

नेपाल नागरिक उड्डयन प्राधिकरण
प्राविधिक सेवा, इलेक्ट्रिकल इन्जिनियरिङ्ग समूह, सातौं तह, वरिष्ठ अधिकृत पदको खुला/आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र – सेवा सम्बन्धी

खण्ड (क) - ५० अङ्क

1. **Basic Concept of Electrical Engineering**
 - 1.1 Electric charge and current, direct and alternating currents, electric voltage, potential difference, power and energy
 - 1.2 Ohm's Law, Kirchoff's Law; Star/ Delta and Delta / Star transformation; Circuit Analysis; Transient and Steady State Condition; Frequency response on circuit analysis; Relationship between current and voltage in capacitor and inductor
 - 1.3 AC fundamentals: RMS and average value of different waveform; Generation of alternating emf; Power and Power Factor; Three Phase System, Voltage and Current relations for Star and Delta connected System; Balanced and Unbalanced Load on Three Phase System; Three Phase Power measurement
2. **Electrical Machine**
 - 2.1 **Transformers:** type, construction, load and no load condition, open circuit and short circuit test, equivalent circuit, losses, efficiency and voltage regulation, auto transformer, parallel operation, load sharing, instrument transformer
 - 2.2 **DC Machines:** type, construction, voltage /speed/ load characteristics of dc generators, separate and self-excited machines, voltage regulation of generator, torque/speed characteristics of shunt field, series field and compound field motors, armature reaction and commutation, DC motor starters, speed regulation and control of DC motor
 - 2.3 **Synchronous Generators:** classification and construction, voltage regulation of an alternator by synchronous impedance method and mmf method, losses and efficiency, power angle characteristics
 - 2.4 **Synchronous Motors:** equivalent circuit, power and torque, effect of excitation, stability v-curve, hunting, starting and application
 - 2.5 **Induction Motors:** type, construction, equivalent circuits. Torque-slip characteristics starters, speed control and motor selection
 - 2.6 **Induction Generators:** principle of operation, application, controllers and harmonics
3. **Power Generation**
 - 3.1 Types of Generating Plants- Thermal, Hydro, Diesel and Solar (Working Principles, Equipment, Bus Bar, AVR and Reactors; Stand by Generator and Auto Transfer Switch; Uninterruptible Power Supplies (UPS); Basic Principle of No-break power generation for airports
4. **Power System Analysis**
 - 4.1 **Load Flow Study:** Load characteristics, effects on voltage and frequency, real power frequency balance, reactive power frequency balance, basic complex power flow equations for a network, voltage profile and VAR compensation, causes and effects of low power factor, advantages and methods of power factor improvement
 - 4.2 **Stability:** Steady state, dynamic and transient stability, equal area criterion, Swing equation for multi machine, Steady-state stability implications
 - 4.3 **Control and Protection:** Faults in power system and their calculation, Components of power system protection, Isolators/Disconnecting switches, contactors, Types and characteristics of circuit breakers and protective relays,

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- Automatic reclosure, Protection of generators, transformers and transmission/distribution lines, Lightning protection, Governor's principle and characteristics
- 4.4 **Load dispatching:** principle of economic load dispatch, requirements, tools and benefits, role of a dispatcher
- 4.5 **Transmission System:** Choice of voltage, route selection, right of way, substation layout and location
- 4.6 **Distribution System:** Types of Distribution systems, Distribution substations, Bus bar schemes, Power factor correction, Protection coordination in distribution systems, Distribution system reliability indices, rural distribution system and Loss reduction
- 4.7 **Quality of Electricity:** Supply quality parameters, effect of quality on equipment and application, standards
5. **Power Distribution and Consumer Services**
Sub-station & switchyards: General layout of Sub-station and their key elements. Types of underground Cable, Cable Resistances and Capacitances, Insulation Resistance, general concepts about Cables used for runway power distribution, selection of cable and selection criteria. Airport series circuit. Advantages and disadvantages of series and parallel circuits. Handling of cable and protection, Cable joints, Single wire power Distribution, lightning phenomenon, lightning arrestors types and function, overhead earth wire, voltage drops, Ferranti effects, SIL of Transmission Line; earthing of electrical system and electrical equipment. its importance and methods of earthing, Energy Tariffs structure
6. **Economics of Power Utilization**
Basic concept about Energy Audit, Load management TOD meter, Demand side management Power Factor Improvement: Causes and effects of low power factor, advantages and methods of power factor improvement. Economics of power generation, Load forecast, demand factor, load factor, plant use factor, diversity factor, energy rates (tariff), depreciation, Rate of Return
- खण्ड (ख) - ५० अङ्क**
7. **Electrical Maintenance**
Maintenance schedules – Periodic, Preventive and emergency maintenance, NOTAM, Fault reporting and fault finding: fault reporting procedures, fault category and action plan, maintaining log, fault clearing and logging and fault recording system; Check list of equipment – Daily, Weekly, Monthly and Yearly. Duty and Responsibilities of Shift-In charge and section Chief, Roaster Duty
8. **Electrical Safety**
Physical effect of electric shock, safety rules and regulation, safety tools and devices, explosion of electrical equipment In premises and precaution to be taken Concept of touch voltage, effects of non-ionizing electromagnetic fields on human, earthing and shielding techniques for electrical equipment. Fire hazards, firefighting techniques and equipment, First aid requirements for after the event treatment Fire Alarm System-Principle and operation, electrical induction into communication and transmission lines, effects of non-ionizing magnetic fields on human body, Noise hazard

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9. **Power Electronics and illumination**
Power diodes, Thyristors, Transistors, Gate turn off devices, AC to DC and DC to AC conversions, Harmonic filtering, Switched Mode Power Supplies
Law of illumination; Radiant Efficiency, design of Lighting Schemes; Type of Electric Lamps and comparison between Filament lamp and Fluorescent Lamp
10. **Engineering Economics**
Cash flow analysis, project evaluation indicator, payback period, risk analysis, taxation system in Nepal, Energy Tariff
11. **Project Management**
Project Planning and Scheduling, capital Planning and budgeting, project monitoring and control, organizational management, Internal Organization, Management Information System, Motivation and Leadership, Personal Management, Familiarization with procurement guidelines and standard of World Bank, ADB, Preparation of Contract documents, specifications, condition of contract and other contractual procedure
12. **Location, Application and Characteristics of Aeronautical Ground Lighting System**
 - 12.1 Approach Lighting System: Simple Approach Light, Precision Approach Light CAT I
 - 12.2 Visual Approach Slope Indicator System: PAPI and APAPI
 - 12.3 Runway lights: Edge light, Threshold and wing bar lights, End lights, Center line lights, Touch zone lights, Guard lights
 - 12.4 Stop way Lights
 - 12.5 Taxiway lights: Centre line lights, Edge lights, Stop bar lights
 - 12.6 Apron floodlighting
 - 12.7 Road holding position light
 - 12.8 Aircraft stand maneuvering lights
 - 12.9 Aeronautical beacon light
 - 12.10 Runway lead-in lighting system
 - 12.11 Runway Threshold Identification Light
 - 12.12 Signs: Mandatory Instruction Sign, Information Sign, Location sign
13. **ICAO Annex – 14 (Related Portion only)**
 - 13.1 Aerodrome design manual part 4
 - 13.2 Aerodrome design manual part 5

द्वितीय पत्रबाट निम्नानुसार प्रश्न सोधिनेछ :

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