ऑयल इंडिया
OIL INDIA

# HR ACQUISITIONS DEPARTMENT, DULIAJAN

## Travel Reimbursement form: Selection Test

## (For SC/ST & PwBD Candidates only)

ROLL NO : _____ DECLARED RAILWAY STATION: _____

NAME : _____

ADDRESS : _____

_____

CONTACT NO. : _____

BANK NAME : _____

(WITH BRANCH)

BANK ACCOUNT NO : _____

BANK BRANCH ADDRESS : _____

IFSC CODE OF THE BRANCH : _____

**JOURNEY DETAILS (To and Fro)**

| FROM | TO | CLASS OF TRAVEL | MODE OF TRAVEL | AMOUNT (RUPEES) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | **TOTAL** | |

I certify that I have travelled / shall travel by the mode /class for which claim has been submitted and the supporting documents /tickets are enclosed herewith.

Date : _____

_____
Signature of Candidate

**FOR OFFICIAL USE ONLY**

ED (F&A)-CHECKED AND VERIFIED. PLEASE PAY AS PER ENTITLEMENT

_____
For Chief General Manager (HR Acquisitions)

***Tickets, copy of PAN Card and copy of bank passbook required to be submitted along with 'Travelling Allowance Claim Form'***

# Syllabus for All Post

**Advertisement No. HRAQ/REC-WP-B/2023-81**

**Dated 30/12/2023**

**SYLLABUS: MECHANIC DIESEL (MDL22023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc. Knowledge of fire and fire extinguishers.
2. Hand & Power Tools: Marking scheme, marking material, Cleaning tools. Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers, Punches, Screw, driver, hammer, spanners, pliers.
3. Systems of measurement: Description, Least Count calculation, care & use of – Micrometers, Vernier Calliper, and various gauges.
4. Different types of metal joint (Permanent, Temporary), methods of Bolting, Riveting, Soldering, Brazing, Seaming etc. Fasteners, Cutting tools, Limits, Fits & Tolerances.
5. Drilling machine, Description, different types, drill holding devices, Drill bits, Taps and Dies, Hand Reamers.
6. Sheet metal: various common metal Sheets used, Shearing, bending, Drawing, Squeezing Sheet metal joints, Hem & Seam Joints Fastening Methods.
7. Ohm's law, Voltage, Current, Resistance, Power, Energy, Voltmeter, Ammeter, Ohmmeter, Fuses & circuit breakers.
8. Description of Chemical effects, Batteries & cells, Magnetic effects.
9. Welding processes, Heat Treatment Process: Introduction, Definition.
10. Non-destructive Testing: Various Methods, Definition and their importance,
11. Internal & External combustion engines. Principle & working of 2 & 4-stroke diesel engine and S.I Engine.
12. Diesel Engine Components: Cylinder head, Combustion chambers, Engine Valves, Camshafts & drives.
13. Description & functions of cylinder block, pistons, piston rings, crank shaft, camshaft, engine bearings.
14. Description & functions of the fly wheel, vibration damper, clutch & coupling units attached to flywheel.
15. Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.
16. Cooling systems: Types, Need. Heat transfer method. Viscosity and its grade as per SAE, Lubrication system components
17. Description of Diesel Induction & Exhaust systems, components and air compressor
18. Fuel Feed System in IC Engine (Petrol & Diesel).
19. Emission Control: Vehicle emissions, Standards- Euro and Bharat II, III, IV, V. Characteristics and Effect of Hydrocarbons.
20. Troubleshooting: Causes and remedy for Engine Not starting Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation.

**SYLLABUS: FITTER (FTR22023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc. Basics of Hot work, confined space work and material handling equipment.
2. Bench Vice, Files – specification, types, uses, care & maintenance. Marking and measuring tools, Marking media, their special application, description.
3. Physical & Mechanical properties of engineering metal. Types, properties and uses: Pig Iron, Cast Iron, Steel and Non-ferrous metals (Copper, Aluminium, Tin, Lead, Zinc).
4. Power Saw, band saw, Circular saw machines used for metal cutting.
5. Micrometer, Vernier calipers, Dial test indicator – principle, features, parts, reading, use and care.
6. Drilling processes - Types, Drill- material, Drill angle, Drill holding devices, Drill troubles: causes and remedy.
7. Sheet metal – sheet, sizes, types, uses as per BIS specifications. Shearing machine- description, parts and uses.
8. Stakes- types, parts, their uses. Various types of metal joints, Wired edges. Solder and soldering: types of solder and flux.
9. Counter sink, counter bore and spot facing-tools, Reamers, Screw threads.
10. Tap and Dies, Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing.
11. Lathe specifications, and constructional features, main parts. Lathe cutting tools.
12. Chucks and chucking. Lapping, Honing: Applications, materials.
13. Turning operations- Types, Uses, Methods.
14. Maintenance- Total productive maintenance,-Autonomous maintenance, Routine maintenance, Maintenance schedules.
15. Screws: material, designation, specifications, Power tools, Nuts, Keys.
16. Heat treatment, various heat treatment methods. Various coatings used to protect metals.
17. Gauges, Bearings, Bearing materials and Pipes and pipe fittings.
18. Vee belts, commercial belts, Couplings, Pulleys. Power transmission.
19. Industrial hydraulic system, Applications, Pascal's Law. Pneumatic valves, Hydraulic oil, filters, cylinders motors and valves.
20. Lubrication and lubricants- Types, Purpose, Use.

**SYLLABUS: WELDER (WLD22023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc. Knowledge of fire and fire extinguishers.
2. Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc.
3. Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance.
4. Welding positions as per EN &ASME: flat, horizontal, vertical and over head position.
5. Arc length – types, effects of arc length. Arc blow – causes and methods of controlling. Polarity, Weld quality inspection, common welding mistakes.
6. Calcium carbide, Acetylene gas, Oxygen gas properties and uses.
7. Oxy acetylene gas welding Systems (Low pressure and High pressure).
8. Specification of pipes, various types of pipe joints, pipe welding all positions, and procedure.
9. Gas welding filler rods, specifications and sizes. Gas welding fluxes – types and functions. Gas Brazing & Soldering: principles, types fluxes & uses. Gas welding defects, causes and Remedies.
10. Electrode: types, functions of flux, coating factor, sizes of electrode, Coding of electrode.
11. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
12. Welding of low, medium and high carbon steel and alloy steels. Stainless steel types- weld decay and weldability.
13. Brass, Copper, Aluminium, Cast Iron – types – properties and welding methods.
14. Types of Inspection methods. Destructive and NDT methods. Welding economics and Cost estimation.
15. Gas Metal Arc Welding (GMAW) and Gas Tungsten Arc Welding (GTAW) – Introduction, Safety precautions, Wire feed system – types –care and maintenance.
16. Heat input and technique. Pre heating & Post Weld Heat Treatment. Metalizing– types, equipment, advantages and applications.
17. Plasma Arc Welding (PAW) -principles of operation, types, advantages and applications.
18. Resistance welding process-types, principles, power sources, welding parameters and applications.
19. Welding codes and standards. Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)
20. Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing.

