लोक सेवा आयोग

संघीय संसद सेवा, प्राविधिक समूह, राजपत्राङ्कित द्वितीय श्रेणी, सिनियर इलेक्ट्रिकल इन्जिनियर पदको खुला तथा आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

## द्वितीय पत्रः प्राविधिक विषय

### 1. Electrical Circuits and Machine

1.1 Ohm's law and Kirchhoff's law, DC Network Theorems, R-L-C circuits and Resonance, Polyphase circuits.

1.2 Transformer: Construction and working principle, types, tests, applications and selection.

1.3 DC motors: Construction and working principle, types and characteristics, starting and speed control methods, applications and selection.

1.4 Synchronous Generators: Construction and working principle, characteristics, parallel operation, synchronization and excitation system, applications

1.5 Synchronous Motor: Construction and working principle, loading effect and operating conditions, starting methods, applications and selection.

1.6 Induction Motor: Construction and working principle, characteristics, starting methods, tests, methods of speed control and motor selection, motors standards and application.

1.7 Instrument Transformers: CT, PT and their characteristics, accuracy class and their role and application in system protection.

### 2. Energy Resources and Electric Power Generation Technologies

2.1 Types of Energy Resources and their general trend in World as well as in Nepal.

2.2 Biomass based power generation and cogeneration

2.3 Wind power plant: Principle, Major Components, advantages and disadvantages.

2.4 Principle, major components, advantages/disadvantages of Coal Fired Power Plant and Diesel Power Plant

2.5 Emergency and Back-Up of Electrical Supply, Operation, Start and Stop procedure of Diesel Generator

2.6 Solar PV and Types, Charge Controller, Batteries, Inverter types for solar applications.

2.7 Concentrated Solar Power (CSP): Working Principle, types, major components and advantages.

2.8 Hydropower: types, Major Components, Power generation theory, turbine types

### 3. Power System

3.1 EHVAC and HVDC power Transmission

3.2 Line parameters, Performance of short, medium and long transmission lines, Insulators, Surge impedance, Skin Effect and Corona loss

3.3 Power Load flow study, Power system stability, Compensation and FACT devices

3.4 Types of overvoltage and their protection, Insulation Coordination

3.5 Single and Three phase distribution system, Protection coordination in distribution system.

3.6 Substation: Types and general layout, bus-bar arrangements, role of auxiliary equipment in substations.

### 4. Utilization of Electrical Energy

4.1 Energy meters: types, testing and application

4.2 Wiring Systems: General rules and methods of wiring, Types of wiring, types of cable, Main Switch and distribution boards, lighting accessories and fittings

4.3 Lighting and calculations: Aspects of good lighting, types of lighting schemes, Tungsten filament lamp, Fluorescent tubes, terms related to lighting, Methods of lighting calculations. CFL, LED-lamps, flood lighting and street lighting.

4.4 Heating Ventilation and Air Conditioning (HVAC): Importance, important factors, types and size selection of HVAC system. Fan Selection. Room Heating.

4.5 Power Electronic devices, Single and three phase rectification, Single and three phase Inverters

4.6 Theory of Measurements and different Transducers, Electrical Signal transmission and processing, Recording Instruments.

4.7 Concept of Closed Loop Control System and its Components, PID & PLCs.

**5. Power System Protection and Safety**

5.1 Fault types and analysis.

5.2 Fuse and types, MCB and MCCB, isolators and contactors Circuit Breaker: types and characteristics, selection of circuit breakers

5.3 Relays and types: Over current, earth fault and under voltage relays, Overload and short circuit protection, earth fault protection, differential protection

5.4 Protection of generators, transformers and transmission/distribution lines.

5.5 Earthing and shielding techniques

5.6 Surge and Lightening Arrestor: characteristics and types

5.7 Touch and step potential

5.8 Electrical safety rules and regulations, safety tools and devices, Fire hazards, Firefighting techniques and equipment

5.9 Maintenance planning, Concept of various maintenance practices, electrical troubleshooting.

**6. Electrical Energy Management and Economics**

6.1 Classification of Costs, Cost analysis of power plants, Interest and Depreciation

6.2 Load curve, load duration curve, plant factor, demand factor, diversity factor and other terms related to economics of power generation, demand side management, load forecasting

6.3 Tariff and types, Type of consumer and their tariff

6.4 Project Financial Analysis: Cash flow, Net Worth, Internal Rate of Return, Payback period, B/C ratio.

6.5 Power factor: Causes of low power factor, Methods of power factor improvement, Economics of Power factor improvement

6.6 Generation scheduling and economic load dispatch

6.7 Concept of Power System Restructuring.

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