

Nepal Airlines Corporation
Syllabus for Senior AME (Avionics) Grade VIII
Aircraft Maintenance Service
Internal Competition

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Subject: Service Related
Time: 2 Hours

Full Marks: 100
Pass Marks: 40

No. of Questions – 4 Subjective Questions each of 10 marks = 40 Marks
60 Objective Questions each of 1 mark = 60 Marks

(Note: Maximum time for objective questions will be 1 Hour. The subjective questions will be provided only after submission of objective answer sheet)

All answers must be written in Black letters
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Part I **Management (10 Marks Subjective Questions)**

- a) Management concepts and principles. Organizational behavior, management level and function, managerial roles, importance of management. motivation and leading people(leadership), personnel management.
- b) History of NAC
- c) Quality assurance, quality control, production system and planning, forecasting techniques.
- d) NAC Service rule, 2058 about performance, reward and punishment ,Leave etc.
- e) NAC Financial rule.(By Laws).
- f) Understanding of the rules and authority. (Tendering procedures of Public Procurement Act and Rules).

Part II **Human Factors (10 Marks Subjective Questions)**

- a) General; Need to take Human Factor into account, incidents attributable to human factor/human error, Murphy's law.
- b) Human factor performance and limitations, vision, hearing, information processing; attention & perception; memory, claustrophobia & fear of heights.
- c) Social psychology, social environment, responsibility individual & group; motivation and de-motivation, peer pressure, culture issues, team working, management, supervision and leadership.
- d) Factors affecting performance: Fitness/health, stress:-domestic and work related, time pressures and deadlines, workload, overload & under load, sleep and fatigue, shift work, alcohol, medication, drug abuse.
- e) Physical environment: Noise, fumes, illumination, climate & temperature, motion and vibration, confined spaces, working environment.

- f) Tasks: Physical work, repetitive tasks, visual inspection, complex systems
- g) Communication: within and between team, work logging and recording, keeping update, currency, dissemination of information.
- h) Human error: understanding human error, Error models & theories, Types of error in maintenance tasks: implications of error, avoiding and managing errors.
- i) Hazards in the workplaces
 - Recognizing and avoiding hazards
 - Dealing with emergencies
- j) Summary: Dirty dozen aviation errors (put safety first and minimize 12 common causes of mistakes in the aviation workplace)
- k) Hazard identification and Risk Management.
- l) Safety Management System.

Part III Aviation Legislation (20 Marks Subjective Questions)

- a) Regulatory framework
 - Role of ICAO/ Role of CAA Nepal (CAAN)
 - General understanding of CAAN Regulations
 - Relationship between NCAR Part -145, NCAR-Part 66, NCAR Part-147 and NCAR Part –M
 - Relationship with other Aviation Authorities
- b) NCAR Part 66- Certifying Staff- Maintenance
- c) NCAR Part 145 – AMO, CAMMOE, Approved maintenance organization(Continuing Airworthiness Management and Maintenance Organization Exposition)- Organization Structure, management and working procedure- general understanding
- d) Commercial Air Transportation
 - Air operators certificate (AOC)
 - Operators Responsibility
 - Documents to be carried on board
 - Aircraft placarding / Marking.
- e) Aircraft certification
 - i) General certification rules
 - ii) Type certification
 - iii) Supplemental type certification
 - iv) NCAR Part-21 Design/ Production Organization Approvals Documents:
 - C of A
 - C of R
 - Noise Certificate
 - Weight & Balance
 - Radio station License Approval (RML)
- f) NCAR Part-M Detailed understanding of Part M

- g) Applicable national and substantial requirements
 - Maintenance Program (CMP) (Customized Maintenance Programme)
 - Maintenance checks and inspection
 - MMEL, MEL, DDG, AD, SB, SI, Mods. and repairs
Maintenance documentation MM, SRM, IPC etc.
- h) Continuing Airworthiness
Test flight, ETOPS, maintenance and dispatch requirements, All weather Ops.
Cat 2/3 and minimum equipment requirements, RVSM/ RNAV.