**SYLLABUS: INSTRUMENT MECHANIC (IMC22023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc.
2. Basic hand tools, types, classification. Measuring instruments, Marking tools, Fasteners & Fastening devices.
3. Precision Measuring Instruments, gauge blocks, sine bar, dial indicators, vernier calipers, micrometers, bevel protractor, thickness gauges.
4. Types of tubes, Tube cutter, Flaring tools, Swedging tools, pipe bending, straightening,thread cutting, method of installation.
5. Ohm's law & Kirchhoff s laws. A.C & DC electricity, types of wave forms, time period and frequency, peak to peak values, RMS values, Average values.
6. Multimeter. Resistor, Resistivity and colour code, soldering anddesoldering. Soft soldering. Types of soldering irons. Solder& flux.
7. Batteries. {Liquid & dry).Maintenance free batteries construction-charging, efficiency-use, advantage.
8. Switches and types. Magnet, magnetism, magnetic properties, Electro-magnetism. E.M. relays, Solenoids, Circuit breakers.
9. A.C.-impedance, Inductive reactance, capacitive reactance.
10. Introduction of AC and DC generators working principles,construction.
11. Transformer, types, transformation ratio. Open circuit and short circuit test.
12. Electrical measuring instruments - absolute and secondary instruments, DC instruments, AC instruments.
13. Semiconductor, Covalent bond,Doping, Intrinsic and extrinsic semiconductor. Transistors, Rectifier, Voltage Regulators.
14. Power Supply units. Introduction, purpose & use. UPS and SMPS, inverters and converters and their applications. Thyristor devices.
15. Oscillator's oscillations,oscillation frequency, basicworking principle and working of Talk circuit, Crystalcontrolled oscillators, Phaseshift oscillators, RC phase shift oscillators, Colpitt, Clapp, Hartley, and IC oscillators.
16. Operational Amplifier. Differential amplifier, ideal op- amp. Op-amp with feedback, Advantages of feedback. Inverting and Non invertingand inverting amplifier.
17. Number systems; binary, octal, decimal and hexadecimalnumber system. Boolean algebra, Logic Circuits. Basic gates, Special gates, Flip flops Counters and registers.
18. A/D and D/A converters, Introduction, Types, Specification
19. Digital meters: frequency meter, phase measuring meter, and time measuring instruments. Digital capacitance meter.
20. CRO: introduction and applications. MultimediaSystem - CD ROMS, DVD ROMS, Sound Cards. Computer Hardware & Software, Microprocessormicrocomputers.

**SYLLABUS: ELECTRICIAN (AEL12023)**

1. Hazard Identification, Response to emergencies- Power failure, system failure, fire etc. Types, Working of fire extinguisher. First aid, PPEs and etc. BIS/ISI, National Electrical Code-2011.
2. Conductors and insulators, shouldering, underground cables. Ohm's Law, Kirchoff's Laws and applications. Laws of Resistance.
3. Principles and laws of electro-magnetism. Capacitor- Inductive and capacitive reactance, Comparison and Advantages of DC and AC systems.
4. Chemical effect of electric current and Laws of electrolysis.
5. I.E. rules on electrical wiring. Types of domestic and industrial wirings.
6. Importance of Earthing, various methods and IEE regulations.
7. Laws of Illuminations. Types of illumination system, Illumination factors, intensity of light etc. Type of lamps, advantages/ disadvantages etc.
8. Measurement of various electrical parameters using different analog and digital instruments. Measurement of energy in three phase circuit. Errors and corrections in measurement.
9. Working principles and circuits of common domestic equipment and appliances. Concept of Neutral and Earth.
10. Working principle, construction, and classification of transformer. Types of Cooling, protective devices, bushings and termination etc.
11. DC generator- Principle, Use of Armature, Field Coil, Polarity etc. Load characteristics, Application, losses & efficiency, maintenance.
12. DC motor -Principle, Type, Characteristics, Losses & Efficiency, Maintenance. Methods of speed control of DC motors.
13. Working principle of three phase induction motor. Different types of starters for three phase induction motors. Various methods of speed control
14. Single phase AC motors- Principle, Type, Characteristics, Losses & Efficiency, Maintenance. Troubleshooting of single phase AC induction motors and universal motor.
15. Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. Working principle of synchronous motor.
16. Rotary Converter, MG Set description and Maintenance. Resistors – colour code, types and characteristics. P-N junction, classification, specifications, biasing and characteristics of diodes.
17. Basic concept of power electronics devices. Working principle and uses of oscilloscope. Study and understand Layout drawing of control cabinet, power and control circuits.
18. Wiring accessories. Working, parameters and applications of AC / DC drive. Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS.
19. Conventional and non- conventional sources of energy and their comparison. Power generation by thermal, hydel power plants, solar and wind energy.
20. Transmission and distribution networks. Types of relays and its operation.

**SYLLABUS: ELECTRONICS MECHANIC (AME12023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc.
2. Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, color-coding, power rating.
3. Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc.
4. Regulated Power supply , PNP and NPN Transistors, E, B & C Terminals.
5. Biasing, Transistor (C-B, C-E & C-C), their characteristics and applications.
6. Oscillator: Uses their applications. FET, JFET, MOSFET, Power MOSFET and IGBT, types, characteristics.
7. Digital electronics - analog and digital signals. Logic Families, Number systems, BCD code. LED panels, CTV, LCD, LED TV, 3 D TV, Remote Control.
8. Combinational logic circuits such as Half Adder, Full adder, Concept of encoder and decoder. Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch.
9. Circuit simulation software - Library components, Various resources of the software.
10. Counters: Types, seven segment display. Basics of Register, types and application of Registers.
11. Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications.
12. Digital storage oscilloscope (DSO)/ CRO – applications, advantages, difference.
13. SMD technology, Surface Mount Technology (SMT).
14. Static charges: prevention, handling, various standards for ESD.
15. Printed Circuit Boards (single, Double, multi- layer). Necessity of fuse, fuse ratings, types of fuses, fuse bases. Single/ three phase MCBs, single phase ELCBs.
16. Types of contactors, relays and working voltages. Fundamentals of single phase Induction motors.
17. Radio Wave, Microprocessor, Microcontroller, Passive and Active transducers.
18. Introduction to optical fiber, optical connections, multiplexing
19. Manual, Automatic Voltage stabilizer. Concept of Uninterrupted power supply. Inverters and UPS.
20. Renewable energy sources. Mobile communication, GSM and CDMA technology.

