

# **CSIR-Central Drug Research Institute**

## **SYLLABUS**

### **TRADE-ELECTRICIAN (ITI STANDARD)**

**TN06**

#### **UNIT-I:SAFETYRULES-FUNDAMENTALOFFELECTRICITY ANDELECTRICAL APPLIANCES**

Safety Rules and safety signs, Hazards, Types and working of Fire Extinguishers, First aid safety practice, Personal Protective Equipments, concept of standards BIS/ISI, Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Types of Wires and Joints. Soldering Methods, Ohm's Law - Simple Electrical Circuits and Problems. Kirchoff's Law and its application, Series-parallel circuit connections, Underground cables: Description, types, various joints and testing procedure.

Domestic Appliances - Working principles and circuits of common domestic equipment and appliances, Concept of Neutral and Earth - Cooking Range, Induction Heater, Food Mixer - Automatic Electric Iron Box, Electric Geyser Wet Grinder, Washing Machine and Fans.

#### **UNIT-II:ACCIRCUITS-CELLSANDBATTERIES-WIRING INSTALLATION**

Laws of resistance and various types of resistors, Inductive and capacitive reactance, their effect on AC circuit, AC Circuits - Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance, Power, Energy in AC Single Phase Circuits, Single, three phase and polyphase systems and simple related numerical problems,

Cells and Batteries - Chemical effect of electric current and Laws of electrolysis. Types of cells, advantages / disadvantages and their applications.

Wiring Installation- I.E. rules on electrical wiring. Types of domestic and industrial wirings. Basic Wiring Practice, Study of wiring accessories e.g. switches-One way Switch, Two way switch, Switch board, Plug Socket (only specification and use), fuses, Isolators, relays, MCB, ELCB, MCCB etc.,PVC conduit and wiring system. Testing a Domestic Wiring Installation – Location of Faults, Remedies.

### **UNIT-III:ILLUMINATION,ELECTRICALMEASURING INSTRUMENTS AND EARTHING**

Illumination – Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Construction Details of Various Lamps, Electrical Measuring Instruments and types - Ammeter, Voltmeter, Ohm Meter, Power Factor Meter, Frequency Meter, Multi meter, Watt Meter, Energy Meters (1 Phase and 3 Phase). Tong Tester (Clamp on Meter), Smart Meters, Automatic Meter Reading - Supply Requirements. Errors and corrections in measurement.

Earthing-Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.

### **UNIT-IV:TRANSFORMERS AND DCMACHINES**

Transformer – Principle, Classification, EMF Equation, Transformer Losses. Open Circuit Test, Short Circuit Test – Efficiency – Voltage Regulation. Simple Numerical problems. Winding of transformers. Parallel Operation of Single Phase and Three Phase Transformers – Methods of Cooling of Transformer – Necessity of Cooling - Transformer Oil and Testing – General Maintenance of three Phase Transformer. Auto Transformer and instrument transformers (CT & PT).

DC Generators – Principle of Operation – Construction – Parts –Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core, Types of DC generators– Characteristics – Build up of emf – Application – Losses efficiency, Routine & maintenance. Simple Numerical problems.

DC Motors – Principle of Operation – Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor, Starters – DOR – Armature reaction – Commutation – Speed Control Methods – Applications – Winding lap and Wave – Losses and efficiency – Maintenance, Service and repair. Simple Numerical problems.

## **UNIT-V:AC MACHINES AND SYNCHRONOUSMACHINE**

Three Phase Induction Motors –Principle of Working–Construction–Parts– Types – Squirrel Cage Induction Motor – Slip ring Induction Motor – Characteristics – Slip Vs Torque – Type of Starters and Functions.

Single Phasing Prevention – Losses and efficiency – Methods of Speed Control– Windings– Types– Concentric/Distributed– Single/double layer winding and related terms – Maintenance Service and repair – Trouble Shooting.

Single Phase Induction Motors - Working Principle – Types – Construction – Parts – Starting & running Methods – Domestic and Industrial – Applications Maintenance and Trouble Shooting of single phase AC induction motor and Universal motor. Simple numerical problems.

Synchronous Machine/ Alternators - Working Principle – Construction – Parts – Types – e.m.f. equation, Relation between Poles, Speed and Frequency – Voltage Regulation – Losses and efficiency – Characteristics – Phase Sequence – Parallel Operation – Care and Maintenance. Effect of changing the field excitation and power factor correction.

Synchronous Motor –Working Principle–Effect of change of excitation and load. V and inverse V curve, Power factor improvement

## **UNIT-VI: ELECTRONICS AND POWER SYSTEM CONTROL CIRCUITRY**

Resistors – Color Code, Types and Characteristics – Active and Passive Components, P-N junction Diode, its classification and specifications – Half wave and full wave Rectifiers– Characteristics – Transistors, SCR, DIAC, TRIAC, IGBT – Applications – Digital Electronics – Logic gates and Combinational Circuits – Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS. Preventive and breakdown maintenance.

Control circuit: Study and understand Layout drawing of control cabinet, power and control circuits. Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc.

Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc.

## **UNIT-VII: POWER GENERATION, TRANSMISSION AND DISTRIBUTION**

Types of Power Generation – Conventional and Non-Conventional Energy Sources – PV Solar Panels – Transmission and Distribution Network – Line Insulators – Over Head Poles and method of joining aluminum conductors– Safety Precautions and IE Rules for Service Lines – Terms related to Distribution. Various substations.