components
 - material

 - Gearboxes
 - types
 - construction
 - material
 - lubrication
 - indications

 - Clutches
 - types
 - components

 - Free wheeling
 - types
 - components

- g) Rotorbrake
 - components
 - construction

- h) Inspection
 - vibration
 - balancing
 - tracking

- i) Hydraulics
 - Basics principles of hydromechanics
 - hydraulic fluids
 - schematic construction and functioning of hydraulic systems

 - Hydraulic systems
 - main, standby and emergency system
 - operation, indicators, warning system
 - ancillary system
 - auxiliary systems

- j) Air driven systems
 - Pneumatic system
 - power sources
 - schematic construction

- potential failures, safety devices
- operation, indicators, warning systems
- pneumatic operated systems

- Air conditioning systems
 - construction, functioning, operation, indicators and warning devices
 - heating and cooling
 - temperature regulation -automatic and manual
 - ram air ventilation

- k) De-ice and Anti-ice Systems
- schematic construction, functioning and operation of
 - air intake
 - rotors (main tail rotor)
 - pitot, static pressure sensor
 - windshield
 - control surfaces (horizontal stabilizer)
 - rain repellent system
 - ice warning systems

- l) Fuel system
- Fuel tanks (main and auxiliary)
 - structural components and types
 - location of tanks on single-and-multi-engine aircraft
 - sequence and types of re-fuelling
 - unusable fuel
 - crashworthiness

 - Fuel feed
 - gravity and pressure feed
 - crossfeed
 - schematic construction

 - Fuel Dumping System
 - Fuel system monitoring
 - operating, indicators, warning systems
 - fuel management (sequencing of fuel tank switching)
 - dip stick

2. Electrics

- a) Direct Current (DC) ; Direct /Alternating Current (DC/AC) (IR)
- General
 - electric circuits
 - voltage, current, resistance
 - Ohm's law
 - resistive circuits
 - resistance as a function and temperature
 - electrical power, electrical work
 - fuses (function, type and operation)
 - the electrical field
 - the capacitor (function) system, shock absorbers)

-Batteries

- types, characteristics
- capacity
- uses
- hazards

-Magnetism

- permanent magnetism
- electromagnetism:
 - relay, circuit breaker, solenoid valve (principle, function and applications)
- electromagnetic power
- electromagnetic induction

- Generators

- alternator:
 - principle, function and applications
 - monitoring devices
 - regulation, control and protection
 - modes of excitation

- starter generator

- Distribution

- current distribution (buses)
- monitoring of electrical flight instruments/systems:
 - ammeter, voltmeter
 - annunciators

-electrical consumers

- DC power distribution:
 - construction, operation and system monitoring
 - elementary switching circuits

- Inverter (applications)
- The aircraft structure as an electrical conductor

b) Alternating Current (AC)

-General

- single and multi-phase AC
- frequency
- phase shift
- AC components

-Generators

- 3-phase generator
- brushless generator (construction and operation)
- generator drive:
 - constant speed drive
 - integrated drive

- AC power distribution

- construction, operation and monitoring

- protection circuits, paralleling of AC-generators
- Transformers
 - function
 - types and applications
- Synchronous and asynchronous motors
- Transformer/rectifier units
- c) Semiconductors
 - principles of semiconductors
 - semiconductor resistors (properties and application)
 - rectifier (function and application)
 - transistor (function and application)
- d) Basic knowledge of computers
 - Logic circuits
 - Logical symbols
 - Switching circuits and logical symbols
- e) Basic radio propagation theory
 - Basic principles
 - electromagnetic waves
 - wave length, amplitude, phase angle, frequency
 - frequency bands, sideband, single sideband
 - pulse characteristics
 - carrier, modulation, demodulation
 - kinds of modulation (amplitude, frequency, pulse, multiplex)
 - oscillation circuits
 - Antennas
 - characteristics
 - polarization
 - types of antennas
 - Wave propagation
 - ground waves
 - space waves
 - propagation with the frequency bands
 - frequency prognosis (MUF)
 - fading
 - factors affecting propagation (reflection, absorption, interface, twilight, shoreline, mountain, static)

3. Power Plant

- a) Piston Engine
 - General
 - design types
 - principles of the 4-stroke internal combustion engine

- mechanical components

- Lubrication system
 - function
 - schematic construction
 - monitoring instruments and indicators
 - lubricants

- Air Cooling
 - system monitoring
 - cylinder head temperature
 - cowl flaps

- Ignition
 - systematic construction and function
 - types of ignition
 - magnetic check

- Engine fuel supply
 - carburetor (construction and mode of operation, carburetor icing)
 - fuel injection (construction and mode of operation)
 - alternate air

- Engine performance
 - pressure/ density altitude
 - performance as a function of pressure and temperature

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

- Fuel
 - types, grades
 - detonation characteristics, octane rating
 - colour coding
 - additives
 - water content, ice formation
 - fuel density
 - alternate fuels, differences in specification, limitations

- Mixture
 - rich and lean mixture
 - maximum power and fuel economy mixture setting

- Engine handling and manipulation
 - power setting, power range
 - mixture setting
 - operational limitations

- Operational criteria
 - maximum and minimum RPM
 - (induced) engine vibration and critical RPM
 - remedial action by abnormal engine start, run-up and in-flight

b) Turbine Engine

- principles of operation
- types of construction
 - turboprop
 - turbojet
 - turbofan

c) Engine construction

- Air inlet
 - function
- Compressor
 - function
 - construction and mode of operation
 - effects of damage
 - compressor stall and surge (cause and avoidance)
 - compressor characteristics
- Diffuser
 - function
- Combustion chamber
 - function, types and working principles
 - mixing ratios
 - fuel injectors
 - thermal load
- Turbine
 - function, construction and working principles
 - thermal and mechanical stress
 - effects of damage
 - monitoring of exhaust gas temperature
- Pressure, temperature and airflow in a turbine engine
- Bleed air
 - effect of use of bleed air on thrust, exhaust temperature, RPM and pressure ratio

d) Engine systems

- Ignition
 - function, types, components, operation, safety aspects
- Starter
 - function, type, construction and mode of operation
 - control and monitoring
 - self sustaining and idle speeds
- Engine start malfunctions
 - cause and avoidance
- Fuel system
 - schematic diagrams, components

- operation and monitoring
- malfunctions

- Lubrication
- construction, components
- operation and monitoring
- malfunctions

- Fuel
- effects of temperature
- impurities
- additives

- Power plant operation and monitoring

- Power
- power sharing engines
- function of density
- flat rated engine

e) Auxiliary Power Unit (APU)

- General
- function, types
- location
- operation and monitoring

1.4 Emergency Equipment

- a) Doors and emergency exits
 - evacuation slides, general usage or as life rafts or flotation devices

- b) Smoke detection
 - location, indicators, function test

- c) Fire detection
 - location, warning mode, function test

- d) Fire fighting equipment
 - location, operation, contents, gauge, function test

- e) Aircraft oxygen equipment
 - drill, use of equipment in case of rapid decompression
 - oxygen generators

- f) Hydraulic systems
 - components, fluids
 - operation, indication, warning systems
 - auxiliary systems

- g) Emergency equipment
 - portable, hand-held fire extinguisher
 - smoke mask, smoke protection hood

- portable oxygen system
- emergency locator beacon, transmitter
- life jacket, life raft
- pocket lamp, emergency lighting
- megaphone
- cash axe
- fireproof gloves
- emergency flotation system

2. Principles of Flight – Helicopters

2.1 Subsonic Aerodynamics

a) Basics Laws and Definitions

- Components of aircraft
- Aircraft configuration
- Units of measurement of
 - length
 - area
 - volume
 - velocity
 - mass
 - pressure
 - temperature
 - density
 - force
 - power
 - energy
- Terms used to describe aerodynamic phenomena
- Reference speeds
- Abbreviations

b) Deviation of lift

- equation of continuity
- Bernoulli's Theorem
- streamline flow
- angle of attack
- pressure distribution about a wing (transverse and longitudinal)
- centre of pressure xx
- aerofoil shape (plan and section) and its effect on lift
- lift formula
- lift/ drag ratio

c) Drag

- profile drag
 - causes
 - variation with speed
 - methods of minimizing it
- induced drag
 - causes

- vortices
- variation with speed
- design factors affecting it

- total effect of the combination of profile and induced Drag

d) Distribution of forces

- lift/ weight and thrust/drag couples
- necessity to achieve balance
- methods of achieving balance

e) Stability

- aircraft axes and planes of rotation
- static stability
- dynamic stability
- effects of design features on stability
- inter-action between stability in difference planes
- effect of altitude/ speed on stability
- roll and yaw dampers rotor thrust, H-force

f) Flying controls

- the three planes
- pitching about the lateral axis
- rolling about the longitudinal axis
- yawing about the normal axis

- effects of cyclic, collective and rudder pedal inputs
- stabilizer and rudder
- control in pitch, roll and yaw
- cross coupling, roll and yaw
- effect of rotor configuration on control power

g) Blade-stall

- angle of attack
- boundary layer and reasons for stalling
- variation of lift and drag in the stall
- movement of the centre of pressure

h) Transonic effects on blades

- shock waves
- the reasons for their formation at subsonic speed
- their effect on the handling and operation of the helicopter

i) Limitations

- manoeuvring and gust envelope

j) Performance degradation

- adverse on performance due to profile contamination
- icing
- rain
- modification to and condition of the airframe

3. Helicopter Aerodynamics

a) The helicopter and associated terminology

- comparison with fixed wing and autogiro
- plane of rotation
- axes of rotation
- rotor shaft axis
- tip path plane
- rotor disc
- disc loading
- blade loading

b) The forces diagram and associated terminology

- pitch angle
- rotational airflow
- induced airflow
- relative airflow to the blade
- angle of attack
- drag-blade
- total reaction – blade
- rotor thrust
- rotor drag
- torque
- weight

c) Uniformity of rotor thrust along blade span

- blade twist
- taper
- coning angle
- centrifugal force
- limits of rotor RPM
- centrifugal turning moments

d) Helicopter Controls

- collective lever
- collective pitch changes
- relationship with rotor thrust and rotor drag

- cyclic stick
- cyclic pitch changes
- rotor disc attitude
- rotor thrust tilt

- yaw pedals
- fuselage torque
- tail rotor drift
- tail rotor roll
- fenestron tail
- tandem rotors
- co-axial rotors