**SYLLABUS: MMV (AMA12023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc. Knowledge of fire and fire extinguishers.
2. Drilling machine – Types, Holding devices, Drill bits. Taps and Dies, Hand Reamers –Types, Uses
3. Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, Ammeter. Fuses & circuit breakers, Stripping wire insulation, cable colour codes and sizes, Resistors, Capacitors.
4. Chemical effects, Batteries & Cells : types, Uses, Maintenance.
5. Internal & External combustion engines. Principle & working of 2 & 4-stroke diesel engine and S.I Engine.
6. Petrol Engine Basics, Intake & exhaust systems.
7. Gasoline Fuel Systems: Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure & vacuum.
8. Cylinder head, Cylinder block, combustion chambers, Valves & Valve Trains, Camshafts & drives.
9. Description & functions of different types of pistons, piston rings and piston pins and materials.
10. Description and function of Crank shaft, camshaft, fly wheel and vibration damper.
11. Cooling systems: Types, Need. Heat transfer method. Viscosity and its grade as per SAE, Lubrication system components
12. Intake system components- Air cleaners, Intake manifolds and material. Exhaust system components- Exhaust manifold, Exhaust pipe, Extractors, Electronic mufflers.
13. Diesel Fuel Systems- Description, function, fuel characteristics. Common Rail Diesel Injection (CRDI) system.
14. Engine assembly procedure. Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.
15. Emission Control: Vehicle emissions, Standards- Euro and Bharat II, III, IV, V. Characteristics and Effect of Hydrocarbons.
16. Troubleshooting: Causes and remedy for Engine Not starting, High fuel consumption, Engine overheating, Low Power Generation, Excessive/Low oil consumption.
17. Clutches & Manual Transmissions, Gearbox layout & operation, Final Drive & Drive
18. Automatic Transmissions, Hydraulic system & controls,
19. Steering Systems, Suspension System, Wheels & Tyres, Braking Systems.
20. Licensing, Registration of vehicle, Traffic rules & Signals, Accidents, Causes & analysis, Locating vehicle information, Obtaining & interpreting scan tool data, Using a repair manual, shop manual, owner’s manual.

| SYLLABUS: SURVEYOR (ATS12023) |
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| 1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc.<br>2. Details layout of lettering, lines & dimensioning system.<br>3. Introduction of surveying, types of surveying, use, application principal.<br>4. Knowledge of different types of scales, determine of R.F & uses of scales.<br>5. Different types of projection views orthographic, sectional, isometric view.<br>6. Use & application of conventional signs & symbols.<br>7. Principle of various survey techniques, applications, instruments, precautions, merits & demerits, errors: Chain Survey<br>8. Principle of various survey techniques, applications, instruments, precautions, merits & demerits, errors: Compass Survey<br>9. Principle of various survey techniques, applications, instruments, precautions, merits & demerits, errors: Plane Table Survey<br>10. Auto CAD. Use, Applications, Commands etc.<br>11. Theodolite: Types, Parts, Theodolite survey.<br>12. Levelling: Types, Levelling Instrument, Common errors, etc.<br>13. Tachometry: Basics, Advantages and Disadvantages.<br>14. Contouring: Characteristics, Uses etc.<br>15. Curves: Purpose, Types, Various methods.<br>16. Basics of Total station, cadastral map.<br>17. Knowledge for preparation of topographical map, cadastral map, road project.<br>18. Importance of cartographic projection. Uses of various types of cartographic projection for mapping.<br>19. GIS & GPS: Elements, Observation principles, Types etc.<br>20. Types of surveys for location of a road, Introduction to hydrographic survey, Basics of transmission line survey. |

**SYLLABUS: INFORMATION & COMMUNICATION TECHNOLOGY SYSTEM (AIT12023)**

1. Importance of safety and general precautions observed in the in the industry/shop floor - First aid, PPEs and Response to emergencies etc.
2. Classification, characteristics and application of different types of resistors. Ohms law and Kirchhoff's Laws. Inductance, Capacitors: Properties, Types, application.
3. Semiconductor, intrinsic and extrinsic semiconductors, P and N type semiconductor. Different types of Diodes.
4. Working principle and application of UJT, SCR, TRIAC and DIAC.
5. Classification of digital IC's. Use of data book for identification of digital IC's. Basic LOGIC GATES and truth table. Boolean algebra. XOR, XNOR gates and application.
6. Lead acid cell, its construction and chemical changes during charging and discharging. Maintenance free batteries. Lithium cell, Ni-cad cells their construction and applications.
7. CRO -Internal parts. Construction and function of CRT and its associated circuitry.
8. Description of mother board, Specification and variation.
9. Effect of weak/ dead battery on PC performance. RAM types, Type of processors.
10. Memory devices, types & principle of storing. RAM, ROM, PROM, EMPROM, EEPROM.
11. Basic Linux commands. Linux file system, The Shell, Users and file permissions, VI editor, X window system, Filter Commands, Processes, Shell Scripting.
12. Dot Matrix printer's laser printer, Ink jet printer, line printer. Working principles of Network Scanner, Multifunction Printer, Network Printer and Print Server.
13. Monitor, Sound cards, Speaker and microphone. Laptops, advantages, essential difference in construction, additional features, PCMCIA cards.
14. Band width, baud rate, wireless communication, synchronous/ asynchronous transmission.
15. PC upgrading: Scope, Limitations. Removable storage devices. Minor repairs and maintenance of CD ROM drives. ZIP & DAT Drive.
16. Circuit Board/ Motherboard, Concept of iOS, Android, Ice- cream sandwich, jellybeans.
17. World wide web and website. Web Browsing, Search Engines, Favorites Folder, Electronic Mail, Email Addressing, BCC and CC, Inbox, Outbox, Address book SPAM.
18. Cloud Computing, Cyber Security, Cyber Laws & IT Act. Importance of privacy and techniques to manage it.
19. Networking – Types, Topologies, Components. Data Communication – Analog and Digital Signals. OSI Model.
20. Protocols, TCP/IP, FTP, Telnet etc. Internet. DNS Server. Internet Access Techniques, Social Networking Sites, Virus and its Protection. Messaging Services, Backup and Recovery of Server.

## SYLLABUS: PLUMBER (PLU12023)

Importance of safety and general precautions required for the trade. Importance of the trade. Types of work to be done by trainees in theinstitute. Scope of a plumbingwork. Types of services haveto plan. Basic Bench fitting. Plumber's commonhand tools - names, description and material from which they aremade. Description, types and uses of holding device, hammers & cold chisels,cutting tools. Description of simple fitting operations hacksawing, punching and filing. Types of files used commonly. Marking instruments and their use of simpledrilling machine. Method of using drills. Description of simple bench drilling Machine. Description of Grindingand Chisel. Description of different types of locking and fastening devices.

