

## IV ENGINEERING & TECHNOLOGY GROUP

### (i) TRADE : ELECTRICAL

#### PAPER-I

#### BASIC ELECTRICITY THEORY

Time : 2 hrs

Theory : 30 Marks

CCE : 10 Marks

Practical : 50 Marks

Total :

90Marks

#### Introduction

Electricity and its Types, Definition & Units of Resistance, Voltage, Current, Power, Energy, Resistor, Rheostat and Potential Divider, Resistance and its types and Colour Coding, Factors affecting Resistance of a Conductor, Temperature Coefficient of Resistance, Difference Between AC and DC Voltage, Advantages of Electric Energy over other types of Energy.

#### D.C. Circuits

Ohm's Law, Relation between Voltage and Current in a DC Circuit, Series and Parallel Resistance Circuits and their Equivalent Resistance, Series-Parallel Resistance Circuits and Calculation of Equivalent Resistance. Kirchhoff's Laws and its Applications.

#### Batteries

Primary Cell, Dry Cell, Battery, Series and Parallel Connection of Cells, Secondary Cells, Lead Acid Cell, Discharging and Recharging of Battery, Common Charging Methods- constant current method and constant voltage method, Care and Maintenance of Secondary Battery, Specifications of a Cell Battery, Silver Oxide Batteries and Lithium Polymer battery.

#### Capacitors

Capacitor Units and Capacity, Concept of Charging and Discharging of Capacitors, Types of Capacitors and their Use in Circuits, Series and Parallel Connection of Capacitors Energy Stored in a Capacitance.

#### Electromagnetic Effects

Permanent Magnets and Electromagnets, Their Construction and use, Properties of an Electromagnet and Rules for Finding them, Faraday's Laws Of electromagnetic Induction and Applications, Dynamically Induced E.M.F - Magnitude and Direction, Static

E.M.F. - Magnitude and Direction, Static Induction, Self Induced M.F. - Magnitude and Direction, Inductance and its Unit, Mutually Induced E.M.F. - Magnitude and Direction.

#### A.C. Circuits

Principles of Generation of A.C. Voltage and Wave Shape Cycle, Frequency, Peak Value, Average Value, Instantaneous Value, R.M.S. Value, Introduction to Resistance, Capacitance and Inductance, Inductive Reactive and Capacitive Reactance, Phase Difference, Power Factor - Leading and Lagging, Impedance, Poly phase and Generation of 3 Phase - Delta and Star Connections.

#### Measuring Instruments

Working Principles of Moving Iron and Moving Coil Voltmeters and Ammeters, Range Extending of Ammeter, Voltmeter, Megger and Induction Type Energy meter, their Circuit Connection and Application for Measurement of Electrical Quality, Multimeters and its Types.

**Earthing**

Need of Earthing, Types of Earthing - Plate Earthing, and Pipe Earthing, Procedure and Application.

**Solar Electricity**

Need of Solar Energy, Solar Photovoltaic (SPV) Technology, Advantages of SPV System, Solar Constant, Formation of Solar Cells, SPV Module, Array and Applications of Solar Photovoltaic System.

**BASIC ELECTRICITY****Time: 3 hrs****PRACTICAL****Marks : 50**

- Measurement of current, voltage and resistance with the help of multimeter.
- Verification of Ohm's Law.
- Measurement of equivalent resistance of series combination of resistors.
- Measurement of equivalent resistance of parallel combination of resistors.
- Measurement of equivalent resistance of series-parallel components of resistors.
- To verify Kirchhoff's current laws (KCL).
- To verify Kirchhoff's voltage laws (KVL).
- Charging a lead acid battery and to test its state of charge.
- Study of series and parallel capacitor circuits.
- Study of series and parallel resistor circuits/lamps.
- Connections of Ammeter, Voltmeter and Wattmeter in an A.C. circuit of resistive load.
- To test a single phase energy meter with the help of standard wattmeter and stop watch with resistive load.
- Controlling low voltage lamps in series.
- Controlling lamps from two or three places.
- Drawing schematic diagram of single phase supply to consumers.
- Drawing schematic diagram of three phase supply to consumers.
- Practice on CTS/TRS (Batten) wiring with 2 fans, 4 lamps, 2 tubes and 4 plug points.
- Practice on conduit wiring.
- Polarity (means phase and neutral testing) test of wiring installation.
- Measurement of insulation resistance of wiring installation by megger.
- Testing of wiring installations with the help of megger.
- Installation of pipe earthing for wiring installation.
- Study of plate earthing for wiring installation.