-notar

e) Rotor blade freedom of movement

- feathering
 - the feathering hinge
 - pitch angle
- flapping
 - the flapping hinge
 - alleviation of bending stresses
 - flapping to equally
- dragging
 - the drag hinge
 - drag dampers
 - leading/ lagging
 - periodic drag changes
 - blade c.g. (conservation of angular momentum)
 - hookes joint effect

f) Phase lag and advance angle

- the control orbit
- pitch operating arm movement
- rate of pitch change
- rate of blade flapping
- resulting disc altitude
- phase lag definition
- advantage angle – definition

g) Vertical flight

- take-off
- vertical climb
- vertical descent
- hover outside ground effect
- ground effect
- factors affecting ground cushion
- dynamic roll-over avoidance of

h) Forces in balance

- at the hover
- in forward flight
- influence of cg
- influence of rotor shaft tilt

i) Translational lift

- effect of horizontal airflow on induced flow
- variation of total flow through the disc with forward flight
- the relationship between pitch angle and angle of attack

j) Power Requirements

- rotor profile power
- power absorption – tail rotor and ancillary equipment
- rotor profile power variation with forward speed
- induced drag
- parasite drag
- total power required
- power available

k) Further aerodynamics of forward flight

- transition from and to the hover
- symmetry and asymmetry of rotor thrust
- main rotor flapback
- total rotor flapback and methods of removal
- factors affecting maximum forward speed
 - design limits of cyclic stick
 - airflow reversal
 - retreating blade stall
 - symptoms and recovery actions
 - compressibility
 - flow separation
 - shock stall
 - 'G' stall

l) Factors affecting cyclic stick limits

- all up mass (AUM)
- density altitude
- cg position

m) The flare – power flight

- thrust reversal
- effect on aircraft attitude
- increase on rotor thrust
- decrease in rotor drag
- increase in rotor RPM
- effect of deceleration

n) Setting with power (vortex ring)

- tip vortices
- comparison induced flow and external flow
 - development
 - change in relative airflow along blade span
 - root stall and turbulence

o) Blade sailing

- rotor RPM and blade rigidity
- effect of adverse wind
- minimizing the danger

- p) Vertical
- rate of descent airflow
 - effective airflow
 - relative airflow
 - inflow and inflow angle
 - autorotative force
 - rotor drag
 - effect of mass and altitude
 - control of rotor RPM with lever
 - rotor RPM stability
- q) Autorotation – forward flight
- Factors affecting inflow angle
 - effect of forward speed on rate of descent
 - asymmetry of autorotative disc area in forward flight
 - turning
 - the flare
 - rotor RPM increase from movement of autorotative selection
 - increase in rotor thrust
 - reduction in rate of descent
 - range and endurance
 - autorotative landing
 - height/ velocity avoidance graph / deadmans curve
- r) Stability
- hover
 - forward flight
 - rearward flight
 - stability aids
 - stabilizers and effects of centre of gravity
 - gyro controlled stabilizer system
 - stabilizer bars
 - delta hinge effect
 - effect of lever application on attitude in translational flight
- s)Control power
- the teetering head
 - fully articulated head
 - the rigid rotor
 - effect on stability
 - effect dynamic/ static rollover
- t) Power requirements – graphs
- power required/ power available graph
 - maximum rate of climb speed
 - operating with limited power
 - best angle of climb speed
 - maximum speed
 - range and endurance

- overpitch
- overtorque
- turning
- comparison of piston and turbine engine helicopters
 - range and endurance
 - effect of density altitude
 - effect of aircraft weight

APPENDIX'D'

**SYLLABUS FOR AIRLINES TRANSPORT PILOT
LICENSE EXAMINATION**

- HELICOPTERS

- 1. Appendix D-1 : Air Navigation**
- 2. Appendix D-2 : Aviation Meteorology**
- 3. Appendix D-3 : Radio Aids & Instruments (Avionics)**
- 4. Appendix D-4 : Air Regulation**
- 5. Appendix D-5 : Helicopter & Engine –
Technical General**

APPENDIX D-1

AIR NAVIGATION

THE SYLLABUS OF AIR NAVIGATION IS AS FOLLOWS:

1. General Navigation

a) Basics of Navigation

- The solar system
 - seasonal and apparent movements of the sun

- The earth
 - great circle, small circle, rhumb line
 - convergency, conversion angle
 - latitude, difference of latitude
 - longitude, difference of longitude
 - use of latitude and longitude co-ordinates to locate any specific position

- Time and time conversions
 - apparent time
 - UTC
 - LMT
 - standard times
 - dateline
 - determination of sunrise, sunset and civil twilight

- Directions
 - terrestrial magnetism: declination, deviation and compass variations
 - magnetic poles, isogonals, relationship between true and magnetic gridlines, isogrives

- Distance
 - units of distance and height used in navigation: nautical miles, statute miles, kilometers, metres, yards and feet
 - conversion from one unit to another
 - relationship between nautical miles and minutes of latitude

b) Magnetism and Compasses

- General principles
 - terrestrial magnetism
 - resolution of the earth's total magnetic force into vertical and horizontal components
 - the effects of change of latitude on these components
 - directive force
 - magnetic dip
 - variation

- Aircraft magnetism
 - hard iron and vertical soft iron
 - the resulting magnetic fields
 - the variation in directive force

- Change of deviation with change of latitude and with change in helicopter's heading
- turning and acceleration errors
- keeping magnetic materials clear of the compass

- knowledge of the principles, standby and landing or main compasses and remote reading compasses
 - detailed knowledge of the use of these compasses
 - serviceability tests
 - advantages and disadvantages of the remote indicating compasses
 - adjustment and compensation of direct reading magnetic compass

c) Charts

- General properties of miscellaneous type of projections
 - mercator
 - lambert conformal conic
 - polar stereographic
 - transverse mercator
 - oblique mercator

- The representation of meridians, parallels, great circles and rhumb lines
 - direct mercator
 - lambert conformal conic
 - polar stereographic

- The use of current aeronautical charts
 - plotting positions
 - methods of indicating scale and relief
 - conventional signs
 - measuring tracks and distances
 - plotting bearings

d) Dead Reckoning Navigation (DR)

- Basics of dead reckoning
 - track
 - heading (compass, magnetic, true, grid)
 - wind velocity
 - airspeed (IAS, CAS, TAS, Mach number)
 - ground speed
 - ETA
 - drift, wind correction angle
 - DR-position, fix

- Use of the navigational computer
 - speed
 - time
 - distance
 - fuel consumption
 - conversions
 - heading
 - airspeed
 - wind velocity

- The triangle of velocities, methods of solution for the determination of
 - heading
 - ground speed
 - wind velocity
 - track and drift angle, track error
 - time and distance problems

- Determination of DR position
 - need for DR
 - confirmation of flight progress (mental DR)
 - lost procedures
 - heading and TAS vector since last confirmed position
 - application of wind velocity vector
 - last known track and ground speed vector
 - assessment of accuracy of DR position

- Measurement of DR elements
 - calculation of altitude, adjustments, corrections, errors
 - determination of temperature
 - determination of appropriate speed
 - determination of mach number

- Measurement of
 - maximum range
 - radius of action
 - point-of-safe-return and point-of-equal-time

- Miscellaneous DR uncertainties and practical means of correction

e) In-flight Navigation

- Use of visual observations and application to in-flight navigation – magnetic influences within the helicopter

- Navigation in climb descent
 - average airspeed
 - average wind velocity
- ground speed/distance covered during climb or descent

- Navigation in cruising flight, use of fixes to revise navigation data as
 - ground speed revision
 - off-track corrections
 - calculation of wind speed and direction
 - ETA revisions

- Flight log (including navigation records)
- Purposes of FMS (Flight Management Systems)

2. Mass and Balance - Helicopters

a) Introduction to Mass and Balance

- Centre of gravity (cg): Definition, importance in regard to aircraft stability (Helicopter); importance in regard to helicopter stability (cyclic stick – travel/limitations) (Helicopter)
- Mass and balance
- consult helicopter flight manual for: cg limits for take-off, landing, cruise configurations
- maximum floor load
- maximum ramp and taxi mass (Helicopter); maximum taxi mass (Helicopter)
- factors determining maximum permissible mass : structural limitations, performance limitations such as – runway available for take-off and landing, weather conditions (temperature, pressure, wind, precipitation); rate-of-climb and altitude requirements for obstacle clearance; engine-out performance requirements
- factors determining cg limits: helicopter stability, stability of flight controls and surfaces to overcome mass and lift pitching moments under all flight conditions
- changes in cg location during flight due to consumption of fuel, raising and lowering of undercarriage, and intentional relocation of passengers or cargo, transfer of fuel
- movement of centre of lift because of influence of hoist and external load operation

b) Loading

- Terminology: empty mass, dry operating mass (empty mass + crew + operating items + unusable fuel), zero fuel mass, standard mass – crew, passengers and baggage, fuel, oil water (volume/mass conversion factors), carry-on luggage, useful load (traffic load + usable fuel)
- Helicopter mass checks
 - procedure (in general terms, details not necessary)
 - requirements for re-weighing of aircraft
 - equipment lists
- Procedures for determining helicopter mass and balance documentation; procedures for determining helicopter mass and balance documentation
 - determine dry operating mass (crew, equipment etc)
 - add mass of passengers and cargo (including passengers baggage (standard mass))
 - add mass of fuel
 - check that applicable maximum gross mass limits are not exceeded (mass within legal limits)
- Effects of overloading: higher take-off and safety speeds, longer take-off and landing distances, lower rate-of-climb, influence on range and endurance (Helicopter), decreased engine-out performance, possible structural damage in extreme cases

c) Centre of Gravity (cg)

- basic of cg calculations (load and balance documentation)
 - Datum – explanation of term, location, use in cg calculation
 - Moment arm – explanation of term, determination of algebraic signs, use

- Moment – explanation, moment = mass x moment arm
- Expression of distance from Datumline

- Calculation of cg (Helicopter); Calculation of cg longitudinal and lateral (including computer calculations) (Helicopter)

- Cg at empty mass
 - determined when helicopter is weighed;
 - recorded in helicopter documentation cg at Dry Operating Mass

- movement of cg with addition of fuel, load and Ballast

- practical methods of calculation
 - computation method using either mathematical computations or specially designed slide rule
 - graph method
 - table method
 - intentional relocation of passengers or cargo re remain within cg limits

3. Performance - Helicopters

a) Airworthiness - Requirements

- definitions of terms and speeds used in CARs

b) Definition of Terms

- masses
- velocities: VLE, VLO, VX, VY, Vtoss: (1) VNE ANO Vmini
- velocity of best range and maximum endurance
- power limitations AEO OEI
- altitudes
- performance class 1, 2, 3 operations
(see ICAO Annex 6 Part III and CARs)

c) Take-off – Cruise – Landing Performance

- Use and interpretation of diagrams and tables associated with CAT A, CAT B, procedures in order to select and develop class 1, 2, 3 performance profiles according to available heliport size and location (surface or elevated)

d) Performance of Helicopters

- applicability – Performance Class 1, 2 and 3
- General
 - helicopter mass
 - approved performance data in Helicopter Flight Manual
- Terminology

e) Performance Class 1

- General and Applicability
 - take-off from surface level heliports
 - take-off from elevated heliports/helidecks
 - critical power unit failure prior to TDP and after TDP