**About different types ofpipes-**

GI, CI, DI, PVC/ CPVC, PPR and HDPE etc. About different Types ofPipe Fittings: - Socket, Elbow, Tee, Union, Bend, Cap, Plug, Cross, Ferrule etc. About different types ofThread cutting.

**Gas Welding :**

Purpose of Gas welding. Method of gas welding, Safety precautions to beobserved -Methods of soldering and brazing - fluxes used & Types of fluxes precautions to be observed. Hard & soft solders - their properties, composition and uses.

**Mason's works :**

Names and descriptionof Mason's hand tools and their uses. Method of making holesin walls and floors. Types of tools used andvarious Processes. Concept of bricks, limeand cement. Preparation of mortarswith various materials of varying composition. Common brick joints. Description of bonds. Scaffolding &plastering. Define Plain cement concrete, RCC and itsproportion, Grades of coarse aggregate and fine aggregate, Knowledge of waterproofing compound. Knowledge of BuildingPlan and Cross sectionof wall. Identify plumbing services required foreach type of building according to usage. Description of plumber tools and Equipment- Ratchet brace, Threading die, Pipe wrench, sliding wrench, Spanner set, Chain Wrench etc. and theirsafety. Care & use of tools. Pipes of different kinds, Method of Pipe bendingin different dia. Plumbing Symbols and Code for Tools & Materials on water line. Equipment and tools forhot gas welding and electric hot plate for PPR pipe joints. Types of fittings for different joints & different pipes : CI,HCI,AC,AC Pressure, DI, GI Pipes. Joints: - Flange joint, Socket jointwith lead, Detachable joint, Socket & Spigot joints etc. Description of pipefittings. Methods of joining and their uses. Precautions to be takenwhile fixing. Different kinds of Joints,Fittings and Materials injoining pipes - PVC/CPVC, PPR and HDPE etc.

**Composition of Water:**

Sources of water, Hard & Soft water, temporary hardness &permanent hardness. Impurities of water – organic and inorganic impurities.Water purification stages and methods. Static water pressuresand measurement of pressures. Bursting pressure,Expansion of water onfreezing and heating. Bernoulli's principles, Pascal's law. Pressure of water on thesides of cistern or tank. Water hammer in pipes. Description and working of water hammerarrester. Use of hummed pipesof different sizes. Method of laying outpipes alignment and joining. Description of various pipe joints-straight, Branch, Taft and blow,Expansion joints. Solders and fluxes used in joints. Description of Plumber'smaterials Lead, tin, Zinc, solder, copper, red lead etc. and their uses. Water supply system of a small town. Description and types of pumps viz. suction pump, Centrifugal pump etc. Contamination of water in a well. Description of pipe dies, their uses, careand precaution. Metric specification ofvarious pipes. Standard pipe threads. Method employed forbending, Joining and fixing PVC pipe. Joining material for water and gas pipes. Use of blow lamp. Inspection chamber, septic tank, descriptionof drains, cesspools, soak pits etc. Types of traps. Layout of drainage system, Method of bending pipes by hot and coldprocess. Method of testing drainage lines, Method of dismantling and renewal of the valves and pipes. Leaksin pipes and noises in plumbing.

Installation of water meters. Air lock in pipes and its removal. Description of cocks & valves-their types, materials & advantagesfor particular work. Description of differenttype of diverts i.e. two way and three way, Sensor system for urinals and wash basinetc. Erecting rain water and drainage pipe system, Installation of sanitary fitting s, inspection andtesting of water supplysystem. -Pipe alignment and slope. -Prevention ofwater hammer. Storage tanks for general water supplypropose. Test for water supplypipes. Description of sanitaryfittings, general points to beobserved when choosing sanitary. Description of concealed flushingcistern (14hrs). Method of bending galvanized mand other heavy pipes.

**Domestic drainage system:**

General layout, one pipe system, specifications of Materials required. Method of testing leakage. Different types of traps, ventilation, anti-syphonage and sinks. About Fire hydrants andtheir fittings. Concept of heat andTemperature. Method of transmission ofheat. Heating system by different thermal units. Domestic hotand cold water. General layout, specification of materials required and Connection of pipes to mains. Tracing leakage. Repairs to service main.Domestic boilers and Geysers. Method of ventilating pipe.Precaution against air Poisoning. Fixing of solar watersystem. Plumbing and sanitarysymbols and plumbingcodes for all tools andmaterials. Corrosion - causes andremedies, prevention.Corrosion due to electrolytic action. Effect of water and frost onmaterials. Layout of pipes as per drawing. Analysis quantity measurement and abstractrate of plumbing and sanitary work.

**Bill of Quantity andEstimation:**

Preparation of bill ofquantity, Preparation of Estimation.

**SYLLABUS: REFRIGERATION AND AIR CONDITIONING TECHNICIAN (RAC12023)**

Introduction to trade and related industries. General safety precautions and first aids, firefighting equipment and electrical safety. History of Refrigeration and Airconditioning. Grooming of technicians.

1. **Fitting:** Different types of Fitting hand tools, their use. Function, construction, working, use, and application, specification of Sheet metal tools, instruments andequipment. Care and maintenance of tools. Rivet & riveting- their types and use.

2. **Electrical** terms such as AC andDC supply, Voltage, Current, Resistance, Power, Energy, Frequency etc. Safety precautions to beobserved while working on electricity. Conductors andInsulators, Materials used as conductors. Series and parallel circuit, open circuit, short circuit, etc. Measuring Instruments such asvoltmeter, ammeter, ohm meter, watt meter, energy meter and frequency meter. Earthing and its importance. Earth resistance. Insulation andcontinuity test.

3. **Electronics:** Introduction to Electronics. Basic Principles ofsemiconductors, Principles and application of Diodes. Solder – its composition and paste. **Rectification,** Zener diode as voltage regulator – transistors parameters- diodes, ICs.

4. **Welding:** Introduction to basic principlesof commonly used Welding processes, oxy fuel gas welding / cutting, brazing & soldering, nozzles, base metal and filler metal. Use of flux. **Difference** between soldering and Brazing in terms of temperatures, filler materials, joint strengths and application.Use of Oxy Acetylene, Oxy LPG,Air LPG and two stage regulators for brazing/soldering. Descriptionof back fire arrester.

5. **Basic Refrigeration:** Basic principle of refrigeration,working, use, specifications of refrigeration tools, instrumentsand equipment. Fundamentals Thermodynamics law. **Science** related to refrigeration, work, power,energy, force, Heat and Temperature, Different temperature scales, Thermometers, Units of heat,sensible heat, latent heat,super heating and sub-cooling,saturation temperature, pressure, types, units. Types of Refrigeration systems, including vapour absorption refrigeration cycle (VARC), water – combination. Study the construction and working of vapor compression cycle, low side & high side of vapour compression system. Applications of vapour compression cycle. Coefficientof Performance (COP), Ton of Refrigeration. Construction and working of V.C Cycle, fundamental operations, sub cooling andsuper heating.

