नेपालनागरिक उड्डयन प्राधिकरण
प्राबिधिक सेवा, ईलेक्ट्रिकल ईन्जिनियरिङ्ग समूह, दशौं तह, उपनिर्देशक पदको खुला/आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

द्वितीय पत्रः सेवा सम्वन्धी
खण्ड (क) - ६० अङ्क

1. Current Issues of Electrical Engineering

1.1. Challenges and prospects of power distribution system at international airports, efforts on load managements and loss reduction
1.2. Reliability and availability of power supply at TIA and related international standards
1.3. Current issues of Civil Aviation Authority related to technical and socio-economic issues in generation, standby power generation and distribution, energy tariff, Trade and supply of energy at International Airports, Domestic Airport, STOL Port and standard station.
1.4. CAAN rules and regulations on employment, procurement and promotions, Inventory control, Impediments for growth and possible reform measures
1.5. Global efforts and achievements on Energy efficiency, energy intensity
1.6. International and National Initiatives on Sustainable and renewable energy promotion
1.7. Convention on International Civil Aviation - Doc 7300, Safety Management System (Aerodrome), ICAO Doc 9859
1.8. Aerodrome Design Manual Part 4 and part 5(Doc 9157)
1.9. Aerodrome certification program, ICAO Doc 9774 related to electrical system.
1.10. Airport Emergency response plan related to electrical system
1.11. Airport signs and graphics, way finding system, procedure and guidelines

2. Basic Concepts of Electrical Engineering

2.1. Transformer: construction, equivalent circuit, open circuit and short circuit test, losses, efficiency and voltage regulation, auto transformer, parallel operation, load sharing, instrument transformer.
2.2. Source of electrical energy: Thermal, Hydro, Diesel, wind and Solar
2.3. Synchronous Generators classification and construction, voltage regulation of an alternator, losses and efficiency, power angle characteristics. Stability, Parallel operation and hunting, Field of applications.
2.4. Induction Motors type, construction, equivalent circuits. Torque-slip characteristics starters, speed control and motor selection
2.5. DC Machines: Performance, Armature reaction, Starter and speed regulation of motors, Applications.

3. Distribution System Planning and Automation

3.1. Distribution system layouts, Radial, loop and ring distribution system, 3-phase and single phase prospective, single phase earth return systems, primary and secondary voltage selection criterion
3.2. Underground Cable; classification, cable resistances and capacitances, insulation resistance, selection of cable, handling of cable and protection, cable joints
3.3. Distribution system Load forecast, load pattern, demand factor, load factor, diversity factor, responsibility factor, load curve and load duration curves
3.4. Distribution substations, General layout of Sub-station and their key elements, Bus bar schemes, Power factor correction
3.5. Distribution system voltage profile improvement and Loss reduction techniques
3.6. Protection coordination
3.7. Distribution Automation and Control Functions

3.8. Protection coordination in distribution systems
3.9. Distribution system reliability indices
3.10. Quality of Electricity: Supply quality parameters, effect of quality on equipment and application, standards.

4. Power System Analysis and Control

4.1. Balanced and unbalanced Faults in power system and their calculation
4.2. Control and Protection: Components of power system protection, Isolators/Disconnecting switches, contactors, Types and characteristics of circuit breakers and protective relays, Automatic reclosure
4.3. Protection of generators, transformers and transmission/distribution lines
4.4. Stability: Steady state, dynamic and transient stability, equal area criterion, Swing equation for multi machine
4.5. Lightning protection and surge arrestors for airports underground system
4.6. Governor's principle and characteristics, real power frequency balance
4.7. Load dispatching: principle of economic load dispatch, requirements, tools and benefits
4.8. Transmission System: Choice of voltage, route selection, right of way, span selection, sag and tension analysis

5. Special features of Airport Electrical Power System

5.1. Frequency Converter Systems
5.2. DC Power Systems
5.3. Uninterruptible Power Supply Systems
5.4. Power Conditioning Systems
5.5. Transducers, electrical signal transmission and processing, non-electrical signal transmission
5.6. Stand by Generator and Auto Transfer Switch
5.7. Types of electrical circuits, Electrical characteristics, Series circuits, Parallel (multiple) circuits, Comparison of series and parallel lighting circuits, Series circuitry for aerodrome lighting, Grounding, Step-down transformers, Series cut-out
5.8. Aerodrome Lighting Circuit, Interleaving of aerodrome lighting circuits, Arrangement in the electrical vault, Provision of interleaving, Possible provision of interleaving Selective switching of taxiway circuits
5.9. Constant current regulators, Types of constant current regulators, Operating characteristics of constant current regulators, Rating characteristics of constant current regulators, Open circuit and over-current protection
5.10. Load calculations/regulator sizing, Types of loading, Calculation of lighting facility load
5.11. Aerodrome ground lighting series transformers, Functions, Transformer design, Enclosure, Transformer ratings, Several lamps from a single transformer, Effects of open circuited secondaries of transformer, Lamp by-pass devices, Transformer stand

