

SYLLABUS

1. PRINCIPLE OF ELECTRICAL ENGINEERING

- (i) Conductor: Conducting materials and their properties, used of conducting materials in different fields.
- (ii) Insulators: Insulating materials and their properties, used of insulating materials in different fields.
- (iii) Work Power and Energy: Definitions and units, relation between electrical, mechanical and heat units simple problems.
- (iv) Direct Current Circuits: Series, parallel and series-parallel circuits of resistance division of current in parallel circuits with problems, Kirchoff's laws-point law and Mesh law with simple problems.
- (v) Magnetism and Electromagnetism: Definition of magnetic flux, flux density, magnetic induction, permeability, magnetizing force, magnetomotive force, reluctance, electromagnet, Faraday's laws of electromagnetic induction, Lenz's, self and mutual induced e.m.f. right hand rule.
- (vi) Capacitors: Definition of capacitance, capacitance of parallel plate condenser and their uses.
- (vii) A.C. Fundamentals: Definition of cycle, time period, frequency, amplitude, phase, phase difference, R.M.S. value, average values, form factor, crest factor, phasor representation of alternating quantities, simple problems.
- (viii) Single Phase A.C. Circuit: A.C. circuit with resistance-inductance, resistance-capacitance, resistance-inductance-capacitance connected in series and parallel by means of phasor diagram, power factor, power with simple problems.
- (ix) 3 Phase Circuits: Line and phase quantities and their relationship in star delta connected circuit, 3 phase power, related problems.

2. D.C. MACHINES AND BATTERY

- (i) D.C. Machines: Construction and function of different parts of D.C. machine. Functional difference between generator and motor. Principles of operation of motor. Back e.m.f. Types of generator and motor, starting of D.C. motors. Different and efficiency of motor and generator.
- (ii) Battery: Construction of lead acid cell and working principle, charging and discharging with chemical reaction, induction of fully charged battery.

3. ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT

- (i) Moving iron and Moving Coil Instrument: Construction working principle of ammeter and voltmeter with application.
 - (ii) Energy Meter: Single phase and 3 phase energy meter-induction type-construction, working principle and application, testing of energy meter.
 - (iii) Watt Meter: Dynamometer and induction type-construction, working principle, measurement of 3 phase power using two watt meter and three wattmeter. Three phase wattmeter basic principle.
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- (iv) Instrument Transformer: Definition of instrument transformer current transformer and potential transformer-construction, application.
 - (v) Power Factor Meter: Single phase and three phase-construction and working principle.
 - (vi) Synchroscope and its uses:
 - (vii) Localization of cable fault: Common fault in cable, Murray loop test.
 - (viii) Cathode Ray Oscilloscope: Construction, working principle and uses.

4. BASIC ELECTRONICS AND COMPUTER

- (i) Electron Emission: Different methods of electron emission.
- (ii) Semiconductor Devices: P.N. junction diode, Zener diode characteristics and application PNP and NPN transistors, rating, characteristic in different configuration.
- (iii) Power Supplies: Half wave and full wave rectifier (centre tap and bridge). Filters and types of filter circuit, Ripple factor.
- (iv) Amplifier: Transistor as an amplifier-CB, CE and CC configuration, voltage, current and power gains, RC coupled, transformer coupled amplifier, push pull amplifier.
- (v) Oscillator: Types of oscillators-Hartley's, Colpitts oscillators. Condition for oscillation and frequency of oscillation.
- (vi) Modulation: Principle of modulation, types of modulation-amplitude modulation and frequency modulation.
- (vii) Basic Concept of Computer: Types of computer, analogue, Digital, general purpose, mini and micro computer, and their application, concept of operating system-function and characteristics. Definition of interpreter, compiler, source code, object code, elementary idea of device and file management.
- (viii) Input/Output Device: Classification, keyboard, display units, their resolution, printers, different types of printers, plotters, mouse, digitizer and character reader.
- (ix) Storage Devices: Disks, magnetic tape, different types of floppy disc.
- (x) Programming Language Concept: Flowcharting, pseudocode, programme development, structure programming.
- (xi) System Installation Concepts: Hardware and software specifications, different types of requirements system layout, testing, training protection and removal of dust free condition.

5. ELECTRICAL DRAWING AND ESTIMATING

- (i) Drawing and estimation of materials required for service connection to domestic and industrial consumer (both overhead and underground).
- (ii) Design and drawing of installation layout of building with C.T.S., P.V.C. and conduit wiring with estimation of material required.
- (iii) Design, drawing and estimation of materials for wiring of industrial installation i.e. workshop etc.
- (iv) Drawing of different earthing (pipe earthing and plate earthing) and estimation of materials required for earthing.
- (v) Estimation and drawing of 440/230 volts distribution lines with details.
- (vi) Design, drawing and estimation of materials required for single and double pole mounted transformer substation for a given load.

6. A.C. MACHINES

- (i) Transformer: Basic definition, constructional features of different types (core type and shell type), principle of operation, e.m.f. equation, transformation ratio, open circuit and short circuit test, losses and efficiency, condition for maximum efficiency, three phase transformer-different types of connections-delta, delta, star/delta star with simple problems, Autotransformer-construction, principle of working and uses.
- (ii) Three Phase Induction Motor: Principle of operation, construction, types of rotor synchronous speed, rotor speed slip, rotor current and frequency, star-delta starter and autotransformer starter for squirrel cage and slip ring motor.
- (iii) Alternator: Constructional features of different types of alternator (Hydro and turbo generator), effect of change of excitation synchronizing of single and three phase alternator.
- (iv) Synchronous Motor: Construction and working principle, method of starting,

- operation at constant and variable excitation with problems motor on load, vector diagram, application with special reference to p.f. improvement.
- (v) Synchronous Converter: Description and operational principle starting from A.C. side from D.C. side.
- (vi) Mercury Arc Rectifier: Description and operation for single phase and three mercury rectifier.

7. ELECTRICAL POWER

- (i) D.C. and A.C. Distribution System: Different types of distributor, use of interconnectors in distribution system with simple problems comparison of A.C. and D.C. system.
- (ii) Overhead Distribution Lines: Different types of poles bracket, insulators, stays, guard wires. Materials used for insulators, different types of insulators with diagram and uses.
- (iii) Underground Cable: Different types, comparison with overhead system, laying of underground cables.
- (iv) Power Factor Improvement: Causes of low power factor and its effect. Methods of improving power factor with simple problem.
- (v) Power Station: Sources of electric power, general layout and selection of site for thermal power station, hydro electric and nuclear power station.
- (vi) Over Head Transmission: Short lines and medium lines, low medium and high voltage, I.E. rules for voltage drops, simple problems. Elementary idea of skin effect and corona effect, sag and tension.
- (vii) Economic Considerations: Economic of generating, load factor, demand factor, capacity factor, load curve, load-duration curve, methods of tariff, simple problems.
- (viii) Switch Gear and Protection: Oil circuit breaker and air blast circuit breaker, construction and operational principle with simple diagram for over current relay. Over voltage relay, buchholz relay lightning arrester-description with diagram for horn gap and thyristor type arrester construction and uses of isolator, H.R.C. Fuse and current limiting reactor.
- (ix) Substation: Different types of substation names of different types of equipments, measuring instruments and recording instrument, earthing substation.

8. ELECTRICAL INSTALLATION

- (i) Internal Wiring: Different types of internal wiring with their field of application, advantage and disadvantage, material required for each system. I.E. rules for placing of switches mains, cut-outs and sockets. Testing of wiring before commissioning as per I.E. rules, megger and its uses.
- (ii) Illumination: Definition of lumen, lux, illumination level laws of illuminations, coefficient of illumination, maintaining factors, spaceheight ratio. Different types of lamps, connection of fluorescent lamps and gas discharge lamps.
- (iii) Machine Installation: Different methods of foundation alignment and leveling. Necessity of earthing, selection earthing points as per I.E. rules, size of earth conductor.

9. PLANT MAINTAINANCE

- (i) Symptom, fault and remedies A.C. and D.C. motors, transformer.
- (ii) Schedule maintenance of transformer motors.
- (iii) Preventive maintenance of transformer, maintenance of cooling oil.
- (iv) Maintenance of lead acid cell.
- (v) Preventive maintenance of alternator.
- (vi) Details of a hydraulic and thermal power project-equipment and machineries used

(preliminary idea about line plans in various activities of the project).

10. ELECTRICAL MACHINE DESIGN

- (i) Design of single phase Transformer: Design of core, primary winding, secondary winding, yoke, over all size, tank.
- (ii) Design of 3 phase induction motor-design of stator, rotor.
- (iii) Design of a choke.
- (iv) Design of main dimension of alternator, stator, rotor.

Disclaimer : The above syllabus is broadly indicative but not exhaustive
