## GROUP-22

## A.L.M./ Electrician/ Shift Attendant

**(Level- Matric+ ITI Certificate in Electrician/Wireman/Electronics)**

**1)** General awareness, Reasoning, Mathematics, Science, History including Haryana related history, current affairs, literature, Geography, Civics, Environment, Culture etc.- (**Weightage 20%)**

**2)** Computer terminology, Fundamentals, word software, excel software, Power point, internet, web browsing, Communication, emails, downloading and uploading data on websites etc**. -**

**(Weightage 10%)**

**3) Subject related syllabus- (Weightage 70%)**

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## Occupational Safety & Health:

Safety rules and safety signs for Danger, Warning, caution & personal safety messages. Basic injury prevention, Basic first aid, Hazard identification, avoidance and PPEs. Personal safety and factory safety. Effects of electric current on human being. Reasons for shock. Disposal procedure of waste materials. Response to emergencies e.g., power failure, fire, and system failure. Concept of Standards and advantages of BIS/ISI. Familiarization with signs and symbols of electrical accessories Introduction to 5S concept. Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints. Marking tools; callipers Dividers, Surface plates, angle plates, scribers, punches, surface gauges, Types, Uses, Care and maintenance. Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools.

## Wire Joints:

Trade tools specifications, Properties of conductors, Fundamental of electricity. Electron theory; free electron, fundamental terms, definitions, units & effects of electric current. Types of wires & cables, standard wire gauge, Current carrying capacity of different conductors. Specification of wires & Cables, insulation & voltage grades -Low, medium & high voltage Precautions in using various types of cables / Ferrules. Types of Wire joints & their application. Insulators, semi-conductors and resistors. Voltage grading of different types of Insulators, permissible temperature rise. Solders, flux and soldering techniques.

## Basic Electricity:

Introduction of National Electrical Code 2011. Ohm's Law, Kirchhoff's Laws Series and parallel circuits. Open and short circuits in series and parallel networks. Laws of Resistance and various types of resistors. Series and parallel combinations of resistors. Wheatstone bridge; principle and its applications. Different methods of measuring the values of resistance

## Magnetism:

Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism,Self and mutually induced EMFs

## Electrostatics:

Capacitor, Different types, functions, grouping and uses. Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value, Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Advantages of AC poly-phase system. Problems on A.C. circuits. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.

## Measuring instruments:

Classification of electrical instruments and essential forces required in indicating instruments. PMMC and Moving iron instruments, Measurement of various electrical parameters using different analog and digital instruments viz., multi-meter, Wattmeter, Energy meter, Phase sequence meter, Frequency meter, etc. Measurement of energy in three phase circuit. Important common applicable IE rules

## Meter Reading:

Description of MRI - Reading of Meter by MRI

## Power system:

Generation, transmission and distribution of electrical power General idea about overhead transmission, distribution (LV, MV & HV) and their types and accessories used. Types of Distribution system Line protecting devices Types of substations - indoor, outdoor & Pole mounted, etc.

## Substation Equipment Switchgear:

CBs – ACB, VCB, SF6, OCB etc. protection schemes, current transformer, Potential transformer, Protective relays, lightning arrestors, Different types of switches and switch gears, multi-Range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc.

## Earthing:

Importance of Earthing. I. E. Rules for earthing conduits using earth clips and earth wire as per IS 732-1863. Plate earthing, pipe earthing grid/mesh earthing. Earth resistance, earth leakage current and circuit breaker. Difference between grounding and earthing. Awareness of circuit main earth (CME) and portable earth.

## Transformers, AC motors, starters and Alternators:

Working principle, construction and classification of transformers. Single phase and three phase transformers. Testing of transformers. General concept of rotating electrical machines. Principle of operation of AC motors and generators, components and various types.

## Motor Starters:

Different types of starters for AC motors, its necessity, basic contactor circuit, parts and their functions. Basic knowledge of soft starter, Different control elements and equipment, their symbols. Power and control schematic drawings with interlocks. Relay ladder logic. Relay and control panel wiring. Circuits of various electrical appliances and controls. Power Distribution network drawing.

## Domestic Wiring:

Introduction and explanation of electrical wiring systems, cleat wiring, Casing-capping, CTS, Conduit and concealed etc. IE Rules related to wiring, National Building codes for house wiring, specification and types, rating & material. Minimum load capacities (W/m2) of various buildings. Electrical load categories. Terms; Maximum demand, Load factor and Diversity factor, etc. Various wiring accessories/ electrical fittings e.g. switches, fuses, lamp holders, plugs, brackets, ceiling rose, cut out relays, sensors, voltage regulators, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Selection of switchgear. Voltage drop concept. IS 732-1863. Wiring materials used for PVC cables, Indian standards regarding the above wiring such as clip distance fixing of screws, cable bending etc. Introduction to estimation procedure, PVC casing and capping materials, sizes and grades etc. Conduit pipe wiring materials and accessories, types and sizes of conduit. Branching of circuits with respect to loads such as lighting and power. Layout of Light points, fan points, heating loads etc., their controls, main switches, distribution boards as per IE rules. Difference between MCCB, MCB, ELCB, RCCB, MPCB. Different types of wiring; PVC conduit; Surface and concealed (PVC Conduit;/ metal conduit) Casing-capping wiring system. Power, control, Communication and entertainment wiring. Wiring circuits planning, permissible load in sub-circuit and main circuit.