- Account of
 - take-off mass
 - pressure altitude
 - ambient temperature
 - take-off technique
 - head-wind component
 - tail-wind component

- Take-off flight path
 - critical power unit inoperative take-off flight path
 - obstacle vertical and lateral margins and change of direction clearance margins

- En-route critical power unit inoperative
 - en-route flight path
 - out of sight of the surface
 - areas of mountainous terrain
 - visual meteorological conditions and, insight of surface
 - flight path altitudes
 - effects of winds on the flight path
 - fuel jettisons
 - width margins flight path reductions

 - Landing: to surface level heliports; to elevated heliports/helidecks; with critical power failure prior LDP and after LDP
 - Account of:
 - landing mass
 - pressure altitude
 - ambient temperature
 - take-off technique
 - head-wind component
 - tail-wind component

f) Performance Class 2

- General and Applicability
- Take-off
 - surface level heliports
 - elevated heliports/helidecks
 - take-off flight path
 - critical power unit failure prior and/or after DPATO

- En-route – critical power unit inoperative

- Landing
 - critical power unit failure prior to/or after DPBL

- Landing mass
- surface level heliports
- elevated heliports and helidecks

g) Performance Class 3

- General applicability helicopter certified in either Category A or B
- operation conducted only from aerodromes
 - heliports and route areas and diversions that permit a safe forced landing in the event of a power unit failure
 - Operations – ceiling and visibility limits
 - over-water in a hostile environment limits
 - Operations with exposure time
- Take-off
- En-route
- Landing

4. Flight Planning and Monitoring

a) Flight Plans for Cross Country Flights

- Navigation Plan
 - selection of routes, speeds, heights (altitudes) and alternate airfield/landing sites
 - terrain and obstacle clearance
 - cruising levels appropriate for direction of flight
 - navigation check points, visual or radio
 - measurement of tracks and distances
 - obtaining wind velocity forecast for each leg
 - computations of headings, ground speeds, and time en-route from tracks, true airspeed and wind velocities
 - completion of pre-flight portion of navigation flight log
- Fuel Plan
 - computation of planned fuel usage for each leg and total fuel usage for the flight
 - flight manual figures for fuel flow during climb, en-route and during descent
 - navigation plan for times en-route
 - fuel for holding and diversion to alternate airfield
 - reserves
 - total fuel requirements for flight
 - completion of pre-flight portion of fuel log
- Flight monitoring and in-flight re-planning
 - in-flight fuel computations
 - recording of fuel quantities remaining at navigational checkpoints
 - calculation of actual consumption rate
 - comparison of actual and planned fuel consumption and fuel state
 - Revision of fuel reserve estimates
 - in-flight re-planning in case of problems
 - selection of cruise altitude and power settings for new destination

- time to new destination
- fuel state, fuel requirements, fuel reserves
- Radio communication and navigation aids
 - communication frequencies and call signs for appropriate control agencies and in-flight service facilities such as weather stations
 - radio navigation and approach aids, if appropriate
 - type
 - frequencies
 - identification

b) ICAO ATC Flight Plan

- types of flight plan
- ICAO flight plan – format
 - information included in completed plan
 - repetitive flight plan
- completing the flight plan
 - information for flight plan obtained from
 - navigation flight plan
 - fuel plan
 - operator's records for basic helicopter information
 - mass and balance records
- Filling the flight plan
 - procedures for filing
 - agency responsible for processing the flight plan
 - requirements of the State concerning when a flight plan must be filed
- Closing the flight plan
 - responsibilities and procedures
 - processing agency
 - check slot time
- Adherence to flight plan
 - tolerances allowed by the State for various types of flight plans
 - in-flight amendment of flight plan
 - conditions under which a flight plan must be amended
 - pilot's responsibilities and procedures for filing an amendment
 - agency to which amendments are submitted

c) Practical Flight Planning -

- Chart preparation
 - Plot tracks and measure directions and distances
- Navigation plans
 - Completing the navigation plan using:
 - tracks and distances from prepared charts
 - wind velocities as provided
 - true airspeeds as appropriate
- Simple fuel plans

- Preparation of fuel logs showing planned values for:
 - fuel used on each leg
 - fuel remaining at the end of each leg
 - endurance, based on fuel remaining and planned consumption rate, at end of each leg
- Radio planning practice
- Communications
 - frequencies and call signs of air traffic control agencies and facilities and for in-flight services such as weather information
- Navigation aids
 - frequencies and identifiers of en-route terminal facilities, if appropriate

d) IFR (Airways) Flight Planning

- meteorological considerations
 - analysis of existing weather patterns along possible routes
 - analysis of winds aloft along prospective routes
 - analysis of existing and forecast weather conditions at destination and possible alternates
- Selection of routes to destinations and alternates
 - preferred airways routings
 - extraction of tracks and distances from RAD/NAV chart
 - Frequencies and identifiers of en-route radio navigation aids
 - minimum en-route altitudes, minimum crossing and reception altitudes
 - Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs)
- General flight planning tasks
 - checking of AIP and NOTAM for latest airfield and en-route status information
 - selection of altitudes or flight levels for each leg of flight
 - application of wind velocity on each leg to obtain heading and ground speeds
 - calculation of en-route times for each leg to the destination and to the alternate and determination of total time en-route
 - completion of fuel plan
 - preliminary study of instrument approach procedures and minima at destination and alternate
 - filling out and filing air traffic flight plan

e) Practical Completion of a 'Flight Plan' (flight plan, flight log, nav log ATC plan, etc.)

- Extraction of data
- extraction of navigational data
- extraction of meteorological data
- extraction of performance data
- completion of navigation flight plan
- completion of fuel plan

- time and fuel to top-of-climb
- cruise sector times and fuel used
- total time and fuel required to destination
 - fuel required for missed approach, climb en-route altitude, and cruise alternate
- reserve fuel
 - Computation of PET (point-of-equal-time), including equi-fuel and equi-time points, and PSR (point-of-safe-return)
 - Completion of air traffic flight plan

f) Offshore or Remote Area Operation

- Additional flight planning aspects for offshore or remote area operation
 - Fuel planning
 - en-route contingency fuel
 - destination holding and diversion fuel
 - destination onshore reserve
 - use of performance chart to plan fuel usage of and requirements based on planned climb en-route cruise and descent
 - reserve fuel requirements
 - one engine out (OEI) considerations
 - Computation of point-of-equal-time (PET) and point-of-safe-return (PSR)
- Computerized Flight Planning
 - General principles of present systems
 - advantages
 - shortcomings and limitations

APPENDIX D-2

AVIATION METEOROLOGY

THE SYLLABUS OF AVIATION METEOROLOGY IS AS FOLLOWS :

2. Meteorology

1.5 The Atmosphere

- h) Composition, extent, vertical division : composition, extent, vertical division
- i) Temperature
 - vertical distribution of temperature
 - transfer of heat : solar and terrestrial radiation, conduction, convection, advection and turbulence
 - lapse rate, stability and instability
 - development of inversions, types of inversions
 - temperature near the earth's surface, surface effects, diurnal
 - variation, effect of clouds, effect of wind
- j) Atmospheric pressure
 - barometric pressure, isobars
 - pressure variation with height, contours (isohypses)
 - reduction of pressure to mean sea level, QFF
 - surface low/upper-air low, surface high/upper-air high-precipitation
- k) Atmospheric density : interrelationship of pressure, temperature and density
- l) International Standard Atmosphere (ISA)
- m) Altimetry
 - pressure altitude, true altitude
 - height, altitude, flight level
 - altimeter settings: QNH, QFE, 1013.25 hPa
 - calculation of terrain clearance, lowest usable flight level, rule of thumb for temperature and pressure influences
 - effect of accelerated airflow due to topography

1.6 Wind

- a) Definition and measurement
- b) Primary cause of wind
 - primary cause of wind, pressure gradient, coriolis force, gradient wind
 - relationship between isobars and wind
 - effects of convergence and divergence
- c) General circulation
 - general circulation around the globe
- d) Turbulence
 - Turbulence and gustiness, types of turbulence
 - origin and location of turbulence
- e) Variation of wind with height
 - variation of wind in the friction layer
 - variation of the wind caused by fronts
- f) Local winds: Anabatic and katabatic winds, land and sea breezes, Venturi effects
- g) Jet Streams
 - origin of jet streams
 - description and location of jet streams
 - names, heights and seasonal occurrence of jet streams
 - jet stream recognition
 - CAT : cause, location and forecasting
- g) Standing waves
 - origin of standing waves

1.7 Thermodynamics

- a) Humidity
 - water vapour in the atmosphere
 - temperature/dew point, mixing ratio, relative humidity
- b) Change of state of aggregation
 - condensation, evaporation, sublimation, freezing and melting, latent heat
- c) Adiabatic processes

1.4 Clouds and Fog

a) Clouds formation and description

- cooling by adiabatic expansion and by advection
- cloud types, cloud classification
- influence of inversions on cloud development
- flying conditions in each cloud type

b) Fog, mist, haze

- radiation fog
- advection fog
- steaming fog
- frontal fog
- orographic fog

1.5 Precipitation

a) Development of precipitation

- development of precipitation
- types of precipitation
- type of precipitation, relationship with cloud types

1.7 Airmasses and Fronts

a) Types of airmasses

- description, factors, affecting the properties of an airmass
- classification of airmasses, modifications of airmasses, areas of origin

b) Fronts

- boundaries between airmasses (fronts), general situation, geographic differentiation
- warm front, associated clouds and weather
- cold front, associated clouds and weather
- Warm sector, associated clouds and weather
- weather behind the cold front
- occlusions, associated clouds and weather
- stationary front, associated clouds and weather
- movement of fronts and pressure systems, life cycle

1.7 Pressure Systems

a) Location of the principal pressure areas

b) Anticyclone: Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence

c) Non frontal depressions

- thermal, orographic – and secondary depressions, cold air pools, trough

d) Tropical revolving storms

- development of tropical revolving storms
- origin and local names, location and period of occurrence

1.8 Climatology

a) Climatic Zones

- General seasonal circulation in the troposphere and lower stratosphere
- tropical rain climate, dry climate, mid-latitude climate, subarctical climate with cold winter, snow climate

b) Tropical Climatology

- cause and development of tropical showers : humidity, temperature, tropopause
- seasonal variations of weather and wind, typical synoptic situations
- inter-tropical convergence zone (ITCZ), weather in the ITCZ, general seasonal movement
- climatic elements relative to the area (monsoon, trade winds, sandstorms, cold air outbreaks)
- easterly waves

c) Typical weather situations in mid-latitudes

- westerly waves
- high pressure area
- uniform pressure pattern
- cold pool

d) Local seasonal weather and wind

- local seasonal weather and wind
- Fohn, Mistral, Bora, Scirocco
- Khamsin, Harmattan, Ghibbli and Pampero

