

Nepal Airlines Corporation
Syllabus for Senior Technician (Grade - V)
Aircraft Maintenance Service (Avionics)
Open Competition

A. Stages and Procedures of Examination System

चरण	विषय	अंकभार	परीक्षा प्रणाली	प्रश्न संख्या X अङ्क	समय
प्रथम चरण ८०%	सेवा सम्बन्धी	१००	Multiple Choice Questions (वस्तुगत)	५० X २ = १००	४५ मिनेट
द्वितीय २०%	अन्तरवार्ता	२०	मौखिक		

Full Marks: 100
Pass Marks: 40

B. Material Contents

Part 1 - Fundamentals 24 Marks (12 Questions)

- 1.1. **Arithmetic:** Fractions, decimals, percentages, ratio, proportion, variation, power, roots and logarithms.
- 1.2. **Algebra:** Addition, subtraction, multiplication and division of like unlike terms, simple equations, transpositions of formulae
- 1.3. **Geometry and Mensuration:** Lines, angles, regular plane figures, regular solids. Areas of plane figures and surfaces of regular solids. Volumes of cubes, prisms and cylinders
- 1.4. **Trigonometry:** Sine, cosine and tangent ratios, Solution of right-angled triangles using trigonometrical ratios.
- 1.5. **Graphs:** Construction and interpretation of graphs of linear, simple exponential, sine and cosine functions.
- 1.6. **Vectors:** Vector and scalar quantities, summation and resolution of vector quantities.
- 1.7. **Mechanics:** U.S. British and metric systems of measurement the S.I. System and methods of conversion: measurement tolerances, mass, weight, moments, centre of gravity. Dynamics: force, speed, velocity, angular velocity, acceleration, inertia, momentum, torque, work, energy and power, Newton's Laws of Motion.
- 1.8. **Fluid-mechanics:** Pressure, density, specific gravity, Pascal's principle, Archimedes' principle Properties of fluids, Bernoulli's Theorem, Ventury meter, steady and unsteady flow, potential and kinetic energy effects in fluid flow.
- 1.9. **Heat and Thermodynamics:** Thermometers and temperature scales Celsius, Fahrenheit, Rankine and Kelvin. Conversion between scales, Quantity of heat: units of heat (calories, B.T.U., C.H.U.), heat capacity, specific heat. Heat transfer convection, radiation and conduction, expansion of solids and liquids: co-efficient of linear expansion of solids, bi-metallic strips, elementary thermodynamics, first and second laws, mechanical equivalent of heat, humidity, absolute and relative vapour pressure, Gases; Charles' and Boyle's Laws, internal energy of a gas, specific heat of gas, relationship between internal energy and heat.

- 1.10. **Electricity and Magnetism** Fundamentals, atoms and electrons, conductors and insulators electric currents, electromotive forces, difference of potential; electrical units; power; work and energy Ohm's Law, specific resistance series, parallel and combined DC circuits Kirchhoff's Laws, the Wheatstone bridge, Electromagnetic Induction: Faraday's Laws, Lenz's law, magnitude and direction of induced EMF, generators, induction coils, Inductance and capacitance: mutual inductance, self inductance, unit of capacitance, specific inductive capacity, condensers, dielectric strength, losses and efficiency, Simple A.C. principles: generation, measurement of A.C. current, voltage and frequency; simple transformers and rectifiers.
- 1.11. **Basic Computer knowledge**

Part 2 - Aircraft General Knowledge 10 Marks (5 Questions)

- 2.1 **Aircraft Flight:** Theory of flight, General principles, fixed wing and rotary wing advantages and disadvantages.
- 2.2 **Wing Design:** Aerodynamic and structural requirements. Aspect ratio, plan form, sweep-back, delta wings. Design for sub-sonic, transonic and supersonic.
- 2.3 **Engines** Piston engine, Turbine engine, types and their principles

Part - 3 Basic Electronics and Servomechanisms 16 Marks (8 Questions)

- 3.1 **Transformers and Rectifiers:** Principles of transformers; single-phase and three-phase transformers, Rectification: half-and full-wave rectification, metal rectifiers, bridge rectifiers; hard and soft tube rectifiers Semi-conductor rectification the PH junction.
- 3.2 **Magnetic Amplifiers:** Principles and construction of storable reactors and magnetic amplifiers, Bias, polarity sensitive inputs, auto-excitation, self-excitation, phase sensitive half-wave and full-wave outputs, polarity-sensitive output, push-pull output, Effects of stage gain and cascading on time response.
- 3.3 **Thermionic Tubes:** Multi-elements tubes. Thyratrons: triode and tetrode. Cathode-ray tubes: principles; elements-the electron gun, gas-focused tubes, electrostatic and electromagnetic focusing and deflection, connections, transistors, IC's.
- 3.4 **Servomechanisms:** Principles: open and closed loop controls systems. Components and operation of simple closed loop control system.