## Control Panel Wiring:

Control panel components; DIN rails, trunking, connector blocks, screw terminals, relays, contactors, protective units, fuses, fuse holders; chassis mounted, fuse-links, resistors; fixed, variable, capacitors, switches, lamps, labelling grommets and clips etc. Cable forming; template, wiring schedule, run out

sheet, binding, continuous lacing, loop tie, lock stitch, finish knot, breakouts, lacing breakouts, spot ties, laying of wires, twisted pair, Cable markers and colour codes etc. Connections and routing of cables. Consideration of EMI/EMC Conductors of different circuits. Symbols and use of relay contacts: NO, NC, changeover, make/break after delay. Testing of various control elements and circuits.

## Battery and solar cell:

Chemical effects of electric current and Laws of electrolysis. Explanation of Anodes and cathodes. Types of cells, advantages/ disadvantages and their applications. Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and maintenance. Grouping of cells for specified voltage and current. Principle and operation of solar cell, Types of solar cell,Solar energy fundamentals. Study of Sun path (east to west, North to south and south to north movement). Study of daily and seasonal changes of sunlight. Angle of inclination of radiant light and its relation with latitude and longitude of different locations on Earth. Solar DC domestic application: Making of solar lantern. Solar Day lighting. Solar Garden Lights. Safety in DC system. Quality standards List out the inventory list of equipment's. Solar DC industrial application: Solar Street light. Solar home lighting system. Solar Security system. Solar DC water pump. Differentiate AC and DC solar pumps and their PV requirements for various HP capacities. Solar PV e-learning software.

## Workshop Calculation & Science:

Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM, Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage - Changing percentage to decimal and fraction, Mass, Weight, Volume and Density Mass, Related problems, Work, power, energy, HP, IHP, BHP and efficiency Potential energy, kinetic energy, Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point, Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature Heat &Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation. Mensuration Area and perimeter of square, rectangle, Triangles, circle, semi-circle, circular ring, sector of circle, volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder.

## Industrial Wiring:

Adverse conditions likely to affect the installation. Degree of mechanical and electrical protection necessary. Peak-Non-peak Loads in Office Buildings Lighting Design; lighting power density, Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g. hospital, go down, tunnel and workshop, etc. Danger notice as per IE rules.

## Cable Management:

Types of cables, their use, Various cable gland s Introduction to IP ratings (Ingress protection) and IP Codes format. Importance of Bonding and grounding, various types. Testing of cables, locating faults, open circuit, short circuit and leakage in cables.

## Illumination & Stage Light Control:

Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages and their applications. Calculations of lumens and efficiency. Spotlights, downlights, Strip lights Various reflectors; PAR (Parabolic aluminized reflector), MR (Multi-faceted reflector) LED video wall panel applications

## CFL/LED Lamps & DC regulated power supply:

Resistors; colour code, types and characteristics. Diode; P-N junction, classification, specifications, biasing and characteristics. Rectifier circuit; half wave, full wave, bridge rectifiers and filters. Active and passive components. Functioning of components used in CFL and LED circuits. CFL and LED lamp's circuit. Safety and disposal procedure.

## Underground cable joints:

Need of cables, advantages and disadvantages, various types viz., PVC, XLPE, PILC, oil filled, etc. Cable insulation & voltage grades. Joints and terminations; pre-moulded, heat shrinkable, extrusion moulded

joints Slip on, cold shrink terminations. Types of connectors used in the cable, current path. Methods of conductor connection, contact resistance. Galvanic corrosion and use of bimetals. Connectivity for cable screen and armour, mechanical protection Kits for joints and terminations. Cable termination to equipment Standards and testing; type, routine, field test, Stress control.

## Domestic appliances:

Working principles and circuits of common domestic electrical appliances; Bell, buzzer, electric iron, kettle, cooking range, geyser, induction heater, mixer, grinder, juicer, food processor, fan, pump set, washing machine, refrigerator and air conditioner etc. Concept of Neutral and Earth.

## Winding:

Concentric/ distributed, single/ double layer winding and related terms. Troubleshooting of single-phase, AC induction motors and universal motor, Concept and Principles of estimation and costing. Different wiring layouts and Bill of material; domestic, commercial, and industrial wiring. Smart wiring concept Procedure for taking wireman permit and competency certificate.

**Important Note: The Weightage as mentioned against the syllabus is tentative & may vary.**