1.9 Flight Hazards

a) Icing

- weather conditions for ice accretion, topographical effects
- types of ice accretion
- hazards of ice accretion, avoidance

b) Turbulence

- effects on flight, avoidance
- CAT : effects on flight

c) Windshear

- definition of windshear
- weather conditions for windshear
- effects on flight

d) Thunderstorms

- structure of thunderstorms, squall lines, life history, storm cells, electricity in the atmosphere, static charges
- conditions for and process of development, forecast, location, type specification
- Thunderstorm avoidance, ground/airborne radar, storm scope
- development and effect of down bursts

- development of lightning discharge and effect of lightning strike on aircraft and flight execution
- e) Tornadoes
 - occurrence
- f) Low and high level inversions:Influence on helicopter performance
- g) Stratospheric conditions
 - tropopause influence on helicopter performance
 - effect of ozone, radioactivity
- h) Hazards in mountainous areas
 - influence of terrain on clouds and precipitation, frontal passage
 - vertical movements, mountain waves, windshear, turbulence, ice accretion
 - development and effect of valley inversions
- i) Visibility reducing phenomena
 - reduction of visibility caused by mist, smoke, dust, sand and precipitation
 - reduction of visibility caused by low drifting and blowing snow
 - micro meteorology

1.11. Meteorological Information

- h) Observation
 - on the ground – surface wind, visibility and runway visual range, transmissometers; Clouds – type, amount, height of base and tops, movement; Weather – including all types of precipitation, air temperature, relative humidity, dew point, atmospheric pressure
 - upper air observations
 - satellite observations, interpretation
 - weather radar observations ground and airborne, interpretation
 - aircraft observations and reporting, data link systems, PIREPS
 -
- i) Weather Charts
 - significant weather charts
 - surface charts
 - upper air charts
 - symbols and signs on analysed and prognostic charts
- j) Information for Flight Planning
 - aeronautical codes: METAR, TAF, SPECI, SIGMET, SNOWTAM, runway report
 - meteorological broadcasts for aviation: VOLMET, ATIS, HFVOLMET, ACARS
 - content and use of pre-flight meteorological documents
 - meteorological briefing and advice
 - measuring and warning systems for low level windshear, inversion
 - special meteorological warnings

- information for computer flight planning

APPENDIX D-3

RADIO AIDS AND INSTRUMENTS

(AVIONICS)

1. Radio Navigation

a) Radio Aids

- Ground D/F (including classification of bearings)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- ADF (including associated beacons and use of the radio magnetic indicator)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- VOR and Doppler – VOR (including the use of the radio magnetic indicator)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- DME (distance measuring equipment)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- ILS (Instrument Landing System)
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
- MLS (Microwave Landing System)
 - principles
 - presentation and interpretation
 - coverage

- range
- errors and accuracy
- factors affecting range and accuracy

b) Basic Radar Principles

- Pulse techniques and associated terms – latitude and longitude
- Ground radar
 - principles
 - presentation and interpretation
- coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy

- Airborne weather radar
 - principles
 - presentation and interpretation
 - coverage
 - range
 - errors and accuracy
 - factors affecting range and accuracy
 - application for navigation

- SSR secondary surveillance radar and transponder
 - principles
 - presentation and interpretation
 - modes and codes, including mode S
 - Use of radar observations and application to in-flight navigation

c) Area Navigation Systems

- General philosophy
 - use of radio navigation systems or an inertial navigation system

- Typical flight deck equipment and operation
 - means of entering and selecting waypoints and desired course information (keyboard entry system)
 - means of selecting, tuning and identifying ground stations
 - instrumentation for en-route course guidance
 - for some types of systems, instrumentation for presenting distance traveled, distance to go and, if necessary, ground speed information
 - instrumentation for presenting current position data
 - flight detector and autopilot coupling

- Instrument indications
 - Types of area navigation system inputs
 - self-contained on-board systems (IRS/IRS systems)
 - external sensor systems (VOR/DME, GPS)
 - air data inputs (true airspeed, altitude, magnetic heading)

- VOR/DME area navigation (RNAV)
 - principle of operation
 - advantages and disadvantages
 - accuracy, reliability, coverage
 - flight deck equipment
- Flight director and autopilot coupling

d) Self-contained and External-Referenced Navigation Systems

- Doppler
 - principles of operations (airborne system)
 - ground speed and drift calculation
 - advantages and disadvantages
 - accuracy and reliability
 - flight deck equipment
- Loran – C
 - principle of operation
 - Decca navigation system
 - principle of operation
- Satellite assisted navigation: GPS / GLONASS/DGPS
 - principle of operation
 - advantages and disadvantages

6.2 Instrumentation - Helicopters

6.3 Flight Instruments

a) Air data instruments

- pitot and static system
 - pitot tube, construction and principles of operation
 - static source
 - malfunction
 - heating
 - alternate static source
- Altimeter
 - construction and principles of operation
 - display and setting
 - errors
 - correction tables
 - tolerances
- Airspeed indicator
 - construction and principles of operation
 - speed indications (IAS)
 - meaning of coloured sectors

- maximum speed indicator, Vmo, Mmo pointer
- errors

- Vertical Speed Indicator (VSI)
 - aneroid and instantaneous VSI (IVSI)
 - construction and principles of operation
 - display

b) Gyroscopic instruments

- Gyro fundamentals
 - theory of gyroscopic forces (stability, precession)
 - types, and principles of operation:
 - vertical gyro
 - directional gyro
 - rate gyro
 - rate integrating gyro
 - single degree-of-freedom gyro /tied gyro
 - ring laser gyro
 - apparent drift
 - random drift
 - mountings
 - drive types, monitoring

- Directional gyro
 - construction and principles of operation

- Slaved gyro compass
 - construction and principles of operation
 - components
 - mounting and modes of operation
 - turn and acceleration errors
 - application, uses of output data

- Altitude indicator (vertical gyro)
 - construction and principles of operation
 - display types
 - turn and acceleration errors
 - application, uses of output data

- Turn and bank indicator (rate gyro)
 - construction and principles of operation
 - display types
 - application errors
 - application, uses of output data
 - turn coordinator

- Gyro stabilized platform (gimbaled platform)

- types in use
- accelerometer, measurement system
- construction and principles of operation
- platform alignment
- applications, uses of output data

- Fixed installations (strap down systems)
 - construction and principles of operation
 - types in use
 - input signals
 - application, uses of output data

- c) Magnetic Compass
 - construction and principles of operation
 - errors (deviation, effect of inclination)

- d) Radio Altimeter
 - components
 - frequency band
 - principle of operation
 - displays
 - errors

- e) Electronic Flight Instrument System (EFIS)
 - information display types
 - data input
 - control panel, display unit
 - example of typical aircraft installation

- f) Flight Management System (FMS)
 - general principles
 - inputs and outputs of data

6.2 Automatic Flight Control Systems

- a) Flight Director
 - function and application
 - block diagram, components
 - mode of operation
 - operation set-up for various flight phases
 - command modes (bars)
 - mode indicator
 - system monitoring
 - limitations, operational restrictions

- b) Autopilot
 - autoland, sequence of operation

- system concepts for autoland, go around, take-off, fail passive, fail operational (redundant)
- c) Flight envelope protection
 - function
 - input, signals
 - output data, signals
 - system monitoring
- d) Yaw Damper / Stability augmentation system
 - function
 - block diagram, components
 - signal interfacing to vertical stabilizer

6.3 Warning and Recording Equipment

- a) Warnings general
 - classification of warning
 - display, indicator systems
- b) Altitude alert system
 - function
 - block diagram, components
 - operation and system monitoring
- c) Ground Proximity Warning System (GPWS)
 - function
 - block diagram, components
 - input data, signals
 - warning modes
 - system integrity test
- d) Traffic Collision Avoidance System (TCAS)
 - function
 - warning modes
- e) Flight Data Recorder
 - Function
 - block diagram, components
 - operation
 - system monitoring
- f) Cockpit Voice Recorder
 - Function
 - block diagram, components
 - operation
- g) Rotors and engine over/underspeed warning
 - function
 - input data, signals

- display, indicators
- function test
 - effects on operation in case of failure

6.4 Powerplant and System Monitoring Instruments

- Pressure Gauge
 - sensors
 - pressure indicators
 - meaning of coloured sectors

- Temperature Gauge
 - ram rise, recover factor

- RPM Indicator
 - interfacing of signal pick-up to RPM gauge
 - RPM indicators, piston and turbine engines
 - meaning of coloured sectors

- Consumption Gauge
 - high pressure line fuel flowmeter (function, indications, failure warnings)

- Fuel Gauge
 - measurement of volume/mass, units
 - measuring sensors
 - content, quantity indicators
 - reasons for incorrect indications

- Torque Meter
 - indicators, units
 - meaning of coloured sectors

- Flight Hour Meter
 - drive source
 - indicators

- Remote (signal) transmission system
 - mechanical

- Electronic Displays
 - EFIS
 - EICAS
 - ECAM

- Chip detection
 - indicators
 - principles

APPENDIX D-4

AIR REGULATION

THE SYLLABUS OF AIR REGULATION IS AS FOLLOWS:

1. Air Law

1.1 International Agreements and Organizations

a) The Convention of Chicago

b) Air Navigation

- General principles and application: sovereignty, territory
- Flight over territory of Contracting states: right of non-scheduled flight, scheduled air services, sabotage, landing at customs airports, applicability of air regulations, rules of the air, search of aircraft.
- Measures to facilitate air navigation: customs duty, conditions to be fulfilled with respect to helicopter: certificates of airworthiness, licences of personnel, recognition of certificates and licences, cargo restriction, photographic apparatus: documents to be carried in aircraft.
- International standards and recommended practices: adoption of international standards and procedures, endorsement of certificates and licenses, validity of endorsed certificates and licenses: departure from international standards and procedures (notification of differences)

c) The International Civil Aviation Organization

- objective and composition
- regional structure and offices
- duties in relation to – annexes to the convention, standards and recommended practices, procedures for air navigation services, regional supplementary procedures, regional air navigation, manuals and circulars

d) Other International Agreements

- The International Air Transport Agreement - the five freedoms
- The Convention of Tokyo, La Haye, Montreal – Jurisdiction, authority of pilot-in-command of the aircraft
- DGCA India: Organization and Structure – Indian organizations name, composition, objectives and relevant documents (Aircraft Act 1934, Indian Aircraft Rules 1937)
- Indian Civil Aviation Conference
- Including Civil Aviation Requirements
- Warsaw Convention

a) PIC authority and responsibility regarding safety and security

- b) Operators and pilots liabilities towards persons and goods on the ground, in case of damage and injury caused by the operations of the aircraft
- c) Commercial practices and associated rules (leasing)
 - dry lease
 - wet lease