- Testing faults of wiring installation and rectification.
- Installation of a sub-meter between a given electrical wiring.
- Measurement of open circuit voltage and short circuit current of a PV Module.
- To study /install a Solar Street Light System.

**PAPER-II**

**ELECTRICAL DOMESTIC APPLIANCES**

**- I THEORY**

**Time : 2 hrs**

**Theory : 30 Marks**

**CCE : 10 Marks**

**Practical : 50 Marks**

**Total :  
90Marks**

**Introduction**

Introduction to Phase, Neutral, Earth, Voltage between Phase and Neutral, Phase and Earth Common Faults – (i) Open Circuit, (ii) Short Circuit (iii) Earth Fault, Series Testing Board and its Uses.

**Electric Room Heater**

Construction and Working Principle of Reflector type Room Heater, Common Defects, Testing and Repairs.

**Electric Iron**

Types - Ordinary type and Automatic/ Thermostat Control type, Steam Iron, Constructions and Working Principles of Electric Irons, Common Defects, Testing and Repairs.

**Electric Stove**

Types - Coiled Types, Oven, Construction and Working Principles of Electric Stoves, Induction Plates - Merits and Demerits, Common Defects, Testing and Repairs.

**Electric Toaster**

Types - Ordinary and Automatic, Construction and Working Principles, Common Defects, Testing and Repairs.

**Immersion Heater and Geyser**

Construction, Working Principle, use of Immersion Heater, Common Faults and Causes, Testing and Repairs, Construction, Working Principles and use of Geyser, Common Defects and Causes, Testing and Repairs, Testing and Installation of Geyser, Precautions in using Immersion Heater and Geyser.

**Electric Kettle**

Construction, Working Principle and use of Electric Kettle, Common Faults and Causes.

**Illumination**

Joul's Laws of Electric Heating and its Domestic Applications, Heating Efficiency, Lighting Effect of Electric Current, Constructions, Working Principles and uses of Table Lamp, Night Lamp and Tube Light, Common Faults and Causes, Testing and Repair, Study of CFL and LED – Construction working principle, fault and causes, testing and repair.

**Electric Bell, Buzzer and Door Chimes**

Constructions, Working Principles and uses of Electric Bell, Buzzer and Door Chimes, Common Faults and Causes, Testing and Repair.

## ELECTRICAL DOMESTIC APPLIANCES - I

**Time: 3 hrs**

**PRACTICAL**

**Marks : 50**

- Fabrication of a control panel board with meters and series test lamp for testing of electrical appliances.
- Fabrication of a mains lead with three pin plug and iron connector.
- Dismantling and reassembling of reflector type room heater.
- Testing and repairing of reflector type room heater.
- Dismantling and reassembling of electric iron - ordinary type, automatic/ thermostat control type.
- Testing and repairing of electric iron - ordinary type, automatic/ thermostat control type.
- Dismantling and reassembling of electric stove - coiled type, oven.
- Testing and repairing of electric stove - coiled type, oven.
- Dismantling and reassembling of electric toaster – ordinary, automatic.
- Testing and repairing of electric toaster – ordinary, automatic.
- Dismantling and reassembling of geyser.
- Testing and repairing of geyser.
- Dismantling and reassembling of electric kettle.
- Testing and repairing of electric kettle.
- Connections of a fluorescent tube.
- Testing and repairing of (i) table lamp (ii) night lamp (iii) tube light (iv) CFL
- Testing and repairing of (i) electric bell (ii) buzzer (iii) door chimes.
- Fabrication of an extension cord for three plug points with independent controls.
- Dismantling and reassembling of induction plate.
- Construct and test decorative running LED lamp assembly

**THEORY****Time : 2 hrs****Theory : 30 Marks****CCE : 10 Marks****Practical : 50 Marks****Total :****90Marks****Safety Precautions and Shock Treatment**

Familiarize the Students with Shop Discipline, Layout of Shops, Safety Precautions, use of Fire Fighting Equipment, First Aid Practice, Causes of Electric Fire and Electric Shock, Precautions to Avoid Electric Fire and Electric Shock, Procedure for Removal of Person from Contact of Live Wire, Treatment of Electric Shock and Burns as per IEI Rules.