6. **Refrigerator (Direct cool & Frost free)** Function, construction, working of singledoor direct cool refrigerator, frost free refrigerator, specifications, trouble shooting. Heat Insulation materials. Care and maintenance of refrigerators. **Refrigerator (Direct cool & Frost free):** Study the electrical components of refrigerator. Importance of flushing in evaporator and condenser, useof dry nitrogen for flushing, necessity of replacing capillary and drier. Evacuation, leak testing, gas charging method in refrigerator. **Frost Free Refrigerator:** Study the construction and working of Frost Free (2 or 3 door) Refrigerator parts particularly, the forced draft cooling, Air Duct circuit, temperature control in Freezer & cabinet of Refrigerator, air flapper / louver used in refrigerator section, automatic defrost system. Study of Electrical accessories & their functions (Timer, Heater, Bimetal, Relay, OLP, T/S etc.) Refrigerator cabinet volume calculation. **Refrigerator (Inverter Technology):** Study the construction and its working of two and three door frost free refrigerator with inverter technology Care and maintenance.

7. **Compressor:** Function, construction,working, application of hermetic compressor, (Fixed speed and variable speedcompressor) like Reciprocating,rotary, scroll and inverter type.

Study the construction & working of reciprocating, rotary,scroll, wobble & swash plate compressor. wet compression, oil, properties, lubricationmethods. AC motors and their types. Advantages of AC motor overDC motor. Split phase induction motors, working principle and construction. Starting winding and running winding. Starting current and running current. Study the shaded pole motor, RSIR, CSIR, CSR and PSC motors. Centrifugal switch and its function. Common faults, causes and remedies in motors.

8. **Motors:** Function of Starting relay, Capacitors, OLP's. Working principle of inverter technology, advantages of variable speed technology overfixed speed. Working principle of control system for inverter Air Conditioners(ACs).

9. **Condenser:** Function of condenser, types,Construction of air-cooledcondenser. Effect of chocked condenser. Advantages, de scaling of air-cooled condenser, application, and advantages. Liquid receiver,pump down, application, types,function and working.

10. **Drier:** Function of drier, types, application and its advantage.Description of desiccants. **Expansion Valve:** Expansion valve used in domestic refrigeration and air conditioning. **Evaporator:** Working principle, Function, types of evaporators used inrefrigerator, water coolers, bottle coolers, window and split A.C, Super heating in evaporators, Function of accumulator and types. Methods of defrosting.

11. **Refrigerant**: Classification of refrigerants, nomenclature of refrigerants including chemical name andformulas, hydrochlorofluorocarbons (HCFCs), hydro fluorocarbons (HFCs) and hydro fluoroolefins (HFOs), blends of HFCs andblends of HFCs/HFOs. Climatic impact refrigerants : Stratospheric ozone depletion,global warming, mechanism of ozone depletion; the Montreal Protocol phase-out schedule of ozone depleting refrigerants(HCFCs) and high global warming refrigerants (HFCs). Brief introduction of Ozone Depleting Substances(Regulation and Control) Rules, 2000 and its amendments. Introduction of properties ofrefrigerants; environment related properties Ozone Depleting Potential (ODP),GWP; ODP and GWP of various refrigerants, thermo chemical properties: flammability and toxicity ofrefrigerants, lowerflammability limit (LFL) and upper flammability limit of A3 and A2L refrigerants. Thermo physical properties: pressure temperature of different refrigerants. Safe handling of flammable refrigerants. Refrigerant leak detection methods, evacuationand charging of refrigerant, temperature glides of refrigerant blends, procedure of charging of refrigerant blends especially the zeotropicblends, hydrocarbon blends, HFC blends (R-404A, R-407C, R-410A) and blends ofHFC/HFO.

12. **Retrofitting:** Changes of components &practices while retrofitting CFC appliances with HCRefrigerants. Properties of HCs. **Thermal Insulation:** Function, types, thermodynamic properties of heat insulation materials used in refrigeration and AirConditioning systems.

13. **Window Air Conditioner** Study, **Split AC (wall/floor/Cassette)** Construction, **Split AC (Wall Mounted)** Construction and working principle, types, troubleshooting. Description ofelectrical components used insplit A.C. Study the wiring circuit. S**PLIT A.C (floor, Ceiling /Cassette mounted Split A.C)** Construction and workingprinciple, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit. **SPLIT A.C (Ducted**) Study of the Duct able split AC, its Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit. **MULTI SPLIT A.C** Study the construction and working, various components, electrical circuits,testingcomponents, fault detection. **INVERTER SPLIT A.C.** Study of construction and working principle of inverter AC and its components, electrical circuit and controls,installation, servicing, trouble shooting, fault detection, leak testing and gas charging. Concept of Indian. SeasonalEnergy Efficiency Ratio ISEER).

Energy Efficiency leveling on inverter AC.

14. **COMMERCIALCOMPRESSOR (Fixed & Variable)** Function, types,Construction & working, applications of compressors used in commercial refrigeration. Volumetric efficiency,Capacity control. Compressor lubricant oil, types, properties, types of lubrication methods such as splash, forced feed. Study the Construction and working principle of different commercial compressor, open type, (Reciprocating, centrifugal. Screw compressor. Star and Delta connection and their comparison. Production of rotating magnetic field by three phase AC supply. Workingprinciple of three phase induction motor. Terms such as torque, slip, rotor frequency and their relation. Construction ofsquirrel cage induction motor. Importance of phase sequence. Construction of slip ring induction motor Comparison between SCIMand SRIM. Three phase motor starters such as DOLstarter, Star – Delta starter, Auto transformer starter and Rotor resistance starter. Common faults, causes and remedies in three phase AC motors.

15. **WATER COOLER CONDENSER** Study the water-cooled Condenser, its type and capacity, construction and working, de scaling, application. Evaporative condenser,function, construction and application. Liquid receiver, function. Drier, types and application. **COOLING TOWER** Cooling tower, types, Construction, capacity advantage & disadvantages of different types of cooling tower. Efficiency, approach and Cooling tower range. **WATERTREATMENT** Causes for watercontamination and water treatment. **WATER COOLER & WATERDISPENSER** Studytherefrigerationcycle of storage type water cooleranddispenser types. Construction & working, Capacity & applications. Study theelectrical and mechanicalcomponents of storagetype water cooler.