1.2 Annex 8 – Airworthiness of Aircraft

- applicability

1.3 Annex 7 – Aircraft Nationality and Registration Marks

- applicability

1.4 Annex 1 – Personnel Licensing

- applicability
- relation between Annex 1 and CAR

1.5 Rules of the Air (Based on Annex 2)

- Annex 2: essential definitions, applicability of the rules of the air, general rules (except water operations), visual flight flights, instrument flight rules, signals, interception of civil aircraft, table of cruising levels

1.6 Procedures for Air Navigation – Aircraft Operations Doc. 8168-Ops/611, Volume 1

- a) Foreword – introduction
- b) Definitions and abbreviations (see general statements)
- c) Departure procedures - general criteria, standard instrument departures, omnidirectional departures, published information, simultaneous operations on parallel or near-parallel instrument runways, area navigation (RNAV) departure procedures based on VOR/DME, use of FMS/RNAV equipment to follow conventional departure procedures
- d) Approach procedures
 - general criteria (except tables)
 - approach procedures design : instrument approach areas, accuracy of fixes (only intersection fix tolerance factors, other fix tolerance factors, accuracy of facility providing track, approach area splays, descent gradient)
 - arrival and approach segments : general, standard instrument arrival, initial approach segment (only general), intermediate approach segment, final approach segment (except tables), missed approach segment (only general)
 - visual manoeuvring (circling) in the vicinity of the aerodrome: general, the visual manoeuvring (circling) area (except table), visual manoeuvring (circling) area not considered for obstacle clearance (except table), minimum

- descent altitude/height, visual flight manoeuvre, missed approach whilst circling.
 - Simultaneous ILS operations on parallel or near-parallel runways
 - Area navigation (RNAV) approach procedures based on VOR/DME
 - Use of FMS/RNAV equipment to follow conventional non-precision approach procedures
- e) Holding procedures
- in-flight procedures (except table), entry, holding
 - obstacle clearance (except table)
- f) Altimeter setting procedures (including ICAO Doc. 7030-Regional Supplementary Procedures) – basic requirements (except tables), procedures
- g) Secondary surveillance radar transponder operating procedures (including ICAO Doc. 7030 – Regional Supplementary Procedures)
- operation of transponders
 - operation of ACAS equipment
 - phraseology

1.7 Air Traffic Services (based on Annex 11 and Doc. 4444)

1. Air Traffic Services – Annex 11 : Definitions (see general statements)
2. General
 - objectives of ATS, divisions of ATS, designation of the portions of the airspace and controlled aerodromes where ATS will be provided, classification of airspaces (appendix 4 of Annex 11), required navigation performance (RNP), establishment and designation of the units providing ATS, specifications for flight information regions, control areas and control zones, minimum flight altitudes, priority in the event of an aircraft in emergency, in-flight contingencies, time in ATS
3. Air Traffic Control
 - application
 - provision of air traffic control service, operations of air traffic control service, separation minima, contents of clearances, co-ordination of clearances, control of persons and vehicles at aerodromes
4. Flight Information Service
 - application

- scope of flight information service
 - operational flight information service broadcasts
5. Alerting Service: application, notification of rescue co-ordination centres (only INCERFA, ALERFA, DETRESFA), information to aircraft operating in the vicinity of an aircraft in a state of emergency
 6. Principles governing the identification of RNP types and the identification of ATS routes other than standard departure and arrival routes (Appendix 1)
 7. Rules of the Air and Air Traffic Services (ICAO Doc. 4444 – RAC/501/11 and ICAO Doc. 7030 – Regional Supplementary Procedures)
 - definitions (See general statements)
 - relationship to other document
 8. General provisions
 - general air traffic services operating practices: submission of a flight plan, change from IFR to VFR flight, clearances and information, control of air traffic flow, altimeter setting procedures, indication of heavy wake turbulence category and MLS capacity, position reporting, air traffic incident report, procedures in regard to aircraft equipped with airborne collision avoidance systems (ACAS)
 - Appendix 1
 9. Area Control Service
 - general provisions for the separation of control traffic
 - vertical separation : vertical separation application, vertical separation minimum, minimum cruising level, assignment of cruising level, vertical separation during ascent or descent
 - horizontal separation: lateral separation application, lateral separation application, longitudinal separation application (except between supersonic aircraft)
 - reduction in separation minima
 - air traffic control clearances: contents, description of air traffic control clearances, clearance to fly maintaining own separations while in visual meteorological conditions, essential traffic information, clearance of a requested change in flight plan
 - emergency and communication failure: emergency procedures (only general priority, emergency descent, action by pilot-in-command), air-ground

communication failure (only concerning the actions by pilot-in-command),
interception of civil aircraft

10. Approach Control Service

- departing aircraft: general procedures for departing aircraft, clearances for departing aircraft to climb maintaining own separation while in visual meteorological conditions, information for departing aircraft
- arriving aircraft: general procedures for arriving aircraft, clearance to descend subject to maintaining own separation in visual meteorological conditions, visual approach, instrument approach, holding, approach sequence, expected approach time, information for arriving aircraft

11. Aerodrome Control Service

- functions of aerodrome control towers: general, alerting service provided by aerodrome control towers, suspension of VFR operations by aerodrome control towers
- traffic and taxi circuits: selection of runway-in-use
- information to aircraft by aerodrome control towers: information related to the operation of the aircraft, information on aerodrome conditions
- control of aerodrome traffic: order of priority for arriving and departing aircraft, control of departing and arriving aircraft, wake turbulence categorization of aircraft and increased longitudinal separation minima, authorization of special VFR flights

12. Flight Information Service and Alerting Service

- Flight information service
- Alerting service

13. Use of radar in Air Traffic Services

- general provisions: limitations in the use of radar, identification procedures (only establishment of radar identity), position information, radar vectoring
- use of radar in the air traffic control service

1.8 Aeronautical Information Service (based on Annex 15 and AIP, India)

- essential definitions
- applicability

1.9 (Based on Annex 14, Vol 1 & 2)

- a) Annex 14
 - definitions
 - aerodrome data
 - conditions of the movement area and related facilities

- b) Visual aids for navigation
 - indicators and signaling devices
 - markings
 - lights
 - signs
 - markers

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

- d) Visual aids for denoting restricted use of areas
- e) Emergency and other services : rescue and fire fighting, apron management service, ground servicing of aircraft
- f) Attachment A to Annex 14
 - calculation of declared distances
 - radio altimeter operating areas
 - approach lighting systems

1.10 Facilitation (based on Annex 9)

- definitions
- entry and departure of aircraft – description, purpose and use of aircraft documents general declaration
- entry and departure of persons and their baggage – entry requirement and procedures crew and other operator's personnel

1.11 Search and Rescue (based on Annex 12)

- a) Annex 12 – definitions
- b) Organization
 - establishment and provision of SAR service
 - establishment of SAR regions
 - establishment and designation of SAR services units

- c) Co-operation x
 - co-operation between States
 - co-operation with other services

- d) Operating procedures
 - procedures for pilots-in-command at the scene of an accident
 - procedures for pilot-in-command intercepting a distress transmission
 - search and rescue signals

- f) Search and Rescue Signals
 - signals with surface craft
 - ground/air visual signal code
 - air/ground signals

1.12 Security (based on Annex 17)

- a) General – aims and objectives
- b) Organization – co-operations and co-ordination
- c) Operators: operators security programme

1.13 Aircraft Accident Investigation (based on Annex 13)

- a) Annex 13 – definitions, applicability

1.14 CARs

1.15 National Law – National Law and differences to relevant ICAO Annexes and CARs.

Indian aircraft act 1934-section 1,2,8,10,11A,11B, 17&18(3/9)

Aircraft Rule 1937- Rule No. 1-19,21-29A,30,33,37A,38-48,50,52,53,55,65,67,67A,67B,68-70,76,79-89,133A,134,140, 140(AB&C)15&161

Schedule I, II, VI, & XI

INDAIN AIRCRAFT RULES 1920-RULE NO 53-64

AIRCRAFT RULES 1954 (Public Health Rules)

AIRCRAFT RULES 2003 (Carriage of Dangerous Goods)

2. Human Performance & Limitations

2.1 Human Factors : Basic Concepts

- a) Human Factors in aviation

- competence and limitations
- becoming a competent pilot – the traditional approach towards 'proficiency', the human factors approach towards 'professionalism'
- b) Accident statistics
- c) Flight Safety concepts

2.2 Basic Aviation Physiology and Health Maintenance

- a) Basics of flight physiology
 - the atmosphere : composition, gas laws, oxygen requirements of tissues
 - Respiratory and circulatory systems: pressurization, decompression, rapid decompression, entrapped gases, barotraumas, counter measures, hypoxia, symptoms, time of useful consciousness, hyperventilation, accelerations

- b) Man an Environment the sensory system
 - Central and peripheral nervous system
 - sensory threshold, sensitivity, adaptation
 - habituation
 - reflexes and biological control systems

 - Vision
 - functional anatomy
 - visual field, foveal and peripheral vision
 - binocular and monocular vision
 - monocular vision cues
 - night vision motion sickness

 - Hearing
 - functional anatomy
 - flight related hazards to hearing

 - Equilibrium
 - functional anatomy
 - flight related hazards to hearing

 - integration of sensory inputs : spatial disorientation, illusions, physical origin, physiological origin, psychological origin, approach and landing problems

- c) Health and Hygiene

- personal hygiene
- common minor ailments: cold, influenza, gastro-intestinal upset
- problem areas for pilots : hearing loss, defective vision, hypotension, hypertension, coronaric disease, obesity, nutrition hygiene, tropical climates – epidemic diseases
- intoxication: tobacco, alcohol, drugs and self-medication, various toxic materials
- incapacitation : symptoms and causes, recognition

2.3 Basic Aviation Psychology

a) Human information processing

- attention and vigilance: selectivity of attention, divided attention
- perception: perceptual illusions, subjectivity of perception, 'bottom-up' / 'top-down' processing
- memory : sensory memory, working memory, long term memory, motor memory (skills)
- Response selection: learning principles and techniques, drives, motivation and performance

b) Human error and reliability

- reliability of human behaviour
- hypotheses on reality
- similarity, frequency
- completion causality

- theory and model of human error
- error generation
- internal factors (cognitive styles)
- external factors
 - ergonomics
 - economics
 - social environment (group, organization)

c) Decision making

- decision-making concepts: structure (phases), limits, risk assessment, practical application

d) Avoiding and managing errors : Cockpit Management

- safety awareness
 - risk area awareness
 - identification of error proneness (oneself)
 - identification of error sources (others)
 - situational awareness stress

