

नेपाल नागरिक उड्डयन प्राधिकरण  
प्राबिधिक सेवा, इलेक्ट्रिकल ईन्जिनियरिङ्ग समूह, पाँचौं तह, वरिष्ठ सहायक पदको खुला/आन्तरिक  
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम  
द्वितीय पत्र - सेवा सम्बन्धी

खण्ड (क) – ५० अङ्क

**1. Fundamental of Electrical Engineering**

- 1.1. Electric circuit, electric charge, electric potential, potential difference, EMF, Ohm's law
- 1.2. Conductor, semi-conductor and insulator
- 1.3. Resistance, resistivity, effect of temperature on resistance, Ohmic and non-Ohmic resistance, series and parallel combination of resistance, power dissipation in resistor, insulation resistance
- 1.4. Inductance, series and parallel combination of inductance, energy stored in inductance
- 1.5. Capacitance, series and parallel combination of capacitance, energy stored in capacitance
- 1.6. Cells and Batteries: Dry cell and Lead Acid Battery – construction, charging & discharging principle; maintenance – free battery; cells in series, parallel and mixed grouping, internal resistance of cell; power supply by battery
- 1.7. Electric power, electrical energy, heating effect of electric current, power dissipation and efficiency
- 1.8. Kirchhoff's current law, Kirchhoff's voltage law and Wheatstone bridge
- 1.9. Thevenin's theorem, Norton's theorem, Super-position theorem, Maximum Power Transfer theorem for DC circuit analysis

**2. AC Circuit Analysis**

- 2.1 Generation of 1-phase AC voltage, RMS value, average value, peak value, time period, frequency, phase of alternating sinusoidal wave
- 2.2 Phase difference, power factor, active power, reactive power, apparent power, use of J-operator
- 2.3 Analysis of R-L, R-C, R-L-C series circuits
- 2.4 Analysis of R-L, R-C, R-L-C parallel circuits
- 2.5 Analysis of series resonance and parallel resonance circuits
- 2.6 Generation of 3-phase voltage, phase sequence, star-delta connection; 3-ph, 4-wire star connected balanced and unbalanced load

**3. Power Generation**

- 3.1 Diesel Generator Plant: advantages, disadvantages, main components, operation
- 3.2 Solar Power Generation and its characteristics
- 3.3 Auto Power Transfer Switch/System, Automatic Voltage Regulator of load, UPS

**4. Electric Machines**

- 4.1 Transformer – working principle, No-load & On-load operation, losses, efficiency, voltage regulation, tests of transformer, auto-transformer, current transformer, parallel operation, transformer oil characteristics
- 4.2 DC Generator: types, No-load & On-load characteristics, armature reaction
- 4.3 DC Motor: Back EMF, characteristics of shunt, series and compound DC motor
- 4.4 Induction Machine: operating principle, torque-slip characteristics, speed control, star-delta starter
- 4.5 Synchronous Machine: operating principle of synchronous generator, advantages of rotating magnetic field and stationary armature system, alternator on-load

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5. **Power Distribution and Consumer Services**
  - 5.1 Overhead Line: types of conductors, line supports, insulators, spacing between conductors, length, sag
  - 5.2 Underground Cable: characteristics of insulating materials, classification of cable, methods of laying underground cable, joining and termination of cable, selection of cable and causes for damage of cables
  - 5.3 Concept of feeders, distributors, service mains/wire, busbar system
  - 5.4 Installation, connection and protection of 11KV/400V distribution transformer substation
  - 5.5 Electric Wiring System: PVC casing capping, conduit surface and concealed wiring, installation and wiring lighting circuits, power circuits
  - 5.6 Estimating and costing of distribution system for different electric loads
  - 5.7 Earthing resistance, method of rod earthing, pipe earthing, plate earthing and chemical earthing
  - 5.8 Lightning Arrestor- Characteristics; Metal-Oxide Lightning Arrestor – Construction and Operating Principle; Installation of Building Lightning Arrestor
  
6. **Power System Control and Protection**
  - 6.1 Fuses: Protective function, fusing factor, types, rating, application, time-current and cut-off characteristics
  - 6.2 Protective function and application of MCB and MCCB
  - 6.3 Magnetic Contractors: Operative principle and application
  - 6.4 Principle of operation and application of ACB, VCB, ABCB, BOCB, MOCB, SF6 circuit breakers
  - 6.5 Protective Relays: Principle of operation, IDMT relay, PSM, TDS, Pick-up current, numerical relays
  - 6.6 Over-voltage, under-voltage, earth fault protection of transformer, Buchholz relays
  