Servo-actuators and rate generators: principles and characteristics of types of motors and rate generators used in servo system.

System operation and response: response to displacement and rate command signal. Follow-up and rate feedback signals, Causes of hunting and methods of damping, Trouble-shooting servo-systems.

Part 4-Electrical Systems and Equipment 30 Marks (15 Questions)

- 4.1. **D.C/A.C Power Supply:** Generators: shunt-wound and alternator-rectifier types, Voltage regulation types of regulators, cut-outs, reverse current relays, circuit protection, Typical D.C. power systems: current balancing, trouble-shooting, AC generators, Inverters, Starters, Switches, Motors, Batteries (Lead acid, Ni-Cd)
- 4.2. **Electrical Maintenance:** Function checking electrical systems. Soldering, crimping and repair techniques. Trouble Shooting, Power supplies during maintenance and testing, Fire precautions.
- 4.3. **Instrument Installation:** Presentations: round and linear indicators, head-down and head-up displays, digital displays, cathode-ray tubes. Mounting: panels, vibration protection, pneumatic instruments, pipe systems: installation, leak tests. Location of pitot heads, static vents, computer, black boxes. etc.

Part 5-Basic Radio and Navigation Theory 20 Marks (10 Questions)

- 5.1 **Wave Propagation :** Radio waves : characteristics, propagation at LF, MF, HF, VHF; polarization , Properties of the ionosphere: refraction absorption, skip distance, reflection, fading, scatter, cyclic and irregular variations in the ionosphere; critical frequency, maximum usable frequency (muf), properties of the troposphere temperature inversion, Relationship between velocity of propagation frequency and wave length, Field strength: Frequency tolerance and stability.

- 5.2 **Antennae Fundamentals:** Half and quarter wave antennae. Current and voltage distribution, impedance, methods of feed, polarization, effective height, radiation patterns, reciprocity, parasitic elements, gain, bandwidth, side bands, advantages of SSB equipment, H.F. communication antennae. Variation of reactance with frequency for an antenna of fixed length. Antenna tuning and loading,. Antennae losses, magnitude of RF voltages, Types of insulators used at HF and precautions to be used with lead-ins.

Transmissions lines and wave guides: characteristics impedance, standing waves, WSR and its measurement, impedance matching, balances and unbalanced transmission lines, losses. Transfer of energy in wave guides, bends and joints, loss checks, VSWR checks

Loop and sense antennae: HF and VHF communication, typical polar diagrams

- 5.3 **Radio Transmitter:** Functions block diagram, stages.
Oscillators: crystal controlled variable frequency; stability; modulation, types of modulators.
RF amplifiers: A.B and C class amplifiers, use of triodes, tetrods and pentodes and equivalent solid state devices, instability effects, parasitic oscillations, harmonic generation, methods of biasing decoupling.
Transmitters keying: on-off and frequency shift "chirps" and "clicks" tone-keyer circuitry.
Power supplies: heater; bias and anode supplies, distribution, smoothing, decoupling, regulation.
Radio receiver Functional diagram and stages.

- 5.4 **Radio Aids to Navigation:** Direction finding: principles; ADF, Principles: VHF Omni-directional radio range. DME, VHF market system, instrument landing systems (ILS), radio altimeter.

5.5 **Radio Station Installation** : Mechanical aspects: standard radio racking system, methods of mounting and release, common plugs and sockets, precautions against vibration, shock, electrical faults, moisture, Radio junction box, and circuit breaker panel. Ventilation, cooling and dust precautions. Inter-unit cabling, power cabling, cable identification, routing charts, insulation. Selectors and switches: standard panels; radio instrument presentations, Location and mountings. Headsets and microphones, cabin speakers, Passenger addresses and inter-communication systems: studio amplifier. In-flight entertainment systems (Music/Video System).