- Communication
 - communication model(s)
 - verbal and non-verbal communication
 - communication barriers
 - conflict management

e) Personality

- Personality and attitudes : development, environmental influences
- individual differences in personality: self-concepts (e.g. , action vs. state-orientation)
- identification of hazardous attitudes (error proneness)

f) Human overload and under load

- arousal
- stress: definitions, anxiety and stress, effects of stress
- fatigue: types, causes, symptoms, effects of fatigue
- body rhythm and sleep: rhythm disturbances, symptoms, effects, management
- fatigue and stress management: coping strategies, management techniques, health and fitness programmes, relaxation techniques, religious practices, counseling techniques

g) Advanced cockpit automation

- advantages and disadvantages (criticalities)
- automation complacency
- working concepts

3. Operational Procedures

3.1 Operational Procedures – Special and Emergency Procedures

General:

- a) ICAO Annex 6, Parts I, II and III (as applicable)
 - definitions
 - applicability
 - general framework and contents
- b) CAR-OPS – Requirements

- General requirements about
 - quality system
 - additional crew members
 - methods of carriage of persons
 - admission of flight deck
 - unauthorized carriage
 - portable electronic devices
 - endangering safety
 - additional information and forms to be carried
 - information retained on ground
 - power to inspect
 - production of documentation and records

 - preservation of documentation

 - leasing

- Operator certification and supervision requirements
 - general rules for Air Operator Certification
 - issue
 - variation and continued validity of an AOC
 - administrative requirements

- Operational Procedures requirements
 - operational control and supervision
 - use of Air Traffic Services
 - instrument departure and approach procedures
 - carriage of person with reduced mobility
 - carriage of inadmissible passengers, deportees, or
 - persons in custody
 - stowage of baggage and cargo
 - passengers seating
 - security of passenger cabin and galley(s)
 - smoking on board
 - take-off conditions
 - application of take-off minimas

- All-weather Operations requirements: Low Visibility
 - Aerodrome Operating Minimas – General
 - Terminology
 - Low Visibility Operations – General operating rules
 - Low Visibility Operations – Aerodrome considerations
 - Low Visibility Operations – Training and qualifications
 - Low Visibility Operations – Operating procedures
 - Low Visibility Operations – Minimum equipment

-Instrument and safety equipment requirements

- general introduction
- circuit protection devices
- windshield wipers
- airborne weather radar equipment
 - flight crew interphone system
- public address system
- internal doors and curtains
- first aid kits
- emergency medical kit
- first air oxygen
- supplemental oxygen – pressurized aeroplanes
 - supplemental oxygen – non-pressurized aeroplanes

- crew protective breathing equipment
- hand fire extinguishers
- crash axes and crowbars
- marking of break-in points
- means for emergency evacuation
- megaphones
- emergency lightings
- automatic emergency locator transmitter
- life jackets
 - life rafts and survival ELTs for extended over-water flights
- survival equipment

-Communication and navigation equipment requirements

- radio equipment VFR
- communication and navigation IFR and VFR

-Aircraft maintenance

-terminology

- application for and approval of the operator's maintenance system
- maintenance management
- quality system
- operator's maintenance management exposition
- operator's aircraft maintenance program
- continued validity of the Air Operator's Certificate in respect of maintenance system

-Flight crew

- flight and duty time limitations and rest requirements (Reserved)

- cabin crew

c) Special Operational Procedures and Hazards (General Aspects)

-Minimum equipment list

-AFM

- Ground de-icing
 - icing conditions
 - definition and recognition, on ground/in-flight
 - de-icing, anti-icing, types of de-icing fluids
 - performance deterioration, on ground/in-flight

- Bird strike risk and avoidance

-Noise abatement

- influence by the pilot (power setting, low drag, low power)

-Fire/smoke

- actions in case of overheated brakes after aborted take-off and landing

-Windshear, microburst

- definition and description

- effects and recognition during departure and approach
- actions to avoid and actions taken during encounter

-Wake turbulence

-cause

-influence of speed and mass, wind

- actions taken when crossing traffic, during take-off and landing

-Security

-unlawful events

- Emergency and precautionary landings operations in various terrain – water (i.e. slopes, mountains, jungle, offshore)

-definition

-cause

- factors to be considered (wind terrain, preparation, flight tactics, landing in various terrain and water)

-passenger information

-evacuation

-action after landing

-Fuel jettisoning

-safety aspects

-legal aspects

- Transport of dangerous goods
 - Annex 18
 - practical aspects
- Contaminated runways
 - kinds of contamination
 - braking action, brake co-efficient
 - performance correction and calculations
- Rotor Downwash
 - operation
 - influence by meteorological conditions i.e. : icing, white out, strong winds, windshear, microburstdownwash

d) Emergency Procedures

by technical problems i.e.

- engine failure
- fire in cabin cockpit engine
- tail/rotor/directional control failure
- ground/resonance
- blade/stall
- setting with power (vortex ring)
- overpitch
- overspeed
- sudden stoppage
- dynamic rollover/mast bumping

3.2 Communications

3.2.1 VFR Communications

a) Definitions

- Meaning and signification of associated terms
- Air Traffic Services abbreviations
- Q-code groups commonly used in RTF air-ground communications
- Categories of messages

b) General Operating Procedures

- Transmission of letters
- Transmission of numbers (including level information)
- Transmission of time
- Transmission of technique

- Standard work and phrases (relevant RTF phraseology included)
- Radiotelephony call signs for aeronautical stations including use of abbreviated call signs
- Radiotelephone call signs for aircraft including use of abbreviated call signs
- Transfer of communication
- Test procedures including readability scale
- Read back and acknowledgement requirements
- Radar procedural phraseology

c) Relevant Weather information terms (VFR)

- Aerodrome weather
- Weather broadcast

d) Action required to be taken in case of communication failure

e) Distress and urgency procedures

- Distress (definition – frequencies – watch of distress frequencies – distress signal – distress message)
- Urgency (definition – frequencies – urgency signal – urgency message)

f) General Principles of VHF Propagation and Allocation of Frequencies

3.2.2 IFR Communications

a) Definitions

- Meaning and significance of associated terms
- Air Traffic Control abbreviations
- Q-code groups commonly used in RTF air-ground communications

b) General Operating Procedures

- Transmission of letters
- Transmission of numbers (including level information)
- Transmission of time
- Transmission of technique

- Standard words and phrases (relevant RTF phraseology included)
- Radiotelephony call signs for aeronautical stations including use of abbreviated call signs
- Radiotelephone call signs for aircraft including use of abbreviated call signs
- Transfer of communication
- Test procedures including readability scale; establishment of RTF communications
- Read back and acknowledgement requirements
- Radar procedural phraseology
- Level changes and reports categories of messages

c) Action required to be taken in case of communication failure

d) Distress and Urgency Procedures

- PAN medical
- Distress (definition – frequencies – watch of distress frequencies – distress signal – distress message)
- Urgency (definition – frequencies – urgency signal – urgency message)

e) Relevant Weather Information Terms (IFR)

- Aerodrome weather
- Weather broadcast

f) General Principles of VFH propagation and allocation of frequencies

g) Morse Code

3.2.3. Radio Telephony

- a) radiotelephony procedures (1 hr):
- b) phraseology as applied to VFR operations (1 hr);
- c) action to be taken in case of communication failure(1 hr).

APPENDIX D-5

HELICOPTER & ENGINE - TECHNICAL GENERAL

THE SYLLABUS OF HELICOPTER AND ENGINE – TECHNICAL GENERAL AS FOLLOWS :

1. Helicopter & Engine – Technical General

1.1 Airframe and Systems - Helicopter

- a) Helicopter configurations
 - single rotor
 - tandem rotor
 - coaxial rotor
 - side by side rotor

- b) Controls and rotors
 - Control systems
 - types
 - components
 - adjustments
 - primary controls (cyclic, collective, directional)

 - Rotorheads
 - types
 - components
 - material

 - Tailrotors/ Notor
 - types
 - components
 - material

 - Blades
 - types
 - section
 - construction
 - material
 - adjustment

 - Control surfaces
 - vertical horizontal
 - construction
 - material

- c) Fuselage
 - types of construction
 - structural components, materials, limitations

- d) Cockpit and Cabin
 - construction
 - structural limitations

- e) Landing Gear
 - types e.g. floats, skids, wheels, etc.

 - construction
 - locking devices and emergency extension systems
 - accidental retraction prevention devices
 - position, movement lights and indicators
 - braking systems
 - construction
 - parking brake
 - operation, indications and warning systems

- f) Transmission systems
 - Drive shafts
 - types
 - components
 - material

 - Gearboxes
 - types
 - construction
 - material
 - lubrication
 - indications

 - Clutches
 - types
 - components

 - Free wheeling
 - types
 - components

- g) Rotorbrake
 - components

 - construction

- h) Inspection

- vibration
- balancing
- tracking

i) Hydraulics

- Basics principles of hydromechanics
- hydraulic fluids
 - schematic construction and functioning of hydraulic systems

-Hydraulic systems

- main, standby and emergency system
- operation, indicators, warning system
- ancillary system
- auxiliary systems

j) Air driven systems

-Pneumatic system

- power sources
- schematic construction
- potential failures, safety devices
- operation, indicators, warning systems

-pneumatic operated systems

- Air conditioning systems

- construction, functioning, operation, indicators and warning devices
- heating and cooling
- temperature regulation - automatic and manual
- ram air ventilation

k) De-ice and Anti-ice Systems

- schematic construction, functioning and operation of
- air intake
- rotors (main tail rotor)
- pitot, static pressure sensor
- windshield
- control surfaces (horizontal stabilizer)
 - rain repellent system
 - ice warning systems

- l) Fuel system
 - Fuel tanks (main and auxiliary)
 - structural components and types
 - location of tanks on single-and-multi-engine aircraft
 - sequence and types of re-fuelling
 - unusable fuel
 - crashworthiness
 - Fuel feed
 - gravity and pressure feed
 - crossfeed
 - schematic construction
 - Fuel Dumping System
 - Fuel system monitoring
 - operating, indicators, warning systems
 - fuel management (sequencing of fuel tank switching)
dip stick

2. Electrics

- a) Direct Current (DC)); Direct /Alternating Current (DC/AC) (IR)
 - General
 - electric circuits
 - voltage, current, resistance
 - Ohm's law
 - resistive circuits
 - resistance as a function and temperature
 - electrical power, electrical work
 - fuses (function, type and operation)
 - the electrical field
 - the capacitor (function) system, shock absorbers)
 - Batteries
 - types, characteristics
 - capacity
 - uses
 - hazards
 - Magnetism
 - permanent magnetism
 - electromagnetism:
 - relay, circuit breaker, solenoid valve (principle, function and applications)
 - electromagnetic power
 - electromagnetic induction