16. **EXPANSION VALVE** Types and function, construction, working principle, & their advantage& disadvantages. Thermostatic ExpansionValves (TXV), Automatic Expansion Valves (AXV), Float valves, fixed andmodulating orifice controls& electronic Expansion Valves, LMC (level master control).(07 hrs.) Selection of Expansion valves and capillaries forvarious Refrigeration andAir-conditioning applications. (04 hrs.)

17. **EVAPORATOR** Function, types, Plate & Tube forced air DXevaporators. Types of Defrost system. Water/ Brine chillers. Types of brine used as secondary refrigerant. Accumulator, its function. Liquid-suction-liquid Heat- exchanger, their function, construction, application &advantages. Study of Accumulator and Oil separator.

18. **VISIBLE COOLER AND BOTTLE COOLER** Visiblecooler & bottle coolers. Description, construction & working, with HFC-134a andhydrocarbons, safetyespecially for flammable refrigerants, maintenance, testing ofmechanical and electrical components including sealedelectricalcomponents fitted inappliances usingflammable refrigerants. **DEEP FREEZER / DISPLAY CABINET** Description, Construction, working, specifications, function, care and maintenance, faults and remedies. **ICE CUBE MACHINE-** Description, Construction, working, reverse cycle functioning & Circuit diagram, installation method. **SOFTY MACHINE -** Description, Construction and function. **ICE CANDY PLANT-** Function, construction, working principle, Circuit diagram, capacity& types of compressor used. Brine composition to maintain required temperature.Operation, maintenance, retrofit. **ICE PLANT-** Details about componentsof Ice plant their functioning. **WALK IN COOLER & REACHIN CABINET-** Details about components,their functioning, working principle, Circuit diagram, capacity & types. Care andmaintenance.

19. **COLD STORAGE-** Study of cold storage plant,parts, Construction, applications, controls & electrical diagram used in cold storage plant. Food preservation spoiling agents-controlling of spoiling agents, preservation by refrigeration system, maintaining temperature indifferent places. Types of cold storage and its details capacity and specification.Use of vibration eliminator and shock absorber, Studythe lay out. Cold storage plant operation, its

common trouble & remedies. Deep freezing, freezing tunnel, blast freezer its function and working, its application.

20. **HVAC (Plant) –** Introduction to HVAC, Fundamentals of Central Air Conditioning / HVAC plant, requirements of comfort A.C, study of psychometric terms, DBT,WBT, RH, enthalpy, dewpoint, and specific humidity. Types of Central air conditioning (Direct and indirect system) Construction, working, components, faults, care and maintenance. Description of blowers& fans, function and types, static and velocity pressure measurements.

**21. DUCT-** Function, types, materials, duct designing, duct insulation, properties of **AIR FILTERS** Function of air filters, types, construction, maintenance, effect of chocked Air filter.

**22. PACKAGE AC (with Air Cooled Condenser) -**Study the Package AC (with Air Cooled Condensers), its construction and working principle, types, troubleshooting. **PACKAGE A.C WITH WATER COOLEDCONDENSER-** Study Package AC, construction and working principle, Duct system, AHU. Care and maintenance.

23. **CENTRAL/ INDUSTRIALAIRCONDITIONING -**Construction and workingprinciple, types, maintenance of Industrial Air-conditioning plant. Humidification and dehumidification methods.Description of AHU andFCU Temperature and pressurecontrols used in AC plant, its construction, working, safety devices, piping lines.

24. **DIRECT EXPANSION SYSTEM -** Study Direct expansion system. Operation & Preventive MaintenanceSchedule of central AC plant. Maintain log book for daily operation. (05hrs.) VRF / VRV system – description and function ofdifferent parts. Details of piping have and controls system, Common reason for error code,types of ODU and IDU.

25. **INDIRECT/CHILLERSYSTEM -** Study central station AHU and FCU, **Air washers** used in chilled water system, understanding lay out, modulating valves for temperature control. Expansion valves & other related control –description and function. Study of Humidification &De-humidification. Humidifiers & De- humidifier's. Humidity control. Use of hygrometer. (05 hrs.) Construction and study of commercial A.C plant, package chillers, screw chillers, reciprocating chillers. (5 hrs.) Controls used in AC system, Electromechanical, pneumatic and electronic. Detail study of heat loadcalculation for commercialand industrial buildings.

**SYLLABUS: WIREMAN (ELL12023 & ELC12023)**

**Occupational Safety & Health:** Scope of the Wireman trade and career progression. Power sector scenario in India. 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 accessoriesIntroduction 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; calipers 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, Kirchoff'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, Potentialtransformer, Protective relays,lightning arrestors,
Different types of switches andswitch 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.

**DC Machines;** General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self- excited generators. Series, shunt and compound generators. Armature reaction, Commutation, interpoles and connection of interpoles. Parallel Operation of DC Generators. Application, losses & efficiency of DC Generators. Principle and types of DC motors. Changing the direction of rotation. Methods of speed control of DC motors.

**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. (10 hrs) 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 drawings.

**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.

**Commercial Wiring:** Wiring in commercial building- their special precautions as per I.E. rules. Different types of wiring - Power, control, Communication and entertainment wiring. Wiring circuits planning, Cabling in healthcare facilities; importance of grounding, shielding and routing in accordance with life safety codes to minimize interference with medical equipment. GFCI (Ground-fault circuit interrupter) receptacles.

**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, godown, tunnel and workshop, etc. Danger notice as per IE rules.

**Cable Management:** Types of cables, their use, Various cable glands 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 LightControl:**

Laws of Illuminations, Types of illumination system, Illumination factors, intensity oflight,
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 panelapplications.

**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

**Solar Power Plant:**

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 equipments. 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.

**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 molded 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.

**EV scenario in India and EV Charging basic theory**. EV Charging safety requirements.

**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.

**SYLLABUS: OT TECHNOLOGY (OPT12023)**

1. **Basic Anatomy**: Oropharynx; Nose; Trachea and trachea-bronchial tree

2. **Basic Physiology**: Respiratory System; Cardiovascular System; Blood and its components; G.I Tract; Blood Transfusion

3. **Pharmacology**: Pharmacology of life saving drugs; concept of Emergency Medicine

4. **Microbiology** : Sterilization of instruments (including endoscopic instruments)

5. **Anaesthesiology and OT**: Ventilator (I.C.U); Monitor (bedside and central); Fumigation of I.C.U.; Hygiene standard of I.C.U.; Oxygen Bank Study I.C.U. Operational procedures like I.Y. Line connection, Central line connection , etc.; Basic life support procedures; Emergency drugs; Cardiac Resuscitation; Disaster Management Training; Basic surgical and orthopaedics procedures like wound dressing, splint application, cervical collar application, etc.; Dressing methods; Safe transport methods of patients; Vascular Assessment like recording of pulse, B.P, etc.

