नेपाल नागरिक उड्डयन प्राधिकरण

प्राविधिक सेवा, एयरवर्दिनेश समूह, सातौं तह, वरिष्ठ अधिकृत पदको खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्रः सेवा सम्बन्धी

खण्ड (क) - ५० अङ्क

1. **Materials and Parts**
   - 1.1. Sheet Metal: Sheet metal marking and calculation of bend allowance, Sheet metal working: bending and forming, Inspection of sheet metal work
   - 1.2. Corrosion: Types of corrosion and their identification, Causes of corrosion, Material types, Susceptibility to corrosion
   - 1.3. Aircraft Materials (Composite and Metallic): The detection of defects/deterioration in composite and non-metallic material, Repair of composite and metallic material, Bonding practices and Environmental condition

2. **Airframe Structures**
   - 2.1. Fuselage: Construction and pressurization sealing, Wing, Stabilizer, Pylon and undercarriage attachments, Seat installation and cargo loading system, Doors and emergency exits, Windows and windscreen
   - 2.2. Wings: Construction of wings, Fuel storage, Control surface and high lift/drag attachments
   - 2.3. Stabilizers: Construction, Control surface attachment
   - 2.4. Nacelles/Pylons: Construction, Firewalls, Engine mounts
   - 2.5. Airframe Construction methods: Stressed skin fuselage, stringers, longerons, bulkheads, frames, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, empennage and engine attachments

3. **Aerodynamics**
   - 3.1. Aerodynamics: Airflow around a body, Boundary layer, Laminar and turbulent flow, Free stream flow, Relative airflow, Upwash and downwash, Vortices, Stagnation
   - 3.2. Aerodynamics terms: Camber, Chord, Aerodynamic mean chord, Profile (parasite) drags, Angle of attack, Wash in and wash out, Fineness ratio, Thrust, Aerodynamic resultant
   - 3.3. Lift and Drag generation: Angle of attack, Lift coefficient, drag coefficient, Polar curve, Stall, Aero-foil contamination

4. **Aircraft Flight Controls**
   - 4.1. Theory of Flight: Relationship between Lift, Weight, Thrust and Drag, Steady state flights and performance
   - 4.2. Influence of load factor: Flight envelope, Structural limitation, Lift augmentation
   - 4.3. Flight Stability and Dynamics: Longitudinal, Lateral and Directional stability
   - 4.4. High-Speed Flight: Speed of sound, Subsonic flight, Transonic flight, Mach number, Critical Mach number, Effects of sweepback on critical Mach number
   - 4.5. Operation effect: Roll control, Pitch control, Yaw control, Control using elevons and rudder
   - 4.6. High lift devices: Slots, slats, flaps, flaperons
   - 4.7. Drag devices: Spoilers, lift dumpers, speed brakes
   - 4.8. Effects of wing fences: Saw tooth leading edges, Boundary layer control using vortex generator, Stall wedges or leading-edge devices, Operation effect of trim tabs, Balance and anti-balance (leading) tabs, servo tabs

5. **Air Conditioning and Pressurization:**
   - 5.1. Heating and venting system for pressurized and unpressurized aircraft: Cabin pressurization principles, structure requirements, system layouts

5.2. Air sources: Types of compressors and blowers, air bleeds, Silencers and coolers
5.3. Flow and pressure control: Flow control valves, pressure controllers, out-flow valves, sensing and control devices
5.4. Temperature and humidity control: Heat sources- compression, combustion heaters
5.5. Cooling system: Heat exchange, air cycle coolers, vapor cycle coolers, Humidifiers, Temperature sensing and control system, Protection and warning devices

6. **Landing Gear System**
6.1. Type of Landing Gear: Tail wheel, tricycle, fixed, retractable, Shock struts principle and type
6.2. Wheels and tires: Types, construction, sizes, inspection
6.3. Brakes: Brake mechanisms, heat dissipation, anti-skid and auto braking system
6.4. Anti-shimmy, Nose-wheel steering
6.5. Retracting mechanisms: Geometry, construction, actuation, locking, doors and position indication
6.6. Extension and retraction system: Normal and emergency
6.7. Indications and warning: Air-ground sensing, Landing gear servicing

