

Nepal Airlines Corporation
Syllabus for Suptd. AME (A&C) Grade IX
Aircraft Maintenance Service
Internal Competition

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Subject: Service Related
Time: 2 Hours 05 Minutes

Full Marks: 100
Pass Marks: 40

No. of Questions – 5 Subjective Questions each of 10 marks = 50 Marks
50 Objective Questions each of 1 mark = 50 Marks

(Note: Maximum time for objective questions will be 50 Minutes. 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 (20 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 Manitenance 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/ Aerodynamics (Structures and Systems)

(30Marks Objective Questions)

- a) Physics of the atmosphere, International Standard Atmosphere (ISA)
- b) Aerodynamics, Airflow, Boundary layer, laminar & turbulent flow, free stream flow, relative airflow, upwash 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) Theory of flight

- Aeroplane aerodynamics and flight control.
- Operation and effect of roll control, ailerons and spoilers.
- Pitch control, elevators, stabilizers, variable incidence stabilizers and canards;
- Yaw control, rudder limiters.

High lift devices: flaps , slats .

Drag inducing devices: spoilers, speed brakes.

Effects of wing fences. Boundary layer control using, vortex generators, stall wedges or edge devices.

Operation and effect of trim tabs, balance and anti-balance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamics balance panels.

High speed flight: speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating.

Factors affecting airflow in engine intake of high speed aircraft. Effect of sweepback, critical Mach number.

Aircraft Airframe structures: General concepts.

- a. Fundamentals of structural systems; (Primary, secondary e.t.c.)
- b. Zonal and station identification systems.
- c. Drain and ventilation provisions.
- d. Electrical bonding
- e. Lightning strike protection provision.

Fuselage (ATA 52/53/56)

- a. Construction and pressurisation sealing.
- b. Wings, stabilizer, pylon and undercarriage attachments.
- c. Seat installation & cargo loading systems.
- d. Doors and emergency exits.
- e. Windows and windscreen

Wings (ATA 57) Landing Gear (ATA 32)

- a. Construction.
- b. Fuel storage.
- c. Landing gear, pylon, control surface, and high lift/ drag attachments

Stabilizers (ATA 55)

- a. Control surface attachment

Flight control surfaces (ATA 55/57)

- a. Construction and attachment
- b. Balancing- mass and aerodynamics

Nacelles / Pylons (ATA 54) – Construction, firewalls, Engine Mounts.

Air conditioning & cabin pressurization (ATA 21)

a. Air supply – source – engine bleed

- APU
- Ground cart

Airconditioning – Aircycle and vapour cycle machine

- Distribution system
- Flow, temp & humidity control system
- Pressurization
- Control and indication including control and safety valves, cabin pressure controllers.
- Safety and warning devices.
- Protection and warning devices.

Hydraulic system: ATA 29/ General system layout, hydraulic fluids, hydraulic reservoirs and accumulators: pressure generation, electric, mechanical, pneumatic, emergency pressure generation, RAT (Ram air Turbine). Pressure control, power distribution, indication and warning system, interface with other systems. Hydraulic pipeline markings and pressure test.

Fuel System: ATA 28/General layout, Fuel tanks, supply systems, dumping, venting and draining, crossfeed, transfer, indication and warning, refueling, defueling, longitudinal balance of fuel system, fuel hazard, fuel tank preservation. N2 pressurization.

Electric System: ATA 24/General layout., DC power generation, batteries, AC power generation, Emergency power, voltage regulation, power distribution, Inverters, transformers, rectifiers, Circuit protection, external GPU.

Flight Controls: ATA 27/Primary controls, aileron, elevator, rudder, spoiler, trim control, Active load control, high lift devices, speed brakes. System operation- manual/hydraulic/pneumatic/electrical/fly by wire. Artificial feel, yaw damper, mach trim, ruder limiter. Gust lock systems, Balancing and rigging, Stall warning and protection system.

Fire system: ATA 26/Fire/smoke detection and warning system, fire extinguishing system, portable fire extinguisher.

Equipment Furnishing ATA 25/ Electronic emergency equipment requirements, Seat Belts Harness, Galley installation.

Ice and Rain Protection;ATA30/Ice formation, classification and detection: anti-icing systems, electrical/hot air pneumatic and chemical, rainrepellant, probe and drain heating, wiper system.

