

Syllabus for Energy Assistants (JLM Grade-II)

1. Fundamentals of Electrical Engineering

Electric current-conductors- Semiconductors-Insulators, Electric potential-resistance- laws of resistance, Effects of temperature on resistance, Ohms law, Resistances in series, parallel and Series-parallel, Kirchhoff's laws.

2. Electro Magnetism

Introduction to magnets, Magnetic pole, magnetic axis, pole strength, Properties of magnets, Classification of magnets, Fleming left hand rule, Field pattern of long straight conductor, solenoid.

3. Electro Magnetic Induction

Concept of electro-magnetic induction Lenz's law -Fleming's right-hand rule, Faraday laws of electromagnetic induction-types of emf's-dynamically and statically induced emf, Self and mutual induction.

4. Cells and Batteries

Chemical effects of electric current-faraday laws of electrolysis, Cells and their components- Definition of battery-Primary cells -defects and remedies, dry cell-Secondary cell-comparison between primary cells and secondary cells, Lead acid cell-principle and working of lead acid cell detailed study-Wh & Ah efficiencies of cell, charging methods of secondary cells, Maintenance of Lead acid cell and testing of lead acid battery.

5. Electrostatics

Definition of Electric charge& its Units, Capacitance- Definition and formula, Types of Capacitors, Capacitors in series and parallel.

6. Electrical Wiring accessories, wiring tools and wire joint

Types of switches with modern approach, Other accessories like lamp holders, ceiling roses, sockets, fuses etc. (detailed study), Fuses and fuse materials, MCB & CBs, wiring tools, Wire joints, Soldering, taping and termination of wires/Cables and cable joints.

7. Wiring Systems & wiring circuits

Types of house wiring-Cleat wiring, CTS/TRS wiring, Conduit wiring, Casing capping wiring-detailed study, Comparison between different wiring methods, Stair case wiring, series and parallel circuits, Master switch circuits, Corridor wiring circuits, Fluorescent tube light circuit, flashers, moving lights.

8. Earthing

Necessity of earthing- definitions of fundamental terms in earthing like earth, earth lead, earth electrode, earth wire etc, Types of earthing-detailed study of pipe earthing and plate earthing, Specifications of materials used for earthing, Measurement of Earth resistance, IE rules for earthing.

9. IE rules for Electrical wiring

Precautions to be observed while installing different electric appliances in houses, I E Rules regarding house wiring, Causes of Fire accidents due to Electricity failures.

10. Indicating Instruments

Classification of Indicating type measuring instruments, Effects of currents used in indicating instruments, torques/forces in electrical instruments, Basic requirements of indicating instruments, Moving Iron Instruments, MC instruments – difference between MI and MC insts., Extension of MI & MC Instruments, Measurement of Power-Dynamometer type, different types of errors in indicating instruments.

11. Integrating Instruments

Definition and classification of integrating instruments, 1-ph, 3-ph phase induction type energy meters, errors in energy meters.

12. Special instruments

Power factor meter, Frequency meter, Synchronoscope, Instrument transformers CT-PT, Multi meter, Megger, Tongue tester.

13. Semiconductor Devices and Their Applications

Atomic structure and semiconductor theory, P-type and N-type materials, P-N junction, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers, Transistors-types of transistors- configurations, applications, working of inverter and UPS.

14. D.C. Generators

Generator Principle, simple loop generator, Production of induced EMF and its nature, Construction details of DC Generator, Yoke-poles-pole shoes -Armature- Commutator - brush assembly bearing Field coils, Armature winding-lap and wave winding, E.M.F. equation, Types of Generators-separately- Self excited-series-shunt-compound wound, Applications of different types of Generators.

15. D.C. Motors

Principle of working-Significance of back EMF(E_b), Types of dc motors, Series-shunt and compound motors, speed and torque equation, Speed Control of Motors-Field control method for series & shunt motors- Armature control methods (for shunt motors only), DC motor starters-Necessity of starter working of 3-point starter-4-point starter, Applications of different types of motors.

16. A C fundamentals & Circuits

Definitions of Alternating currents and voltage, different wave forms, Definition of cycle, time period, Frequency, Amplitude, Instantaneous value, maximum, Average and RMS values of A.C voltage & current, Form factor, Peak factor of sinusoidal wave, Phasor representation of A.C, Phase & Phase difference of ac, Power & Power Factor. Single phase A.C. Through Pure Resistive/Inductive/capacitive circuit- current-voltage-phasor diagrams- power-power factor, A.C. through R-L/R-C/R-L-C Circuit Current -voltage-phasor diagram Power-Power factor, Poly phase circuits-advantages of poly phase over single-phase Star and delta connection- voltage & current Relation in star connection - Delta or mesh connections, 3-phase power equation.

17. Transformers

Transformer – Its construction, working, performance, EMF equation, Cooling of transformer, losses and efficiency, transformation ratio. Construction of core, winding shielding, auxiliary parts breather, conservator. Buchholz's relay, other protective devices, Transformer oil testing, Auto transformer- working, Applications.

18. Alternators

Principle and operation of Alternators, Relation between speed, no. of poles and frequency, Constructional details of alternator – Salient pole type and smooth cylindrical type, EMF equation.

19. Three-Phase Induction Motors

Classification of 3-Ph motors, working principle of 3-Ph Induction motors, Relations between N_s , no. of poles and supply frequency-Definition of Slip & slip speed, Constructional details of Induction Motors-squirrel cage and slip ring motors, Starters for Induction Motors- Necessity of starter-D.O.L starter-Star/delta starter-Rotor resistance starter for slip ring Induction Motor, Applications.

20. Single phase Induction Motors

Principle of operation of Single-phase Induction Motors, Types of 1-Ph Induction motor like Split phase, capacitor start -capacitor start capacitor run-shaded pole motors- their applications.

21. Generation of Power

Sources of Electrical Energy- conventional-non conventional energy sources, Generation of Electrical power using conventional energy sources -working of Hydel and Thermal power stations.

22. Transmission and Distribution of Power

Transmission of power from generating station to receiving stations, use of step-up and step- down transformers and associated equipment, Use of Circuit breaker-isolators-earth switches, C.T.'s etc., Distribution of power, Transformer substations, Distribution T/F Substation- Double Pole Structure- Pole mounted and Plinth mounted T/F, Substation associated equipment such as A.B. switch, L.A.- H.G. Fuse-Circuit Breaker.

23. Planning, Estimation & Costing of Wiring

Control Panel elements, types and specifications, Concept and Principle of plan, estimation and cost. Preparation of complete house wiring layout, industrial wiring.

24. Illumination

Introduction of Illumination, Terms & definitions, laws of illumination, requirements of good lighting, intensity of light –importance of light, colour available. Construction, working & applications of – Incandescent lamp, Fluorescent tube, CFL, Neon sign, Halogen, Mercury vapour and types, sodium vapour etc. Decoration lighting.