**SYLLABUS: EMERGENCY AND FIRST AID TECHNOLOGY (EFA12023)**

1. **Basic Anatomy**
2. **Basic Physiology**
3. **Pharmacology**: Basic concept of emergency drugs
4. **Anaesthesiology**: Airway management & respiratory emergency; Identification of instruments; Ventilation; Respiratory Emergency
5. **Cardiology**: History taking for Cardiology emergency; Significance of pulse rate, rhythm, quality and abnormal pattern; Acute Cardiac Care; Cardiac arrest; Termination of resuscitation; Angina; Myocardial infarction,; C.C.F., Right &left sided congestive heart failure, ; Hypertension syncope; Transient ischemic attack; Stake indication and contradiction; Components of A.E.D/; Defibrillation - Steps, safety of defibrillation; Positioning of Patients.
6. **Medicine**: History taking; Physical examination approach to patient; Acute abdominal/ genito urinary emergency; Hepatitis; Genital infection; Retention of urine; Acute gastro enteritis; Acute food poisoning, inhaled, injected, absorbed; Allergies/anaphylactic reaction; Drugs overdose, snake bite, scorpion bite etc.; Alcohol abuse; Personal safety measures; Identification of common infectious diseases
7. **Forensic Medicine**: Medico legal responsibilities;
8. Definitions of duty to act; abandonment; negligence informed consent, ethnical responsibilities
9. Psychiatry: Psychiatric emergency cases; Define- Compassion, Competence, Confidence, Sympathy, Diplomacy, Tact, Discretion, Conflict, Patient, Patient Family, Language Barrier; Terminal Patient; Mentally Challenged Patient
10. **Emergency**: ABCD of trauma; Basic life support; Golden hour; CPR; Defibrillator (AED)
11. **Surgery**: Emergency and trauma - Blunt trauma chest, abdomen; R.T.A; Acute abdomen; Penetrating trauma; Haemorrhage and keeping control; Shock; Soft tissue injury; Management of different types of injuries; Burn, scald, chemical, electrical injuries; Faciomaxillary injury; Head injury (GCS); Spinal injury; Haemothorax; Pneumothorax; Injury to heart & great vessels; Specific abdominal injuries
12. **Orthopaedics**: Classification of muscular skeletal injuries; Inflammation and degenerative conditions; Sign & symptoms of external trauma; Upper & lower extremity trauma; Open fractures; Dislocations

**SYLLABUS: ICU TECHNOLOGY (ICU12023)**

1. **Basic Anatomy** : Oropharyngx ; Nose; Trachea and trachea-bronchial tree
2. **Basic Physiology**: Respiratory system; Cardiovascular system; Blood and its components; Blood transfusion
3. **Pharmacology** of life saving drugs and concept of emergency medicine
4. **Microbiology** : Sterilization of instruments
5. **Anaesthesiology and critical care**: Ventilator (ICU); Monitor (Bedside and central); Fumigation of ICU; Hygiene standard of ICU; Oxygen Bank study; ICU operational procedures like IV line connection, central line connection etc.; Basic life support procedures; Emergency drugs; Cardiac resuscitation; Disaster management training; Basic surgical and orthopedic procedures like wound dressing, splint application Cervical collar application etc.; Dressing methods; Safe transport methods of ICU patient; Vascular assessments like recording of pulse, BP etc.

**SYLLABUS: NURSING (NUR12023)**

1. **Bio Science**: Introduction to anatomical terms organization of the human body; Introduction to the detailed structure of the body; Blood; The Circulatory System; The Lymphatic system; The Respiratory system; The Digestive system; The Excretory system;
2. **Microbiology:** Introduction; Micro Organisms; Infection and its transmission; Immunity; Control and destruction of Microbes
3. **Fundamentals of nursing:** Introduction to Nursing; Nursing care of the patient; Meeting the Basic Needs of a patient; Assessment of patient/client; Infection control; Therapeutic Nursing Care; Introduction to clinical Pharmacology
4. **Community Health Nursing I & II:** Introduction to Community Health; Community Health Nursing; Health Assessment; Principles of Epidemiology and Epidemiological methods; Family Health Nursing Care; Family Health Care Settings Home Visit; Family Health Care Settings Home Visit; Records and reports; Minor Ailments; Heath system in India; Health care delivery system; Health planning in India; Specialized community health services and nurse's role; National health problems; National Health programme; Demography and family welfare; Health Team; Health Information System; Health Agencies;
5. **Child health nursing:** Introduction; Growth & Development; The sick child; Disorders and health problems of a child; Child with congenital disorders; Children with various disorders and diseases; Child welfare services.
6. **Midwifery and gynaecological health nursing:** Introduction; Reproductive system; Embryology and foetal development; Normal pregnancy and its management; Normal labor and its management; Management of new born; Management of normal puerperium; Management of complications during pregnancy; Management of high risk labour; Management of complications of puerperium; High risk and sick new born; Obstetric operations; Drugs used in obstetrics; Ethical and legal aspects related to midwifery.
7. **Gynecologial Nursing:** Introduction; Puberty; Fertility and infertility; Pelvic infections; Gynaecological disorders; Breast disorders; Menopause.
8. **Medical Surgical nursing I:** Introduction; Nursing assessment; Pathophysiological mechanism of disease; Altered immune response; Fluid and electrolyte balance and Imbalance; Operation theatre technique; Management of patient undergoing surgery; Nursing management of patient with impaired respiratory function and gaseous exchange; Nursing management of patient with gastro intestinal disorders; Nursing management of patients with metabolic and endocrinal disorders; Nursing management of renal and urinary disorders; Nursing Management of Patients with Connective Tissue and Collagen Disorders; Nursing management of patients with neurological disorders; Nursing Management of Patients with Connective Tissue and Collagen Disorders; Nursing management of the elderly.
9. **Medical Surgical nursing II:** Oncology Nursing; Nursing Management of patients with disorders of Breast; Nursing Management of patient with diseases and disorders of integumentary system; Ophthalmology And Ophthalmic Nursing;
   Nursing Management of Patient with Disorders and Diseases of Ear, Nose and Throat; Nursing Management of Patient with cardio vascular, circulatory and Haematological disorders; Nursing Management of Patients with communicable diseases; Nursing Management of Patients with Sexually Transmitted diseases;
   Nursing Management of Patients with musculo-skeletal disorders and diseases;
   Emergency Management; Emergency and Disaster Nursing.
10. **Mental Health Nursing:** Introduction; History of Psychiatry; Mental Health Assessment; Therapeutic nurse-patient relationship; Mental Disorders and Nursing Interventions; Bio – Psycho & Social Therapies; Community Mental Health; Psychiatric Emergencies and Crisis Intervention; Forensic Psychiatry / Legal Aspects.

