

**ANNEXURE I**  
**ELECTRICAL & ELECTRONICS ENGINEERING**

**UNIT I:- BASIC ELECTRICAL ENGINEERING**

Ohms and Kirchhoff's Laws, star/delta transformation, Network theorems, Power and Energy, Heating effects of Electric current, Magnetic effects, Electromagnetic Induction, Electrostatics, Batteries, Types of Electrical Engineering Materials – Conducting, Semi-conducting, Magnetic, Insulating, Di-electric – Properties and Uses.

**UNIT II:- D.C. MACHINES, BATTERIES & MEASURING INSTRUMENTS:**

**D.C. Generators:** Construction, Operation, types, EMF Equation, Windings, Characteristics, Efficiency and Parallel operation.

**DC Motors:** Principle of operation, Back EMF, Torque Equation, Types, armature reaction. Characteristics, Starters, Speed Control, Losses, Efficiency and Testing.

**Measuring Instruments:** Classification, Principle of Operation of moving Coil, Moving Iron, Dynamometer type, Induction type meters, Instrument Transformers, Induction type Energy meter, Measurement of Resistance, Transducers and Sensors – Types, Thermistor, Thermocouple, Pressure Transducers and Strain gauges, Electronic and Digital Instruments.

**UNIT III:- A.C. CIRCUITS AND TRANSFORMERS:**

**A.C. Circuits:** Fundamentals, Series and parallel R-L-C Circuits, Resonant circuits, Polyphase Circuits, Measurement of power by 2 Wattmeters.

**Transformer:** Single-phase Transformer, Construction, Operation, Equivalent circuit, regulation, efficiency, Testing and Parallel operation, Accessories of Transformers and Cooling. Three-phase Transformers, Auto-Transformers.

**UNIT IV:- A.C. MACHINES**

**Alternators:** Construction, Operation, EMF equation, regulation, testing and parallel operation.

**Synchronous Motors:** Operation and performance, effects of Excitation, 'V'-Curve and inverted 'V'- Curve, methods of Starting and uses.

**Three-Phase induction Motors:** Construction, Principle of Operation, Torque Equation, Slip-torque characteristics, losses, efficiency, speed control, starters.

**Single-phase Induction Motor:** Types, Principle of operation, applications. Single-phase commutator motors: Types, Principle of operation and applications.

**UNIT V:-POWER SYSTEM GENERATION & PROTECTION**

**Generating Stations:** Working, Components, Comparison of Thermal, Hydel, Nuclear and Gas Power stations. Pollution control, Combined Working, Power Stations auxiliaries, Characteristic Curves and Important Terms, types of tariffs, power factor correction and economy.

**Power Systems Protection:** Circuit Breakers – Types, Principles of operation and uses, Current Limiting reactors, Relays – Classification, Principle of Operation of Induction type over current relay, Directional and Non directional relays, differential relays and distance relays, Protection of alternators, Transformers, Bus-bars, Transmission lines, Lightning arrestors, neutral grounding.

## **UNIT VI:- TRANSMISSION AND DISTRIBUTION**

**Transmission and distribution:** Types of supply systems, Transmission line parameters, inductance and capacitance, performance of short and medium lines, regulation, Ferranti effect, Corona, Basic concepts of HVDC Transmission, Advantage and disadvantages of HVDC Transmission.

Components of lines, supports, conductor spacing, ground clearance and sag, insulators, voltage distribution across the string, string efficiency, methods of improving string efficiency. Earthing and layout of sub-stations.

Cables – Classification, insulation resistance, specifications. Distribution – Radial and ring distributors, variation of load voltage.

## **UNIT VII: - ELECTRIC TRACTION**

**Electric Traction:** Systems of Train Electrification, Speed-time Curves for different services, Schedule speed, Tractive Effort, Specific Energy Consumption, Traction system auxiliaries, Traction motor.

## **UNIT VIII:- ELECTRICAL ESTIMATION**

**Electric Wiring:** Tools, Wires, Types of wiring, Accessories, Lamp Circuits, Estimating and costing of domestic, industrial, power, irrigation pump sets, over head lines and ii KV Sub Stations, Rural electrification, departmental tests, earthing, maintenance of electrical machines.

