

## SYLLABUS – ELECTRICIAN

**Basics of Electrical Engineering:** Ohm's law - simple electrical circuits and problems, Kirchhoff's law and its applications, DC series and parallel circuits, Open and short circuit in series and parallel network, Effect of variation of temperature on resistance, Laws of resistance and various types of resistors, Wheatstone bridge - principle and its application, Series and parallel combination circuit.

**Capacitors and Magnetism:** Capacitors - types - series and parallel operations, Magnetic circuits - self and mutually induced emfs, magnetic material and properties of magnet, Principles and laws of electro-magnetism,

**AC Circuits:** Alternating current - terms and definitions - vector diagrams, Series resonance circuit, R-L, R-C and R-L-C parallel circuits, Parallel resonance circuits, Power, energy and power factor in AC single phase system.

**Basic wiring practice:** B.I.S. Symbols used for electrical accessories, Types of domestic wiring, Test board, Extension board and colour code of cables, Special wiring circuits - Tunnel, corridor, godown and commercial wiring.

**Cells and Batteries:** Primary cells and secondary cells, Types of cells, Battery charging method - Battery charger, Installation, care and maintenance of batteries, Solar cells

**Measuring Instruments:** Various measuring instruments –Scales -Classification, Wattmeters, 3-phase Wattmeter, Clamp-on meter, Extension of range of MC voltmeters - loading effect - voltage drop effect.

**Wiring Installation and Earthing:** IE Regulation for main switch and distribution board, Energy meter board installation, Estimation and cost of material for wiring installation, Testing a domestic wiring installation - location of faults – Remedies, Earthing - Types - Terms - Megger - Earth resistance – Tester.

**AC Circuits:** Concept of Neutral and Earth - Cooking range, Electric Bell and Buzzer, Heating element, heater/immersion heater, electric stove and hot plate, Food mixer.

**DC Generator and Motor:** DC Generator - principle - parts - types - function - e.m.f. equation, Building up of a DC shunt generator, Test a DC machine for continuity and insulation resistance, Characteristics of DC generator, DC motor - principle and types, The relation between applied voltage, back emf, armature voltage drop, speed and flux of DC motor - method of changing direction of rotation, DC motor starters, Relation between torque, flux and armature current in a DC motor, Characteristics and applications of a DC series motor, Characteristic and applications of a DC shunt motor, DC compound motor - load characteristics, Speed control methods of a DC motor and their applications, Method of calculation of control resistance and new speed, Troubleshooting in DC machines, Maintenance procedure for DC machines, DC motor control system (drives) AC-DC and DC-AC control, Materials used for winding - field coil winding, Winding wires, Armature winding

- terms - types - rewinding of mixer/liquidizer, Simplex lap and wave winding - developed diagram, Preparation of armature for rewinding, Rewinding of mixer/liquidizer Method of rewinding and balancing the armature, testing of armature winding.

**AC Three Phase Motor:** Principle of induction motor and construction of a 3-phase squirrel cage induction motor - relation between slip, speed, rotor frequency, copper loss and torque, Classification of squirrel cage motors, Insulation test on 3 phase induction motors, Starter for 3-phase induction motor - power control circuits - D.O.L starter, Numerical problems in ac 3-phase induction motors, Rotary type switches, Manual star-delta starter, Semi-automatic star-delta starter, Automatic star-delta starter, Three-phase, slip-ring induction motor, Resistance starter for 3-phase, slip-ring induction motor, Method of measurement of slip in induction motor, Efficiency-characteristics of induction motor- no load test - blocked rotor test, Characteristics of squirrel cage induction motor, Effect of external resistance in slip ring motor rotor circuit, Auto-transformer starter, Braking system of motors, Method of speed control of 3 phase induction motor, 3-phase squirrel cage induction motor winding, Method of placing coils in a basket or distributed winding, Three-phase induction motor winding, Testing of windings Insulating varnish and varnishing process in electric machines Method of connecting end connection, group connection, terminal leads, total loss and efficiency calculations, Power stage of 3-phase induction motor.

**AC Single Phase Motor:** Single phase motors - split phase induction motor - induction-start, induction-run motor, Centrifugal switch Single phase, split phase type motor winding, Capacitor-start, induction-run motor, Capacitors used in single phase capacitor motors, The shaded pole motor, Universal motor, Repulsion motor, Stepper motor, Hysteresis motor, Reluctance motor.

**Synchronous Generator and Motor:** Alternator - principle - relation between poles, speed and frequency, Types and construction of alternators, Generation of 3-phase voltage and general test on alternator, Emf equation of the alternator, Characteristic and voltage regulation of the alternator, Parallel operation and synchronisation of three phase alternators, Synchroscope method, Brushless alternator, Synchronous motor, MG set and rotary converter and inverter.

**Transformer:** Transformer - Principle - Classification - EMF Equation, Transformer losses – Open circuit and short circuit test, efficiency, Voltage Regulation, Parallel operation of two single phase transformers, Three Phase transformer – Connections, Cooling of transformer - Transformer oil and testing, Small transformer winding - Winding machine, General maintenance of three-phase transformers, auto transformer.

**Control Panel Wiring:** Control elements, accessories - layout of control cabinet, Power and control circuits for three phase motors, Installation of instruments and sensors in control panel and its performance testing.

**Inverter and Un-interrupted Power Supply:** UPS and Voltage stabilizer, Emergency light, Battery charger and inverter, Basics of Inverter, Installation of inverter in domestic wiring.

**Electrical Power Generation and Substation:** Sources of energy - Thermal power generation, Hydro power plants, Visiting of electrical substation, Electrical substations, Electrical power generation by non conventional methods, Tidal power generation, Power generation by solar and wind energy.

**Transmission & Distribution:** Electrical supply system - transmission - line insulators, Line insulators, Overhead lines /poles erection-fastening of insulator, Joining of aluminium conductors, Domestic service line - IE rules, Bus-bar system - power tariff terms and definitions, Power tariff - terms and definitions.

**Circuit Breakers and Relays:** Line protective relays - types - operation, Circuit breakers - parts - functions – tripping mechanism, Tripping mechanism of circuit breakers, Repair and maintenance of circuit breakers.

**Wires, Joints - Soldering - U.G. Cables:** Fundamental of electricity - conductors - insulators - wire size measurement - crimping, Wire joints - Types - Soldering methods, Underground cables - construction - materials - types - joints – testing.

**Electrical Safety rules and practice:** Safety rules - Safety signs – Hazards, Fire - Types – Extinguishers, Rescue operations - First aid treatment - Artificial respiration, Disposal of waste material, Personal Protective Equipment, Guidelines for cleanliness of workshop and maintenance.