Instruments, Indication and recording: ATA31/Atmospheric pressure measuring devices-Pitot/Static systems Altimeters, VSI, ASI, Mach meter, Altitude reporting

/alerting system, Air data computers, Pressure and temperature gauges, fuel quantity indicating system, Gyro principles, Artificial horizon. Turn and slip indicator, directional gyro, compass system, GPWS, FDR, EFIS. Instrument warning system including master warning system and centralized warning system, Stall warning system and angle of attack indicating system. Vibration measurement and indication, EICAS (Engine indicating and crew alerting system. VEMD (Vehicle and engine multifunction display.)

On board maintenance system ATA45/ Central maintenance components. Data loading system, Electronic library system, printing, structure monitoring (damage tolerance monitoring)

Landing Gear; ATA32/ construction, shock absorbing, extension & retraction system-normal/emergency., indication and warning., wheels, brakes, antiskid and autobraking, tyres, steering.

Oxygen System; ATA36/system layout, cockpit/cabin, sources, storage, charging and distribution. Supply regulator, indication and warning, chemical oxygen generators, precautions.

Pneumatic; ATA36/System layout, Sources, Engine/APU. Compressors, reservoirs, ground supply, pressure control, distribution, Indication, warning, interfaces with other systems.

Water and Waste; ATA38/ System layout, water supply and distribution, servicing and draining. Toilet system layout, flushing, servicing, corrosion aspects.

Aircraft Handling and Storage: Aircraft taxiing, towing, and associated precautions. Aircraft jacking, chocking, securing and associated safety procedures. Aircraft storage methods, refueling and defueling procedures, de-icing and anti-icing procedures, Electric, Hydraulic and Pneumatic Ground Carts, Effect of environmental condition on aircraft handling and operation.

Disassemble, Inspection, repair and assembly techniques: Types of defects and visual inspection techniques, corrosion removal, assessment and re-protection.

General repair methods, SRM (Structural Repair Manual) ageing, fatigue, and corrosion control program, NDT inspection, Dye penetrant, radiography, eddy current, ultrasonic and boroscopic methods, Inspection following lightning strike, HIRF penetration, ATA chapter 5 inspection following Heavy Landings, and flight through turbulence, etc.

Maintenance Procedures,

Maintenance planning, Modification procedures, Store procedure, Certification release procedure, interface with aircraft operation, Maintenance inspection by QC/QA. Additional maintenance procedure, Control of Timex and life limited parts/components.

Part V Propulsion/ Gas Turbine Engine /Propeller (20 Marks Objective Questions)

- 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. Pressure, temperature and velocity of the gas flow, Engine ratings, static thrust, influence of speed, altitude and hot climate, flat ratings, limitations, .
- g. Inlet: compressor inlet duct, effects of various inlet configuration, Ice protection.
- h. Compressors: axial and centrifugal types: constructional feature and operating principles and applications.
- i. Fan balancing : Operation : Causes and effect of compressor stall and surge; Method of airflow control; bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; compressor ratio,.
- j. Combustion section: constructional feature and principle of operation,.
- k. Turbine section: Operation and characteristic of different turbine blade types: blade to a disc attachment.
- l. Nozzle guide vanes; causes and effect of turbine blade stress and creep.
- m. Exhaust: constructional feature and principle of operation, convergent, divergent and variable area nozzles; engine noise reduction: thrust reversors.
- n. Bearing and seals: constructional feature and principle of operation.
- o. Lubricants and fuels:
- p. Properties and specification : fuel additive; safety precautions;
- q. Lubrication systems:, system operation, layout and components.
- r. 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.
- s. Air systems: operation of engine air distribution and anti-ice control system, including cooling, sealing and external air services.
- t. Starting and ignition systems: operation of engine start systems and components; ignition systems and component, Maintenance safety requirements.
- u. Engine Indicating System:
- v. EGT/ITT .Exhaust gas temp./Inter turbine temp. indication.
- w. 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.
- x. Power Augmentation systems: operation and application. Water injection; water methanol; Afterburner systems.

- y. Turbo Prop engines: Gas Coupled/ Free turbine and gear coupled turbines: reduction gears: integrated engine and propeller Control; over speed safety devices.
- z. 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 synchro phasing equipment.
- h. Propeller ice protection: fluid and electrical de-icing equipment.
- i. Propeller Maintenance: static and dynamic balancing; blade tracking, assessment of blade damage, erosion, corrosion, impact damage, delamination; propeller treatment/ repair schemes; propeller engine running.
- j. Propeller storage and preservation: de preservation.