Part IV Aviation General Knowledge (10 Marks Objective Questions)

- a) Physics of the atmosphere, International Standard Atmosphere (ISA)
- b) Aerodynamics, Airflow, Boundary layer, laminar & turbulent flow, free stream flow, relative airflow, up wash and downwash, vortices, stagnation
Terms: camber, chord, mean aerodynamic chord, profile & parasite drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fitness ratio, wing shape and aspect ratio, thrust, weight, aerodynamic resultants, generation of lift and drag, lift coefficient, drag coefficient, polar curve, stall (angle of attack), Aero foil contamination including ice, snow, frost.
- c) Theory of flight: relationship between lift, weight, thrust & drag. Glide ratio, steady state flights performance, theory of the turn, influence of load factor, stall, flight envelope and structural limitations, lift augmentation
- d) Flight stability and dynamics:
Longitudinal, lateral and directional stability
- e) Wing design, Aerodynamic and structural requirements, Aspect Ratio, plan form, sweep back, Delta wing design of subsonic, trans sonic and supersonic planes.
- f) Engines: Piston engine, Turbine engine, Types and their principles.

Part V Communication & Navigation and aircraft systems (Avionics) (ATA 23/34)

(30 Marks Objective Questions)

Fundamental of radio wave propagation.

Characteristic, propagation at LF, MF, HF, VHF, SHF.

Polarization , properties of ionosphere, refraction, absorption, skip distance, reflection, fading, scatter, cyclic and irregular variations in the ionosphere

Properties of troposphere, temperature inversion.

Relationship between velocity of propagation frequency and wave length, field strength. Frequency tolerance and stability.

Antennas: half and quarter wave antennas current and voltage distribution, impedance, methods of feed, polarization , effective height, radiation pattern.

Gain, bandwidth, side bands, advantage of SSB equipment, antennae tuning and loading (Antenna Coupler). SWR . Antenna losses, Magnitude of RF voltages, types of insulators used at HF and precaution to be used with lead – ins. (disc) parabola and plate antenna for SHF transmission lines and wave guides: characteristics, impedance, standing waves, WSR and its measurement, impedance matching balanced and unbalanced transmission lines ,losses, transfer of energy in waveguides, bends & joints, loop and sense antennas.HF and VHF communication (Air Band)

Radio transmitter – Functional block diagram, stages, oscillator, crystal controlled variable frequency , frequency stabilisation, modulation, types of modulators, RF amplifiers .

Radio receiver: functional diagram & stages

Working principles of following systems

- VHF communication
- VR communication
- Audio ICS
- ELT
- CVR
- ADF
- VOR
- DME
- ILS
- Headsets and microphones
- In-flight entertainment systems (Music/Video)
- Area navigation RNAV system
- FMS
- GPS
- INS
- ATC transporter, secondary surveillance radar.
- TCAS (Traffic Alert & Collision Avoidance System)
- W^X avoidance radar
- Radio altimeter
- ARINC communication and reporting
- ACARS
- EGPWS

Electrical Power: (ATA 24) Batteries, installation and operation. (Various types), DC power generation, AC power generation, Emergency Power, Voltage regulation, power distribution, Inverters, transformers, rectifiers, Circuit Protection, External ground power unit (GPU).

Autoflight ; (ATA 22) Fundamentals and autoflight control including, working principles and current terminology./Command signal processing./ Mode of operation. Roll, Pitch, and Yaw channels, Yaw Dampers,(Dutch Rolling).Auto trim controls./Autopilot navigation aids interface./Auto throttle system./Auto landing system principle and categories, modes of operation, approach, glideslope, land, go around, system monitors and failure condition.

Fire/Smoke detection ATA26. Detection and warning system, Extinguishing system. Inspection and test.

Fuel System ATA28.Fuel supply system, dumping, venting and draining, crossfeed, transfer and balancing, indication and warning, refueling and defueling, fuel hazard and fuel tank pressurization with N2.