7. **Aircraft Systems**
7.1. Fuel System: Fuel system lay-out, Fuel tanks, Fuel supply system, Fuel dumping system, Fuel venting and draining, Fuel cross-feed and transfer, Fuel indication and warning system, Longitudinal balance fuel system
7.2. Hydraulic System: Hydraulic system lay-out, Hydraulic fluids, Hydraulic reservoirs and accumulators, Hydraulic pressure generation: Electric, mechanical, pneumatic, Emergency pressure generation, Hydraulic pressure control, Hydraulic power distribution, Hydraulic indication and warning system
7.3. Pneumatic System: Pneumatic system layout, cockpit, cabin sources, storage, Charging and distribution, Check valves and Pressure Regulating Valves, Indication and warning system
7.4. Ice and Rain Protection System: Ice formation, classification and detection, Anti-icing system: electrical, hot air and chemical system, De-icing system: Electrical, hot air, Pneumatic and chemical system, Rain repellant, Probe and drain heating system, Wiper system
7.5. Oxygen: System layout, cockpit, cabin, sources, charging and distribution, Indication and warning system

8. **Aircraft Performance**
8.1. Determining factors of aircraft performance: Aircraft weight, atmospheric conditions, pressure, temperature, humidity, runway at takeoff
8.2. Performance factors: Takeoff and landing distance, rate of climb, ceiling, payload, range, speed, maneuverability, stability, and fuel economy
8.3. Calculation of aircraft performance chart: Takeoff, climb, ceiling range, endurance of aircraft, descent, and landing
8.4. Aircraft Weight and Balance: Centre of gravity / Balance limits calculation, preparation of aircraft for weighing, aircraft weighing requirement

9. **Helicopter**
9.1. Helicopter structure: Loads and stresses on rotors, fuselage and tail structure
9.2. Rotorcraft flight: Liftoff, ground effect, hover, climb, descent, the transition from hover to forward flight and forward flight to hover
9.3. Rotors: Types of blades and hubs, trimming and balancing devices, tail rotors
9.4. Helicopter Controls: Collective pitch, cyclic pitch and directional control, power boosting of control system, rigging of control system

खण्ड (ख) - ५० अङ्क

10. **Gas Turbine Engine**
    - 10.1. Fundamentals: Constructional arrangement and operation of turbojet, turbofan, turboshaft, and turboprop
    - 10.2. Engine Inlet: Compressor inlet ducts, effects of various inlet configurations, ice protection
    - 10.3. Compressors: Axial and centrifugal types, constructional features, fan balancing, Compressor operation: Causes and effects of compressor stall and surge, Methods of air flow control: Bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades, compression ratio
    - 10.4. Combustion Section: Constructional features and principles of operation
    - 10.5. Turbine Section: Operation and characteristics of different turbine blade types, blade to disk attachment, nozzle guide vanes, causes and effects of turbine blade stress and creep
    - 10.6. Exhaust: Constructional features and principles of operation, convergent, divergent and variable area nozzles, engine noise reduction, thrust reversers
    - 10.7. Engine lubrication system: System operation/layout and components,
    - 10.8. Engine fuel system: System operation/layout and components
    - 10.9. Air system: Operation of engine air distribution, anti-ice control system, internal cooling, sealing and external air services
    - 10.10. Engine starting and ignition system: Operation of engine start system and components, ignition system and components, maintenance safety requirements
    - 10.11. Engine indication system, engine power augmentation system, engine fire protection system

11. **Propeller System**
    - 11.1. Propeller System: Blade element theory, high/low blade angle, reverse angle, angle of attack, rotational speed, aerodynamic centrifugal and thrust forces, torque, relative airflow on blade angle of attack, vibration and resonance
    - 11.2. Construction: Propellor construction method and materials used in wooden, composite and metal propellers, blade station, blade back and hub assembly, fixed pitch, controllable pitch, constant speeding propeller, propeller/spinner installation
    - 11.3. Propeller Pitch Control: Speed control and pitch change methods, mechanical and electrical/electronic control, feathering and reverse pitch, overspeed protection
    - 11.4. Propeller Maintenance: Static and dynamic balancing, blade tracking, assessment of blade damage, erosion, corrosion, impact damage, and delamination, propeller treatment/repair schemes

12. **Aircraft Electrical System**
    - 12.1. Theory of magnetism: Properties of a magnet, earth's magnetic field, magnetization and demagnetization, magnetic shielding, various types of magnetic material, electromagnet construction and principle of operation
    - 12.2. DC System: Construction and chemical action of primary cells, secondary cells, lead acid cells, nickel-cadmium cells, lithium-ion cells, cells connected in series and parallel, operation of photovoltaic cells, calculation of total resistance using series and parallel, operation and function of a capacitor, capacitor types
    - 12.3. AC Power Supply: Aircraft alternator, single-phase and three-phase, alternator drivers, constant speed devices, frequency-wild system
    - 12.4. DC Power Supply: Aircraft generator, solid state control device, voltage regulation and fault protection
    - 12.5. DC Motor/Generator: Basic motor and generator theory, construction of DC generator, factors affecting output and direction of current flow in DC generator, output power, torque, speed and

rotation of DC motors, series wound, shunt wound and compound motors, starter generator construction