**Common Tools**

Familiarize the Students with Common Tools, Safe use of Tools, their Specification and Applications.

**Conducting Materials**

Copper and Aluminum as Low Resistivity Materials, their Electrical Characteristics and Applications, Electric Resistance Materials, Materials for Lamp Filaments and Brushes. Tungsten, Ni-chrome, Selenium and Carbon as High Resistivity Materials, their Electrical Characteristics and Applications.

**Insulating Materials**

Distinction between Conductor, Insulator and Semi Conductor, Insulation Resistance, Dielectric Strength, Breakdown Voltage, Mechanical and Physical Properties and Classification of Insulating Materials, Paper, Plastic Coated Paper, Empire Cloth Leatheroid, Cotton and Silk, Rubber, PVC Porcelain, Bitumen, Micro, Bakelite, Ebonite, Marble, Glass Asbestos, Fiber Glass - uses and Applications, Insulating Tapes, Sleeves, Insulating and Impregnating Varnishes and Paints- uses and Applications.

**Magnetic Materials**

Classification, Properties and uses of Materials - Ferromagnetic Materials, Soft and Hard Magnetic Material, Mild Steel, Silicon Steel, Mu-Metal, Permalloy, Alnico as Magnetic Materials.

**Structure Materials**

Iron Steel, Brass, Gun Metal and Aluminum as Structural Materials, their Properties and Applications.

### **Fuse and Soldering Materials**

Silver, Copper, Lead, Tin and Alloys as Fuse Material, their Properties and Applications, Soldering & Brazing Materials and Tools, Procedure of Soldering & Brazing, Precautionary Measures.

### **Wiring Materials**

Types of Wiring - Introduction to Conduit Wiring, Procedure Systems, Factors for Selection Of a Particular Wiring System, Importance of Switch, Fuse, Change Over Switch and Earthing of Wiring System, Types of Faults, Causes and Remedies, Methods of Finding Numbers of Circuits and Circuit Distribution By Distribution Board System, Indian Electricity Rules (IER) related to Wiring, Introduction to Sub-meters and their Installation in Inverter Wiring. ICTP and ICDP Main Switches, Distribution Boards, Bus Bar, Conduit Fittings and Pipes, Board, Switches Lamp Holders, Ceiling Roses, Plugs, Sockets, Wires, etc. used for Different Wiring.

### **Lubricants**

Solid, Semi - Solid and Liquid Lubricants, Uses and Applications.

### **Corrosion Protective Paints**

Application of Paint for Corrosion Protection and Precautions in Painting.

### **Electrical Symbols**

Electrical Symbols and Blue Print Reading, Simple Domestic Electric Circuit Drawing.

### **Bimetallic Relays**

Construction and Application of Bimetallic Relays and Thermo-Couple for Control of Temperature and Current.

### **MCB**

Introduction To Miniature Circuit Breaker (MCB), MCB DP and Earth Leakage Circuit Breaker (ELCB), Specifications and Their use in Electrical Circuits.

## MATERIALS AND WORKSHOP PRACTICE - I

**Time: 3 hrs**

**PRACTICAL**

**Marks : 50**

- First aid box practice.
- Identification of common tools.
- To form two identical coils using insulated Copper wire and Aluminum wire of same gauge and same number of turns and compare their resistance.
- To make coils of Nichrome and Eureka wires of equal lengths and gauge and measure resistance, current and power at a given voltage.
- Identification of different insulating materials.
- Practice on insulating - slots, cores of motors.
- Insulating the coil winding with varnish.
- Replacing a blown fuse of standard current rating.
- Study the relationship between wire diameter and fusing current for instantaneous fusing.
- Soldering practice.
- Lubricating technique practice.
- Study of thermo coupled oven to control temperature.
- Application of bimetallic relay to control temperature.
- Use of MCB, MCB DP in an electrical circuit.
- Use of an ELCB in an electrical circuit.