Instruments, indicating and recording;ATA31./Pitot Static System, altimeter, VSI,ASI, Machmeter.

,Altitude reporting and alerting system, Airdata computers, Direct reading pressure and temperature gauges, Gyro principles, Artificial Horizon, Turn and Bank Indicator, Directional gyro, Compass systems, EGPWS, FDR, EFIS, Instrument warning system, centralized warning system panel, stall warning system,Angle of attack indicating system., Vibration measurement and indication, EICAS,VEMD.

Lights, ATA 33./External navigation, landing, taxiing, internal cabin, cockpit, cargo and emergency lighting system.

On board Maintenance System, ATA 45./ Data loading system, Electronic Library, printing, structure monitoring (Damage tolerance monitoring.)

Part VI Propulsion/ Gas Turbine Engine /Propeller (20 Marks)

- a. Fundamentals:
- b. Potential energy, Kinetic energy, Newton's law of motion, Braytons cycle. The relation between force, work, power, energy , velocity, acceleration.
- c. Constructional arrangement and operation of turbojet, turbofan, turboshaft and turboprop.
- d. Engine performance: Gross Thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust, thrust horsepower, equipment shaft horsepower
- e. Specific fuel consumption: engine efficiency by pass ratio and engine pressure ratio (EPR).

- f. Properties and specification : fuel additive; safety precautions;
- g. Lubrication systems:, system operation, layout and components.
- h. Fuel systems: operation of engine control and fuel metering systems including electronic engine control (EECU), Full authority digital engine control (FADEC). systems layout and components.
- i. Air systems: operation of engine air distribution and anti-ice control system, including cooling, sealing and external air services.
- j. Starting and ignition systems: operation of engine start systems and components; ignition systems and component, Maintenance safety requirements.
- k. Engine Indicating System:
 - l. EGT/ITT .Exhaust gas temp./Inter turbine temp. indication.
- m. Engine thrust indication: engine pressure ratio EPR, engine turbine discharge pressure, or jet pipe pressure systems. Oil pressure and temperature; fuel pressure and flow; engine speed; vibration measurement and indication; torque, power.
- n. Power Augmentation systems: operation and application. Water injection; water methanol; Afterburner systems.
- o. Turbo Prop engines: Gas Coupled/ Free turbine and gear coupled turbines: reduction gears: integrated engine and propeller Control; over speed safety devices.
- p. Turboshaft engine: arrangement, drive systems, reduction gearing, couplings, control systems.
 - APU: Purposes, operation, Protective systems.
 - Power plant installation: Configuration of firewalls, Cooling, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.
 - Fire protection systems: operation of detection and extinguishing systems. (different types)

Engine monitoring and ground operation: procedure for starting and ground run-up, interpretation of engine power output and parameters; Trends (including oil analysis, vibration and boroscope)

Monitoring: inspection of engine and components to criteria, tolerances and data specified by engine manufacturer: compressor washing/ cleaning: FOD

Engine storage and preservation: Preservation and de-preservation for the engine and accessories/ Systems.

Propeller

- a. Fundamentals: Blade element theory; High/ low blade angle, reverse angle, angle of attack, rotational speed, propeller slip:
- b. Aerodynamic, Centrifugal and thrust forces: Torque; Relative airflow on blade angle of attack; vibration and resonance.

- c. Propeller constructions: Construction method and materials used in wooden, composite and metal propellers; Blade station, blade face, blade shank, blade back and hub assembly.
- d. Fixed Pitch, controlled pitch, Constant speed propeller.
- e. Propeller pitch, controllable pitch, constant speed propeller,.
- f. Propeller Pitch Control: Speed control and pitch change methods, mechanical and electric/ electronic: Feathering and reverse pitch, over speed protection.
- g. Propeller synchronization: synchronizing and synchrophasing equipment.
- h. Propeller ice protection: fluid and electrical de-icing equipment.