6. **Aeronautical Ground Lights (AGL) and Visual Aids for Navigation**
   - 6.1. Indicators and signalling devices, Wind direction indicator, Landing direction indicator, Signalling lamp, Signal panels and signal area
   - 6.2. ICAO SARPs for Emergency lighting, Aeronautical beacons, Approach lighting systems, Visual approach slope indicator systems types application &requirements, Circling guidance lights, Runway lead-in lighting systems, Runway threshold identification lights, Runway edge lights, Runway threshold and wing bar lights, Runway end lights, Runway centre line lights, Runway touchdown zone lights, Simple touchdown zone lights, Rapid exit taxiway indicator lights, Stopway lights, Taxiway centre line lights
   - 6.3. Markings: Runway centre line marking, Threshold marking Aiming point marking, Touchdown zone marking, Runway side stripe marking, Taxiway centre line marking, Runway turn pad marking, Runway-holding position marking Intermediate holding position marking VOR aerodrome checkpoint marking Aircraft stand marking
   - 6.4. Visual aids for denoting obstacles: Objects to be marked and/or lighted Marking and/or lighting of objects
   - 6.5. Electrical systems: Electrical power supply systems for air navigation facilities System design Monitoring
   - 6.6. Discharge-Type Flashing Light Equipment, Portable Runway and Taxiway Lights, Lighted Visual Aid to Indicate Temporary Runway Closure
   - 6.7. Obstruction Lighting Equipment
   - 6.8. Runway and Taxiway Light Fixtures
   - 6.9. Visual passenger guide and motion graphics
   - 6.10. Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories
   - 6.11. Runway and Taxiway Signs, Mandatory instruction signs, Information signs, VOR aerodrome checkpoint sign, Aerodrome identification sign, Aircraft stand identification signs, Road-holding position sign
   - 6.12. Design and Installation Details for Airport Visual Aids
   - 6.13. Maintenance of Airport Visual Aid Facilities
   - 6.14. Segmented Circle Airport Marker System
   - 6.15. Airport Lighting Control and Monitoring System (ALCMS)
   - 6.16. Runway and Taxiway Retroreflective Markers
   - 6.17. Series to Series Isolation Transformers for Airport Lighting Systems
   - 6.18. Panels for the Control of Airport Lighting
   - 6.19. Control and monitoring of aerodrome lighting systems, Apron control panel, Control circuitry, Types of remote control systems, Transfer relay panel, Use of relays, Interconnection of controls, Automatic controls, Monitoring of aerodrome lighting circuits, Classes of monitors

7. **Electrical Maintenances and Safety**
   - 7.1. Maintenance of substations: Substation isolation, Using warning signs, maintenance of major equipment at substations, Maintenance of batteries and DC current circuits, Bus-bar maintenance, Putting a substation back into service
   - 7.2. Line maintenance: Maintenance of energized and de- energized overhead transmission lines, maintenance of underground lines
   - 7.3. Maintenance planning: Periodic, Preventive and emergency maintenance, Maintenance considerations and requirements

7.4. Fault Finding and fault reporting: fault reporting procedures, fault category and action plan, maintaining log, fault clearing and logging, Fault recording system
7.5. Check list of equipment – Daily, Weekly, Monthly and Yearly
7.6. Duty and Responsibilities of Shift- In charge and section Chief, Roaster Duty, Manpower Management and Leadership, Motivation.
7.7. Safety rules and regulation, Electric shocks and First aid requirements
7.8. Concept of touch and step voltage
7.9. Effects of non-ionizing electromagnetic fields on human and shielding techniques for electrical equipment.
7.10. Storage and handling of explosives and compressed gases and flammables substances, explosion of electrical equipment in premises
7.11. Fire Alarm System at Airports- Principle, operation and maintenance procedure
7.12. Electromagnetic induction into communication and transmission lines.