**खण्ड (क) – ५० अङ्क**

  
7. **Economics of Power Utilization**
  - 7.1 Connected load, maximum demand, demand factor, load factor, diversity factor
  - 7.2 Types of tariff, TOD meter
  - 7.3 Power Factor: Causes and effects of low power factor, advantages and methods of improving power factor
  
8. **Electrical Safety**
  - 8.1 General safety precautions in electrical maintenance, voltage precaution; work on energized circuits
  - 8.2 Equipment and system earthing
  - 8.3 Precaution with chemical, safety with fire
  - 8.4 Concept of electric shock; first aid requirement for electric shock
  
9. **Electrical Maintenance Procedures**
  - 9.1 Preventive maintenance: general procedures/steps
  - 9.2 Corrective maintenance: general procedures/steps
  - 9.3 Preventive maintenance of battery, earthing system, distribution transformer and power system
  - 9.4 Handling of ammeter, voltmeter, wattmeter, multimeter, insulation tester and earth tester

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**10. Illumination Engineering**

- 10.1 Laws of illumination, brightness, glare, candela power, luminous flux, illumination, colour temperature, luminous efficacy, solid angle, design of lighting schemes
- 10.2 Types of electric lamps: Incandescent, Fluorescent, CFL, LED,
- 10.3 Power point wiring system, wiring of sub-distribution and main distribution board
- 10.4 Determination of size and length of cable for lighting and power point wiring
- 10.5 Determination of proper rating of fuse, switch, MCB, socket for lighting and power point wiring

**11. Aerodrome and Aeronautical Ground Lights**

- 11.1 Definition of Aerodrome, Aerodrome reference code
- 11.2 Types of Visual Aids for, Indicator and signaling device: Wind Direction Indicator (Application, Location and characteristics)
- 11.3 Aeronautical Ground Light (Application, Location and characteristics)
  - Aeronautical Beacon, Simple Approach Lighting system
  - Runway Edge lights, Runway threshold and wing bar lights, Runway End Lights, Runway Centre line lights
  - Taxiway Edge Lights, Taxiway center line light
  - Visual Approach Slope Indicator system:
  - Application and characteristics of Precision Approach Path Indicator (PAPI) light system
- 11.4 Sign
  - Mandatory Instruction sign, Information sign, Location sign.

**12. Types of electrical circuits**

- 11.5 Series circuits, Parallel (multiple) circuits
- 11.6 Comparison of series and parallel lighting circuits
- 11.7 Series circuitry for aerodrome lighting
- 11.8 Grounding, Isolation transformers

यस पत्रको पाठ्यक्रमबाट निम्नानुसार प्रश्न सोधिने छ :

खण्ड	अङ्कभार	विषयगत प्रश्न	
		छोटो उत्तर	लामो उत्तर
(क)	५०	६ प्रश्न X ५ अङ्क= ३०	२ प्रश्न X १० अङ्क= २०
(ख)	५०	६ प्रश्न X ५ अङ्क= ३०	२ प्रश्न X १० अङ्क= २०
जम्मा	१००	१२ प्रश्न X ५ अङ्क= ६०	४ प्रश्न X १० अङ्क= ४०

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पूर्णाङ्क : ३०

उत्तीर्णाङ्क : १५

**1. Transformer**

**10 Marks**

- 1.1 Introduction, working principle
- 1.2 Transformer polarity test
- 1.3 Short circuit test of single phase transformer

**2. House wiring**

**10 Marks**

- 2.1 Introduction of house wiring
- 2.2 Types of wires used in house wiring
- 2.3 Cable sizing
- 2.4 Types of wiring
- 2.5 SP/DP/TP MCB sizing and connection
- 2.6 Panel board connection
- 2.7 Cable shoe size and connection

**3. Lamp connection**

**10 Marks**

- 3.1 Connection of lamp in series and parallel,
- 3.2 lamp connection by one-way, two-way switch
- 3.3 Bell connection by one switch,
- 3.4 Bell connection by two switch.
- 3.5 Types and connection of contactor; Relay-contactor circuit
- 3.6 Push button switch control