## **UNIT IX: BASIC ELECTRONICS AND DIGITAL ELECTRONICS**

**Semi-Conductor devices:** N type & P type,, Zener diode, PNP and NPN Transistors, Transistor configurations, characteristics, power supplies – half and full wave rectifiers, Filters, Zener diode regulation, Special devices – UJT, FET, LED, SCR, Opto Coupler, Photodiode, Photo Transistor, CRO and Timers.

**Amplifiers:** Types, Principles of operation, Characteristics.

**Oscillators:** Types, operation and application of each.

**Digital Electronics:** Different numbering systems, inter Conversions Boolean Algebra, Logic families, performance of AND, OR, NOT, NOR, NAND gates, combinational Logic Circuits, sequential logic circuits, Resistors and Memories, A/D and D/A converters.

## **UNIT X:- POWER ELECTRONICS AND MICRO CONTROLLER**

**Power Electronic Devices:** Construction and working of SCR, GTOSCR, DIAC, TRIAC, Volt-ampere characteristics, Triggering of SCR using UJT, Protection.

**Converters, AC regulators, Choppers, Inverters and Cycloconverters:**

Types of Converters, working of AC regulators and Choppers. Types of inverters, Principles of working, Basic principle of working of Cyclo converters.

Speed control of D.C. Motors by using converters and choppers, Speed control of induction motor by using AC Voltage regulators – V/F Control, Switched mode power supplies (SMPS), UPS.

**Micro Controllers:** Architecture of 8051, instruction set of 8051, programming concepts, peripheral ICS – Function, features.

**ANNEXURE II**  
**NUMBER OF QUESTIONS TO BE SET**  
**ELECTRICAL & ELECTRICAL ENGINEERING**

<b>Unit No</b>	<b>TOPICS</b>	<b>MARKS</b>
<b>I</b>	Basic Electrical Engineering	<b>7</b>
<b>II</b>	D.C. Machines, Batteries & Measuring instruments	
	D.C. Generators	<b>4</b>
	D.C. Motors	<b>4</b>
	Measurements Instruments	<b>4</b>
<b>III</b>	A.C. Circuits and Transformers	
	A.C. Circuits	<b>5</b>
	Transformers	<b>7</b>
<b>IV</b>	A.C . Machines	
	Alternators	<b>3</b>
	Synchronous Motors	<b>3</b>
	Three-Phase Induction Motors	<b>4</b>
	Single Phase Induction Motors	<b>2</b>
<b>V</b>	Power System generation & Protection	
	Generating Stations	<b>5</b>
	Power System	<b>5</b>
<b>VI</b>	Transmission and Distribution	<b>10</b>
<b>VII</b>	Electric traction	<b>8</b>
<b>VIII</b>	Electrical Estimation	<b>4</b>
<b>IX</b>	Basic electronics and digital electronics	
	Semi-Conductor devices	<b>3</b>
	Amplifiers	<b>2</b>
	Oscillators	<b>2</b>
	Digital Electronics	<b>4</b>
<b>X</b>	Power Electronics and Micro Controller	
	Power Electronics Devices	<b>4</b>
	Converters, AC regulators, Choppers, Inverters and Cycloconverters	<b>6</b>
	Micro Controllers	<b>4</b>
	<b>Total</b>	<b>100</b>

### **ANNEXURE III**

#### **MODEL QUESTIONS FOR ELECTRICAL AND ELECTRONICS ENGINEERING**

1. The value of coefficient of adhesion will be high when rail are
  - 1) Greased
  - 2) Wet
  - 3) Sprayed with oil
  - 4) Cleaned with sand
  
2. Induction type single phase energy meters measure electric energy in
  - 3) kW
  - 4) Wh
  - 3) kWh
  - 4) VAR
  
3. If a 4 ohms resistor is connected across a 12 V voltage source the current in the resistor will be
  - 1) 1A
  - 2) 2A
  - 3) 3A
  - 4) 4A
  
4. Which of the following is known as Universal gate?
  - 1) AND
  - 2) OR
  - 3) NAND
  - 4) NOT