8. Organization and Project Management

8.1. Concept of Management, Internal Organization
8.2. Motivation, Leadership, control, coordination and team work, Decision making, Corporate planning and strategic management
8.3. Management Information System
8.4. Performance appraisal, Auditing and inventory control, Personnel Management
8.5. Budget planning and allocation of resources
8.6. Capital Planning and Budgeting: Capital planning procedures, Preparation of operating budgets, fixed and flexible budget, budgetary control
8.7. Preparation of Contract documents, specifications, condition of contract and other contractual procedures
8.8. Procurement guidelines of World Bank (WB) & Asian Development Bank (ADB)
8.9. International Competitive Bidding (ICB) and National Competitive Bidding (NCB)
8.10. Environmental Impact Assessment, (EIA) of Airport Projects
8.11. Dispute resolution in contract
8.12. Project Planning and Scheduling: Network models- CPM/PERT, Manpower leveling, Material scheduling
8.13. Cash flow analysis, Project evaluation indicators, Payback period, Criteria for capital investment decision, Risk management and analysis
8.14. Project preparation for implementation and justification of the project
8.15. Project monitoring and control: System of control, Project control cycle
8.16. Quality Management

9. Aerodrome Certification, Regulatory System (DOC 9774)

9.1. Aerodrome Certification: Basic principles for aerodrome certification regulations, Implementation of the regulation, Aerodrome certification model regulations
9.2. Aerodrome certification procedures: Certification process, Dealing with the expression of interest, Assessment of a formal application for an aerodrome certificate, The grant or refusal of a certificate, Promulgation in the AIP of the certified status and details of the aerodrome, Transfer of an aerodrome certificate, Surrender of an aerodrome certificate
9.3. Regulatory authority: Organization, Functions and responsibilities of the DASS, Technical library and records, Staffing Qualifications, duties and responsibilities of aerodrome inspectors

9.4. Certification of aerodromes (DOC 9981): Aerodrome manual (Components and subjects covered in an aerodrome manual), Initial certification Process (Technical inspections and on-site verifications), Continued aerodrome safety oversight

9.5. Safety assessments for aerodrome: Safety assessment process, Approval or acceptance of a safety assessment, Promulgation of safety information, Safety assessment flow chart, Safety assessment methodologies for aerodromes

9.6. Reporting format using standard runway condition report (RCR): Runway surface condition assessment and reporting, Aerodrome movement area maintenance, Methods of assessing runway surface condition, NOTAM/SNOWTAM, AIP & its revision process.

10. **Aerodrome Safety Management System (DOC 9859)**

10.1. Safety management system, Safety management applicability, Implementing safety management, Integrated risk management, Safety objectives, Safety performance indicators and safety performance targets, Monitoring safety performance

10.2. Safety data collection, Safety analysis

10.3. Safety data and safety information collection, Safety data processing, Safety data and safety information management, reporting of analysis results, Safety information sharing and exchange, Data-driven decision-making

10.4. State safety program (SSP), State safety policy, objectives and resource, State safety risk management, State safety assurance, State safety promotion, SSP implementation

10.5. SMS framework: Safety policy and objectives, Safety risk management, Safety assurance, Safety promotion, Implementation planning

11. Universal Safety Oversight Audit Programme (USOAP) Continuous Monitoring Approach (CMA).

11.1. Critical Elements of a State Safety Oversight System, Primary aviation legislation (CE-1), Specific operating regulations (CE-2), State system and functions (CE-3), Qualified technical personnel (CE-4), Technical guidance, tools and the provision of safety-critical information (CE-5), Licensing, certification, authorization and approval obligations (CE-6), Surveillance obligations (CE-7), Resolution of safety issues (CE-8)

द्वितीय पत्रबाट निम्नानुसार प्रश्न सोधिनेछ :

द्वितीय पत्र					
विषय	**खण्ड**	**अङ्कभार**	**परीक्षा प्रणाली**		**१ प्रश्न संख्या x अङ्क**
सेवा सम्बन्धी	**(क)**	६०	विषयगत	समस्या समाधानमूलक प्रश्न	३ प्रश्न x २० अङ्क
	(ख)	४०		सैद्धान्तिक-तर्कयुक्त र विश्लेषणात्मक प्रश्न	१ प्रश्न x १५ अङ्क
				व्यवसायिक योजना/मामिला विश्लेषण सम्बन्धी प्रश्न	१ प्रश्न x २५ अङ्क
जम्मा		**१००**			