- Generators
 - alternator:
 - principle, function and applications
 - monitoring devices
 - regulation, control and protection
 - modes of excitation
 - starter generator
- Distribution
 - current distribution (buses)
 - monitoring of electrical flight instruments/systems:
 - ammeter, voltmeter
 - annunciators
 - electrical consumers
 - DC power distribution:
 - construction, operation and system monitoring
 - elementary switching circuits
- Inverter (applications)
- The aircraft structure as an electrical conductor

b) Alternating Current (AC)

- General
 - single and multi-phase AC
 - frequency
 - phase shift
 - AC components
- Generators
 - 3-phase generator
 - brushless generator (construction and operation)
 - generator drive:
 - constant speed drive
 - integrated drive
 - AC power distribution
 - construction, operation and monitoring
 - protection circuits, paralleling of AC-generators
- Transformers
 - function
 - types and applications
- Synchronous and asynchronous motors
- Transformer/rectifier units

- c) Semiconductors
 - principles of semiconductors
 - semiconductor resistors (properties and application)
 - rectifier (function and application)
 - transistor (function and application)

- d) Basic knowledge of computers
 - Logic circuits
 - Logical symbols
 - Switching circuits and logical symbols

- e) Basic radio propagation theory
 - Basic principles
 - electromagnetic waves
 - wave length, amplitude, phase angle, frequency
 - frequency bands, sideband, single sideband
 - pulse characteristics
 - carrier, modulation, demodulation
 - kinds of modulation (amplitude, frequency, pulse, multiplex)
 - oscillation circuits

 - Antennas
 - characteristics
 - polarization
 - types of antennas

 - Wave propagation
 - ground waves
 - space waves
 - propagation with the frequency bands
 - frequency prognosis (MUF)
 - fading
 - factors affecting propagation (reflection, absorption, interface, twilight, shoreline, mountain, static)

3. Power Plant

- a) Piston Engine
 - General
 - design types
 - principles of the 4-stroke internal combustion engine
 - mechanical components

 - lubrication system
 - function

- schematic construction
- monitoring instruments and indicators
- lubricants

- Air Cooling
 - system monitoring
 - cylinder head temperature
 - cowl flaps

- Ignition
 - systematic construction and function
 - types of ignition
 - magnetic check

- Engine fuel supply
 - carburetor (construction and mode of operation, carburetor icing)
 - fuel injection (construction and mode of operation)
 - alternate air

- Engine performance
 - pressure/ density altitude
 - performance as a function of pressure and temperature

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

- Fuel
 - types, grades
 - detonation characteristics, octane rating
 - colour coding
 - additives

 - water content, ice formation

 - fuel density

 - alternate fuels, differences in specification, limitations

- Mixture
 - rich and lean mixture
 - maximum power and fuel economy mixture setting

- Engine handling and manipulation
 - power setting, power range
 - mixture setting
 - operational limitations

- Operational criteria
 - maximum and minimum RPM
 - (induced) engine vibration and critical RPM

- remedial action by abnormal engine start, run-up and in-flight

b) Turbine Engine

- principles of operation
- types of construction
- turboprop
- turbojet
- turbofan

c) Engine construction

- Air inlet
- function

- Compressor
 - function
 - construction and mode of operation
 - effects of damage
 - compressor stall and surge (cause and avoidance)
 - compressor characteristics

- Diffuser
 - function

- Combustion chamber
 - function, types and working principles
 - mixing ratios
 - fuel injectors
 - thermal load

- Turbine
 - function, construction and working principles
 - thermal and mechanical stress
 - effects of damage
 - monitoring of exhaust gas temperature

- Pressure, temperature and airflow in a turbine engine

- Bleed air
 - effect of use of bleed air on thrust, exhaust temperature, RPM and pressure ration

- d) Engine systems
 - Ignition
 - function, types, components, operation, safety aspects

 - Starter
 - function, type, construction and mode of operation
 - control and monitoring

 - self sustaining and idle speeds

 - Engine start malfunctions
 - cause and avoidance

 - Fuel system
 - schematic diagrams, components
 - operation and monitoring
 - malfunctions

 - Lubrication
 - construction, components
 - operation and monitoring
 - malfunctions

 - Fuel
 - effects of temperature
 - impurities
 - additives

 - Power plant operation and monitoring

 - Power
 - power sharing engines
 - function of density
 - flat rated engine

- e) Auxiliary Power Unit (APU)
 - General
 - function, types

- location
- operation and monitoring

1.4 Emergency Equipment

- a) Doors and emergency exits
 - evacuation slides, general usage or as life rafts or flotation devices
- b) Smoke detection
 - location, indicators, function test
- c) Fire detection
 - location, warning mode, function test
- d) Fire fighting equipment
 - location, operation, contents, gauge, function test
- e) Aircraft oxygen equipment
 - drill, use of equipment in case of rapid decompression
 - oxygen generators
- f) Hydraulic systems
 - components, fluids
 - operation, indication, warning systems
 - auxiliary systems
- g) Emergency equipment
 - portable, hand-held fire extinguisher
 - smoke mask, smoke protection hood
 - portable oxygen system
 - emergency locator beacon, transmitter
 - life jacket, life raft
 - pocket lamp, emergency lighting
 - megaphone
 - cash axe
 - fireproof gloves
 - emergency flotation system

2. Principles of Flight - Helicopters

2.1 Subsonic Aerodynamics

- a) Basics Laws and Definitions
 - Components of aircraft
 - Aircraft configuration
 - Units of measurement of
 - length
 - area
 - volume
 - velocity

- mass
- pressure
- temperature
- density
- force
- power
- energy

- Terms used to describe aerodynamic phenomena
- Reference speeds
- Abbreviations

b) Deviation of lift

- equation of continuity
- Bernoulli's Theorem
- streamline flow
- angle of attack
- pressure distribution about a wing (transverse and longitudinal)
- centre of pressure xx
- airfoil shape (plan and section) and its effect on lift
- lift formula
- lift/ drag ratio

c) Drag

- profile drag
 - causes
 - variation with speed
 - methods of minimizing it

- induced drag
 - causes
 - vortices
 - variation with speed
 - design factors affecting it

- total effect of the combination of profile and induced Drag

d) Distribution of forces

- lift/ weight and thrust/drag couples
- necessity to achieve balance
- methods of achieving balance

e) Stability

- aircraft axes and planes of rotation
- static stability
- dynamic stability
- effects of design features on stability
- inter-action between stability in different planes
- effect of altitude/ speed on stability
- roll and yaw dampers rotor thrust, H-force

- f) Flying controls
 - the three planes
 - pitching about the lateral axis
 - rolling about the longitudinal axis
 - yawing about the normal axis
 - effects of cyclic, collective and rudder pedal inputs
 - stabilizer and rudder
 - control in pitch, roll and yaw
 - cross coupling, roll and yaw
 - effect of rotor configuration on control power

- g) Blade-stall
 - angle of attack
 - boundary layer and reasons for stalling
 - variation of lift and drag in the stall
 - movement of the centre of pressure

- h) Transonic effects on blades
 - shock waves
 - the reasons for their formation at subsonic speed
 - their effect on the handling and operation of the helicopter

- i) Limitations
 - manoeuvring and gust envelope

- j) Performance degradation
 - adverse on performance due to profile contamination
 - icing
 - rain
 - modification to and condition of the airframe

3. Helicopter Aerodynamics

- a) The helicopter and associated terminology
 - comparison with fixed wing and autogiro
 - plane of rotation
 - axes of rotation
 - rotor shaft axis
 - tip path plane
 - rotor disc
 - disc loading
 - blade loading

b) The forces diagram and associated terminology

- pitch angle
- rotational airflow
- induced airflow
- relative airflow to the blade
- angle of attack
- drag-blade
- total reaction – blade
- rotor thrust
- rotor drag
- torque
- weight

c) Uniformity of rotor thrust along blade span

- blade twist
- taper
- coning angle
- centrifugal force
- limits of rotor RPM
- centrifugal turning moments

d) Helicopter Controls

- collective lever
- collective pitch changes
- relationship with rotor thrust and rotor drag

- cyclic stick
- cyclic pitch changes
- rotor disc attitude
- rotor thrust tilt

- yaw pedals
- fuselage torque
- tail rotor drift
- tail rotor roll
- fenestron tail
- tandem rotors
- co-axial rotors
- notar

e) Rotor blade freedom of movement

- feathering
- the feathering hinge
- pitch angle

- flapping

- the flapping hinge
- alleviation of bending stresses
- flapping to equally

- dragging
- the drag hinge
- drag dampers
- leading/ lagging
- periodic drag changes
- blade c.g. (conservation of angular momentum)
- hookes joint effect

f) Phase lag and advance angle

- the control orbit
- pitch operating arm movement
- rate of pitch change
- rate of blade flapping
- resulting disc altitude
- phase lag definition
- advantage angle – definition

g) Vertical flight

- take-off
- vertical climb
- vertical descent
- hover outside ground effect
- ground effect
- factors affecting ground cushion
- dynamic roll-over avoidance of

h) Forces in balance

- at the hover
- in forward flight
- influence of cg
- influence of rotor shaft tilt

i) Translational lift

- effect of horizontal airflow on induced flow
- variation of total flow through the disc with forward flight
- the relationship between pitch angle and angle of attack

j) Power Requirements

- rotor profile power
- power absorption – tail rotor and ancillary equipment
- rotor profile power variation with forward speed
- induced drag
- parasite drag

- total power required
- power available

k) Further aerodynamics of forward flight

- transition from and to the hover
- symmetry and asymmetry of rotor thrust
- main rotor flapback
- total rotor flapback and methods of removal
- factors affecting maximum forward speed
 - design limits of cyclic stick
 - airflow reversal
 - retreating blade stall
 - symptoms and recovery actions
 - compressibility
 - flow separation
 - shock stall
 - 'G' stall

l) Factors affecting cyclic stick limits

- all up mass (AUM)
- density altitude
- cg position

m)The flare – power flight

- thrust reversal
- effect on aircraft attitude
- increase on rotor thrust
- decrease in rotor drag
- increase in rotor RPM
- effect of deceleration

n) Setting with power (vortex ring)