12.6. AC Generator and AC Motor: Rotation of magnetic field, operation and construction of revolving armature and revolving field type AC generator, single phase, two phase and three phase alternators, permanent magnet generators, construction, principles of operation and characteristics of AC synchronous and induction motors

13. **Aircraft Instrument System**

13.1. Atmosphere pressure measuring device and system, Pitot static system, Altimeters, Vertical speed indicator, Airspeed indicator, Machmeter, Altitude reporting/alerting system, Air data computers, Instrument pneumatic system, Direct reading pressure and temperature gauge, Temperature indicating system, Fuel quantity indicating system, Accelerometer, Gyroscope, Artificial horizons, Slip indicator, Directional gyro, TCAS, TWAS, GPWS, Compass system, Flight Data Recorder (FDR), Electronic Flight Instrument System, Stall warning system and angle of attack indicating system, Vibration measurement and indication

14. **Communication and Navigation**

14.1. Radio wave propagation, antennas, transmission lines, communication, receiver and transmitter, Radiofrequency amplifier, Audio frequency amplifier, measurement of signal/ noise ratio, sensitivity, distortion and output, Transponder system, Radio Navigation system, Satellite Navigation system, Radar System, Aircraft weather radar system, Radio altimeter, VHF, HF, ELT, CVR, VOR, DME, ADF, ILS, MLS, RNAV, PBN, GNSS, GLS/GBAS

15. **Aircraft Inspection and Maintenance**

15.1. Safe aircraft maintenance working practice, Precautions when working with electricity, gases, especially oxygen, oils and chemical, Aircraft taxiing/towing and associated safety precautions, Aircraft jacking, chocking, securing and associated safety precautions, Aircraft storage methods, Re-fueling/de-fueling procedures, Electrical, hydraulic and pneumatic ground supplies, Effects of environmental conditions on aircraft handling, Fire Protection**:** Fire and smoke detection and warning system, Fire extinguishing system, Portable fire extinguisher

15.2. Continuing Airworthiness, Aircraft Modification, Airworthiness Directives, Service Bulletin, Maintenance planning, Types of aircraft defects, Visual inspection techniques, Corrosion assessment, removal and reprotection, General repair methods, Aircraft aging, Fatigue and corrosion control programs, Non-destructive inspection techniques: penetrants, radiographic, eddy current and ultrasonic, Specialized aircraft inspection: borescope inspection and tap test

16. **Human Factors**

16.1. The human factor in aircraft maintenance: incidents attributable to human factors, safety culture / organizational culture, Human error, types of error in maintenance tasks, error models and theories, Implications of errors, Avoiding and managing errors, Violations, Human reliability, implications of errors, avoiding and managing errors

16.2. Human performance and limitations: Vision, Hearing, Information-processing, Attention and perception, Situational awareness, Memory, Claustrophobia and physical access, Motivation, Fitness/Health, Stress, Workload management, Fatigue, Alcohol, Medication, Drugs, Physical work, Repetitive tasks

17. **Miscellaneous**

17.1. ICAO Overview, ICAO Annex 6,7,8, 16 and 19, ICAO Doc 9760

17.2. Safety Management System

17.3. Human Factor in Maintenance

17.4. Aircraft Incident & Accident Investigation
17.5. Aircraft Leasing
17.6. Nepalese Civil Airworthiness Requirements (NCAR)
17.7. Air Operator Certificate Requirement (AOCR)

द्वितीय पत्रको लागि निम्नानुसार प्रश्न सोधिने छ :

द्वितीय पत्र (विषयगत)				
विषय	**खण्ड**	**अङ्कभार**	**छोटो उत्तर**	**लामो उत्तर**
सेवा सम्बन्धी	**(क)**	५०	२ प्रश्न X ५ अङ्क = १०	४ प्रश्न X १० अङ्क = ४०
	(ख)	५०	२ प्रश्न X ५ अङ्क = १०	४ प्रश्न X १० अङ्क = ४०
जम्मा		**१००**	४ प्रश्न X ५ अङ्क = २०	८ प्रश्न X १० अङ्क = ८०