

Syllabus for Electrical Engineering  
(Diploma Level)

**I CORE/COMPULSORY PAPER**

GENERAL ELECTRICAL ENGINEERING, INTERNAL AND EXTERNAL Electrification. HVAC (HEATING Vantilation and Air conditioning)and Lightning / Illumination etc.

Circuit theory, RLC circuits, magnetically coupled circuits, Ohms law, kichoff law, thevenin theorem, Norton theorem, etc., single phase and 3 phase AC systems, earthing (grounding), equipment earthing, sub-station earthing. Electro-magnetic theory and electrical engineering materials.

System voltage levels, voltage variations, voltage control, load frequency control, load shedding. peak load problem and maximum demand management. Power supply quality, power plants, renewable and conventional sources of energy for electric power generation.

AC transmission, HVDC transmission and national grid of India. Distribution system - Urban, rural, industrial and residential. Sub-stations, equipment and bus-bar systems, conventional, VCB, SF6, GIS, type switchgears

Power cables, LT/HT power cables, cabling and cable fault location. Primary cells, storage batteries, battery charging systems. UPS in electrical plants, fuel cells.

Power transformers, distribution transformers, instrument transformers and auto transformers. Switchgears, circuit breakers, contactors, metal clad, switchgears, capacitors, capacitors banks, voltage control and voltage stability. Protection, control and automation of electrical plants and equipments.

Rotary machines, utilizations protection and maintenance of industrial and other types of electrical machines. Selection of motors. Various types of electric drives. Installation and commissioning of various types of electric motors. Electrical and mechanical maintenance of rotating machines.

Protection and automation of 3 phase alternatives, automatic voltage regulators and excitation systems. Commissioning and synchronization of alternatives with grid system. DG sets, their installation commissioning and maintenance aspects. Single-phase AC motors and their applications.

Power electronics, drive control system using silicon rectifier based power converters. PLC and micro-processor based motor control.

Pumps, fans, blowers and compressors. Ventilation, air-conditioning and refrigeration. Window type. package type and centrally air-conditioning systems. Electrical heating and melting furnishes. Illumination engineering, domestic installation and home electrical appliances.

IEC rules, Indian Electricity Act and electrical clearances etc.

## II Elective Part-A

### **RAILWAY ELECTRIFICATION - RAIL TRACK OVERHEAD EQUIPMENT, POWER SYSTEM INSTALLATION AND SCADA**

#### **OHE:**

- Simple lay out and pegging plan for OHE, criteria for location of section insulators, overlaps, neutral section etc.
- Need for regulation in AC OHE, type of regulating equipments and their principle of operation, effect of temperature variation etc.
- Selection and type of foundation (Soil characteristic, load of OHE etc).
- Selection and type of steel structure, bending moment etc
- Various protections for OHE, type of relays, relay setting calculation
- Various types of electrical clearances, power line crossing regulations.
- Various types of earthing and bonding.

#### **PSI:**

- Sub-station design, earthing system, grid type of earthing, buried rail concept, single line diagram of TSS, and function of various equipments.
- Type of relays used for traction transformer and transmission line and their setting calculation.
- Transmission line - Type of foundation and structures and conductors, various types of spans, counter poise earthing, eccentricity of towers, sag template charts etc.
- Basic principles of thermal, hydro and nuclear power generation
- Electricity generation from non conventional sources

#### **SCADA:**

- Basic principles, two way communication channel, type of cable used, interaction with traffic control, data logging etc

**Note: The Syllabus for diploma holders will be more or less same but with elementary and simple questions on the same.**

## II. Elective Part-B

### **ELECTRIC LOCOMOTIVES, EMUS, AND METRO ROLLING STOCK GROUP**

Design concept for different types of electric locomotives and EMUs based on type of traction i.e. 1500 VDC traction and 25 KVAC traction; based on traction motor i.e. DC series motors versus 3 phase AC induction motor type traction motors; based on type of traction/braking/speed control system such as tap changer control, resistance-contractor control. phase angle control thyristor converters and PWM type four quadrant unity power factor control with GTO/IGBT converters/invertors. Merits and demerits of above mentioned types, operation and maintenance related issues. Maintenance schedules such as inspections overhaul and repair facilities required for such type of locomotives and EMUs. Common horse power ratings, haulage capacity. Tractive / braking effort ranges. single and multiple operations of such locomotives for heavy haul freight operation and high-speed passenger operation. Rating performance parameters pertaining to acceleration / deceleration levels. ability to maintain sectional run times with one motor coach isolated fully or half of it with one bogie without traction for EMUs. Schematic circuit of various types of electric locomotives and EMUs showing the control and protection elements.

IGBT converter based traction rolling stock. Special features of microprocessor based IGBT converter controlled three-phase drive system for locomotive and EMUs. Passenger information system for EMUs and metro rolling stock. Life cycle costs. maintenance depot needs. rake link requirement and operational arrangement etc. for locomotives and EMUs.

**Note: The Syllabus for diploma holder test will be based on the above covering only elementary aspects.**