- tip vortices
- comparison induced flow and external flow
 - development
 - change in relative airflow along blade span
 - root stall and turbulence

o) Blade sailing

- rotor RPM and blade rigidity
- effect of adverse wind
- minimizing the danger

p) Vertical

- rate of descent airflow
- effective airflow
- relative airflow
- inflow and inflow angle
- autorotative force
- rotor drag
- effect of mass and altitude
- control of rotor RPM with lever
- rotor RPM stability

q) Autorotation – forward flight

- Factors affecting inflow angle
- effect of forward speed on rate of descent
- asymmetry of autorotative disc area in forward flight
- turning
- the flare
- rotor RPM increase from movement of autorotative selection
- increase in rotor thrust
- reduction in rate of descent
- range and endurance
- autorotative landing
- height/ velocity avoidance graph / deadmans curve

r) Stability

- hover
- forward flight
- rearward flight
- stability aids
- stabilizers and effects of centre of gravity
- gyro controlled stabilizer system
- stabilizer bars
- delta hinge effect
- effect of lever application on attitude in translational flight

s) Control power

- the teetering head
- fully articulated head
- the rigid rotor
- effect on stability
- effect dynamic/ static rollover

t) Power requirements - graphs

- power required/ power available graph
- maximum rate of climb speed

- operating with limited power
- best angle of climb speed
- maximum speed
- range and endurance
- over-pitch
- over-torque
- turning
- comparison of piston and turbine engine helicopters
 - range and endurance
 - effect of density altitude
 - effect of aircraft weight

FLYING TRAINING SYLLABUS FOR ISSUE OF PPL(H)

S. No.	EXERCISE	NO. OF SORTIES		DUAL	TOTAL DUAL	PIC/ SOLO	TOTAL PIC/ SOLO	GRAND TOTAL
		DUAL	PIC/ SOLO					
1	Cockpit familiarization, external checks, pre-starting checks, engine start up, warm up & run down procedure. Preparation for flight and action after.	On Ground		-	-	-	-	-
2	Familiarization (circuit leaving, local flying area) effect of cyclic, collective, rudder & engine controls. Further effects of cyclic & rudder. Circuit rejoining (race course pattern) Air field layout.	1	-	00:45	00:45	-	-	00:45
3	Circuit leaving, climb & climbing turns, level flight & level turns, descending & descending turns & circuit rejoining.	2	-	02:00	02:45	-	-	02:45
4	Effects of control while hovering (cyclic, rudder & collective) Further, effect of cyclic & rudder effect of wind on hovering.	2	-	01:30	04:15	-	-	04:15
5	Hovering & landing, Forward sideways, backward fights & turning on the spot. Square pattern on ground.	3	-	02:15	06:30	-	-	06:30
6	Repeat Ex. 5, Take off, Standard circuit, approach hover landing.	5	-	05:00	11:30	-	-	11:30

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7	Repeat Ex. 6, Auto Rotation (Symptoms of engine failure, immediate action to be taken, auto rotative flight, effect of wind air speed & collective on Auto rotative flight demonstration of flare height flare and landing/ overshoot).	3	-	03:00	14:30	-	-	14:30
8	Repeat Ex. 7, Quick stop, hovering, takeoff, circuit, normal approach & hover landings. Engine failure at varying height and IAS.	3	-	03:00	17:30	-	-	17:30
9	First solo check & I solo	1	1	00:45	18:15	00:30	00:30	18:45
10	Dual check & Second Solo	1	1	00:45	19:00	00:45	01:15	20:15
11	Dual check & Third Solo	1	1	00:45	19:45	00:45	02:00	21:45
12	Fourth solo	-	1	-	19:45	01:00	03:00	22:45
13	Consolidation	1	4	00:45	20:30	04:00	07:00	27:30
14	PN	2	-	04:00	24:30	-	07:00	31:30
15	Circuit & Landing consolidation	-	3	-	24:30	03:00	10:00	34:30
16	PN	-	2	-	24:30	04:15	14:15	38:45
17	Skill Test/ PC solo	-	2	-	24:30	01:15	15:30	40:00

FLYING TRAINING SYLLABUS FOR ISSUE OF CPL(H)

S. No.	EXERCISE	NO. OF SORTIES		DUAL	TOTAL DUAL	PIC	TOTAL PIC	GRAND TOTAL
		DUAL	PIC					
1	Cockpit familiarization, external checks, pre-starting checks, engine start up, warm up & run down procedure. Preparation for flight and action after.	On Ground		-	-	-	-	-
2	Familiarization (circuit leaving, local flying area) effect of cyclic, collective, rudder & engine controls. Further effects of cyclic & rudder. Circuit rejoining (race course pattern) Air field layout.	1	-	00:45	00:45	-	-	00:45
3	Circuit leaving, climb & climbing turns, level flight & level turns, descending & descending turns & circuit rejoining.	2	-	02:00	02:45	-	-	02:45
4	Effects of control while hovering (cyclic, rudder & collective). Further, effect of cyclic & rudder effect of wind on hovering.	2	-	02:00	04:45	-	-	04:45
5	Hovering & landing, forward sideways, backward flights & turning on the spot. Square pattern on ground.	3	-	02:15	07:00	-	-	07:00
6	Repeat Ex. 5, Take off, Standard circuit, approach hover landing.	3	-	05:00	12:00	-	-	12:00
7	Repeat Ex. 6, Auto Rotation (Symptoms of engine failure, immediate action to be taken, auto rotative flight, effect of wind air speed & collective on Auto	3	-	03:00	15:00	-	-	15:00

CIVIL AVIATION REQUIREMENTS

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	rotative flight demonstration of flare height flare and landing/ overshoot).							
8	Repeat Ex. 7, Quick stop, hovering, takeoff, circuit, normal approach & hover landings. Engine failure at varying height and IAS.	5	-	05:00	20:00	-	-	20:00
9	Check flight & PIC	1	1	00:45	20:45	00:30	00:30	21:15
10	Dual check & Second PIC	1	1	00:45	21:30	00:45	01:15	22:45
11	Dual check & Third PIC	1	1	00:45	22:15	00:45	02:00	24:15
12	Fourth PIC flight	1	1	00:45	23:00	01:00	03:00	26:00
13	PC	1	-	01:00	24:00	-	03:00	27:00
14	Consolidation	1	8	01:00	25:00	08:00	11:00	36:00
15	PN	3	7	06:30	31:30	-	11:00	42:30
16	PC	1	-	03:00	34:30	-	11:00	45:30
17	PN	-	-	-	34:30	06:00	17:00	51:30
18	IF	-	-	10:00	44:30	-	17:00	61:30
19	Navigation	2	8	06:00	50:30	24:00	41:00	91:30
20	Max Power/ steep app	6	6	06:00	56:30	06:00	47:00	103:30
21	Restricted and sloppy area Op	3	-	03:00	59:30	-	47:00	106:30
22	Advanced GF (180 & 200 speed auto, Max load Op)	8	14	08:00	67:30	14:00	61:00	128:30
23	IF	-	-	10:00	77:30	-	61:00	138:30
24	NF	6	3	05:00	82:30	03:30	64:30	147:00
25	Skill test Day and C & L PIC	-	2	-	82:30	01:30	66:30	148:30
26	Skill test Night and Night PIC	-	2	-	82:30	01:30	67:30	150:00

AIRLINE TRANSPORT PILOT LICENCE (HELICOPTER)

A pilot applicant shall have received the dual flight instructions required for the issue of the commercial pilot licence (helicopter) and for the issue of Instrument Rating (helicopter) and acquired flight experience as required in para 1(e) of Section N of Schedule-II of the Aircraft Rules 1937.

The pilot applicant shall have demonstrated the ability to perform as Pilot-in-Command of a helicopter, the following procedures and manoeuvres:

- a) pre-flight procedures, including the preparation of the operational flight plan and filing of the air traffic services flight plan;
- b) normal flight procedures and maneuvers during all phases of flight;
- d) abnormal and emergency procedures and maneuvers related to failures and malfunctions of equipment, such as power plant, systems and airframe; and
- e) procedures for crew incapacitation and crew coordination including allocation of pilot tasks, crew cooperation and use of checklists in case of multi-pilot helicopters.

The pilot shall demonstrate the ability to perform the above procedures and maneuvers with a degree of competency appropriate to the privileges granted to the holder of an Airline Transport Pilot Licence (Helicopter).

APPENDIX 'H'

FLYING TRAINING SYLLABUS FOR ISSUE OF CPL(H) FOR THE PILOTS HOLDING CPL(A) WITH 500 HRS PIC

S. No.	EXERCISE	NO. OF SORTIES	DUAL	TOTAL DUAL	PIC	TOTAL PIC	GRAND TOTAL
1	Cockpit familiarization, external checks, pre-starting, engine start up, warm up & run down procedure.	On Ground	-	-	-	-	-
2	Air experience familiarization (circuit leaving, local flying area) effect of cyclic, collective, rudder & engine controls. Further effects of cyclic & rudder. Circuit rejoining (race course pattern) Air field layout. Circuit leaving, climbing & level turns, descend & descending turns & circuit rejoining.	1	00:45	00:45	-	-	00:45
3	Effects & further effects of control, effect of wind on hovering.	1	00:45	01:30	-	-	01:30
4	Hovering & landing, forward sideways, backward flights & turning on the spot.	2	01:30	03:00	-	-	03:00
5	Repeat Ex. 4, Take off, Standard circuit, approach hover landing and quick stops.	1	01:00	04:00	-	-	04:00
6	Hovering, take off, circuit, normal approach and hover landings, quick stop, engine failure at varying height and IAS. Straight-in auto rotation.	1	01:00	05:00	-	-	05:00
7	Check flight	1	01:00	06:00	-	-	06:00
8	First PIC flt (hovering, normal take off circuit approach & landings)	1	-	06:00	00:30	00:30	06:30
9	Repeat S.No. 7. Second PIC flt as in 8	2	00:30	06:30	00:40	01:15	07:45
10	Repeat S.No. 8. Third PIC flt	1	-	06:30	01:00	02:15	08:45
11	4 th PIC flight as in 8	1	-	06:30	01:00	03:15	09:45
12	Hovering, Take off normal max. power & restricted power, take off	4	00:45	07:15	04:45	08:00	15:15

CIVIL AVIATION REQUIREMENTS**SERIES 'B' PART IX****SECTION 7****16TH JUNE, 2011**

	normal, steep approach. No. hover & restricted power landing. Solo C& L						
13	Navigation	4	01:00	08:15	07:00	15:00	23:15
14	Unfamiliar Ground Landing & General Flying	6	-	09:00	05:00	20:00	29:00
15	Night flying	1	01:00	10:00	-	20:00	30:00
16	Skill Test (Day)		00:45				

Note:

1. The flying hours shown in the syllabus are considered as the bare minimum to attain the required proficiency and may have to be increased if the progress of the pupil is slow.
2. During every dual sortie a minimum of one emergency will be demonstrated/ practiced/ revised.
3. Exercise and flying times shown above may be increased or decreased for each student independently depending on the progress and proficiency of the respective student, and to regain currency in case there been a break in flying.