**SYLLABUS: DIETICIAN (DIE12023)**

1. **Introduction to Nutrition science:** Definition of the term Food, Nutrition, Nutrients, Dietetics, Balance Diet, Health, Energy, Adequate Nutrition, Optimal Nutrition, Malnutrition, Under Nutrition, Over Nutrition, Phytochemicals, Prebiotics, Probiotics. Balance diet, Food as a source of macro (Carbohydrate, fat & protein) and micronutrients (Vitamins & Minerals), Physiological, Psychological & social functions of food, Interrelationship between nutrition & health, visible symptoms of good health.
2. **Food guide – Basic five food groups:** Basic five food groups: Cereals & grains, pulses & legumes, milk & meat products, Fruit & vegetable, Fats & sugars, RDA & its use, Planning balance diet with the use of five food group system according to RDA.
3. **Use of food in Human body:** The process of digestion, absorption, transport, utilization of carbohydrate, lipids, proteins, minerals, vitamins & water in human body.
4. **Effect of heat processing on the nutritive value of foods:** Effect of cooking & heat processing on various micro and macro nutrients of cereals, legumes, oil seeds, nuts fats, oils, milk fish/flesh, vegetables and fruits and products.
5. **Nutrition in Sports:** Nutrition for Sports fitness, Role of macro (Carbohydrate, fat, protein) nutrients, Role of micro nutrients (minerals & vitamins), Role of water /electrolytes, Nutrition recommendations for sport person in pre exercise, during and post exercise.
6. **Processed and Low-cost supplementary foods**: Introduction; Historical perspectives; Supplementary foods In India; Indian multipurpose food; Malt food; Bal Ahar; Novel foods
7. **Food sanitation and hygiene**: Introduction. • Natural toxicants in food. • Toxicant due to contamination of food with harmful bacteria, fungi, parasites, insects and rodents. • Pesticide residue. • Adulterants. • Impact on human health. • Prevention & control.
8. **Recent concepts in food science**: • Introduction. • Organic food. • Food-Fortification. • Genetically Modified food. • Bio fortification. • Space food

**SYLLABUS: GEOLOGY/GEOINFORMATICS/GEOGRAPHY (TCG12023)**

1. **Geology:** Physical Geology and Geomorphology**;** Structural Geology**;** Mineralogy**;** Petroleum Geology**;** Petrology
2. **Fundamental of Remote Sensing & Digital Images Processing:** Basic of Remote Sensing; Physics of Remote Sensing and EMR interaction; Platform and Sensors & Resolutions**;** Earth Recourse Satellite; Image Interpretation; Introduction to digital Images processing**;** Spectral signatures**;** Image Restoration**;** Image Enhancement**;** Image Classification, change analysis**;** Accuracy Assessment**;** Indian space programmes**;** National agencies and Bhuvan.
3. **GIS & GPS:** Introduction and components of GIS**;** Data Structure and Data Models; Map Projections, ellipsoid and datum, datum conversion; Spatial database creation**;** Data Storage; Spatial Analysis (from basic to pro)**;** Geoprocessing; Topology and GIS error; Network analysis**;** Global navigation satellite system (GNSS)**;** Geodesy and Surveying**;** Component of Global Positioning System**;** GPS Accuracy & Affecting Factors; GPS Applications-surveying, data acquiring, transfer, plotting**;** A case study and Report print.
4. **Photogrammetry & Lidar:** Basic of Photogrammetry**;** Geometry of Aerial photographs; Aerial camera, Lens, Film, and Aerial Photos**;** Photo interpretation, Parallax**;** Stereo Photogrammetry**;** Orthophoto**;** Aerial triangulation**;** 3D feature extraction**;** Contour Mapping**;** 3D city modeling**;** Surface modeling and spatial analysis; International mapping standards and quality management**;** Photogrammetry products
5. **Cartography:** Basic concept of Cartography**;** The spheroid, map scale, co-ordinate system; Methods of mapping, map scale, relief maps, thematic maps; Map projections, different type of projection system; Concept of topographical sheets, map reproduction.

**SYLLABUS: B.SC. WITH PHYSICS/ CHEMISTRY/ GEOLOGY (PCG12023)**

## PHYSICS

**Elasticity**: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio- Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion – Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and $\sigma$ by Searles method.

**Laws of Thermodynamics**: Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

**Kinetic Theory of Gases**: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

## CHEMISTRY

### Inorganic Chemistry

**Atomic Structure**: Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

**Transition Series Elements (3d series)**: General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanoids and actinoids : Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

**Coordination Chemistry**: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6.

### Organic Chemistry

**Fundamentals of Organic Chemistry**: Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

**Aliphatic Hydrocarbons**: Alkanes, Alkenes and Alkynes : Preparation and reactions

**Aromatic Hydrocarbons**: Preparation: (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation

**Alcohols, Phenols and Ethers**: Preparation and Reactions:

### Physical Chemistry

**Chemical Equilibrium:** Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔGo, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

**Phase Equilibrium:** Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic deviation. Phase diagrams of one-component

systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points ( lead –silver, FeCl3-H2O and Na-K only)

**Kinetic Theory of Gases:** Gases: Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants. Andrews isotherms of CO 2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision number and mean free path of molecules. Viscosity of gases, effect of temperature/pressure on coefficient of viscosity (qualitative treatment only).

**Analytical Chemistry**

**Spectrometry**: UV-Visible Spectrometry, IR Spectrometry, Flame Atomic Absorption and Emission spectrometry.

**Separation techniques**: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions.

**Qualitative and quantitative aspects of solvent extraction:** extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

**Qualitative and quantitative aspects of chromatographic methods of analysis:** TLC and HPLC.

**Industrial topics**:

**Water Base Drilling Fluid:** Functions of Drilling Fluid / Mud; Types of Drilling Fluid /Mud; Additives used in Drilling Fluid / Mud.; Solid Control Equipment in Rig, their functions; Rig infrastructures for Drilling fluid storage, maintenance, treatment etc.; Volume / Capacity calculation of cylinder, rectangular tank or cuboidal tank; Down hole problems encountered during drilling.

**Drilling Fluid Laboratory:** Drilling fluid parameters measured in Laboratory: (Density, Marsh Funnel Viscosity, Apparent Viscosity, Plastic Viscosity, Yield Point, Gel Strength, pH, Salinity, Fluid Loss , Methylene Blue Test (MBT) / Cation Exchange Capacity, Sand Content determination, Oil/Solid determination by Retort, K+ ion concentration ); Unit of measurement of different mud parameters.

**Workover Fluid:** Types of work over fluids; Additives used in Drilling Fluid / Mud; Workover fluid parameters measured in Laboratory: Density, pH, Salinity, Turbidity, Carbonate content, