

Indicative Syllabus	
Name of Post	Junior Engineer (Plant) – Electrical
Minimum Educational Qualification	Regular Diploma in Electrical/ Electrical & Electronics Engineering from AICTE/ UGC approved University/ Institute.

1. **Electrical Engineering Fundamentals:** Concepts of charge, current, voltage, EMF, resistance, resistivity, inductance, capacitance, power, energy, their Units and various factors affecting them. Ohm's law, Kirchhoff's laws, Series and parallel combination of resistances, star-delta connection, Generation of Sinusoidal AC Voltage, waveform, Frequency, time period, Instantaneous Value, Maximum Value, Average Value, RMS Value, Form Factor and Peak Factor, Inductance, Capacitance, Reactance, Impedance, Admittance, Active Power, Reactive Power, Apparent power, Power Factor, Magnetic lines of force, flux, MMF, reluctance, permeability, magnetic flux density, magnetic field intensity, Analogy of electric and magnetic circuit. Magnetic field produced by current carrying conductor, Force on a current carrying conductor, Faraday's laws of electromagnetic induction, self and mutual induction, Lenz's laws, Fleming's left and right hand rule, Electrical Engineering Materials properties and applications; conducting, semiconducting, insulating and magnetic materials.

2. **Electrical Circuits:** Circuit elements, ideal current source and voltage source. loops, nodes, branches of a network, Analysis of networks by "Mesh" and "Node" methods, T and Pi terminal networks, input and output impedance and admittance, Superposition theorem, Thevenin's theorem, Nortons theorem and maximum power transfer theorem, Reciprocity theorem. Representation of A.C. quantity by phasor methods, rectangular and polar co-ordinates, Concept of Impedance, conductance, admittance and susceptance, A.C. networks problems, resonance, Concept of poly phase A.C. circuits, Generation of three phase voltage system, phase and phase sequence, Star and delta connections, phase and line values of current and voltage, power in three phase circuits, Balanced and unbalanced systems, Transient response of dc and ac networks.

3. **Measurement and measuring instruments:** Fundamentals of measurements, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, L-C-R meter, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis and compensation, Basics of sensors, Transducers, basics of data acquisition systems, extension of range, Ammeter, voltmeter and wattmeter, Megger, Ohm meter, Energy meter. Use of CRO, Signal Generator, Function generator, CT, PT and their uses. Earth Fault detection.

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4. **Electrical Machines:** Principle and law of conservation of energy, classification of electrical machines; D.C. Machine — Construction, Basic Principles of D.C. motors and generators, their characteristics, speed control and starting of D.C. Motors. Method of braking motor, Losses and efficiency of D.C. Machines, applications of D.C. Motors and D.C. Generators; 3 phase induction motors and synchronous machines- rotating magnetic field, Generation of 3-phase e.m.f armature reaction, principle of operation, equivalent circuit, torque-speed characteristics, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power, starting and speed control of 3 phase induction motors, Methods of braking, effect of voltage and frequency variation on torque speed characteristics, applications of three phase induction motor and synchronous motor; Starters- need and types, Hunting, phasor diagram, effect of change in excitation; Three phase Alternators- working principle, construction details, EMF equation, loading, Armature reaction, Voltage regulation, maintenance; Fractional Kilowatt Motors and Single Phase Induction Motors: Basic concepts, working principles, types, characteristics and applications; 1 phase and 3 phase transformers — Construction, Principles of Operation, Classification, Types, basic concepts, phasor diagram, equivalent circuit, voltage regulation, polarity, O.C. and S.C. Tests, Losses and efficiency, condition of maximum efficiency, all day efficiency. Effect of voltage, frequency and wave form on losses, Distribution and Power Transformers, Parallel operation of 1 phase /3 phase transformers, Polarity test, Phasing out test, Special Purpose Transformers - Auto transformers, Instrument Transformers, Isolation Transformer.
5. **Generation, Transmission and Distribution:** Different types of Power Plants, Thermal Power Plants – Coal/Gas/ Diesel/ Nuclear based Power Plants; Hydro Power Plants; Solar and Biomass based Power Plants; Wind Power Plants; Economics of Power Generation and Interconnected Power System- connected load, firm power, cold reserve, hot reserve, spinning reserve, Base Load and Peak Load plants, load curve, load duration curve, Load factor, diversity factor, demand factor, plant capacity factor, plant use factor, cost of generation, interconnection of power stations. Basics of Power Transmission and Distribution-Components of Transmission and Distribution systems, Classification of transmission and distribution lines, Transmission Line Parameters and Performance- Line parameters, types of lines, performance of short line and medium line, skin effect and proximity effect, Extra High Voltage A.C. (EHVAC) Transmission - Necessity, High voltage substation components such as transformers and switchgear, advantages, Ferranti and Corona effect, High Voltage D.C. (HVDC) transmission- necessity, components, advantages, limitations, applications, A.C. Distribution System- Components, Classification, Feeder and distributor, types of distribution schemes, advantages, disadvantages, applications, Distribution Substations, Layout of 33KV /11 KV and 11KV/ 400 V substations, Overhead conductors, Line supports, Line Insulators, Underground cables.

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6. **POWER SYSTEM OPERATION AND PROTECTION:** Various elements of Power System, representation of Power System, Interconnection, Fault Analysis- types of faults, short circuit current for symmetrical faults. Switchgears — Fuse, isolator and circuit breakers, types of circuit breakers, rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Purpose of protective system, requirement and selection, Protection against over voltages, earth leakage, over current, etc. Protective relays – Types, principles and working, Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars, protection of induction motors, thermal relays and under voltage protection, Lightning arresters.

7. **Power Electronics:** Power Electronic Devices - Working of various electronic devices, e.g., P N Junction diodes, Power Transistors (NPN and PNP type), BJT and JFET, IGBT, SET. Thyristor family devices, Turn-on and Turn-off methods of Thyristors, Phase controlled rectifiers Regulated Power Supply, Amplifiers, oscillators, Modulation and Demodulation, Inverter, Converter, Speed control of motors; Industrial Control Circuits using these devices.

8. **Estimating and costing:** - elements of estimating; Domestic and Industrial wiring; Service connections; Substations; Overhead lines- HT & LT Lines; Estimating & Costing for repair maintenance of electrical devices/ equipment;

9. **Utilization of Electrical Power:** Electric Drives; Electric Heating; Electric Welding; Illumination; Power Factor Improvements; Electro-Chemical Processes and Storage Batteries.

10. **Energy Conservation and Audit:** Energy Conservation Basics; Energy Conservation in Electrical Machines; Energy Conservation in electrical Installation systems; Energy Conservation through Cogeneration and Tariff; Energy Audit of Electrical System.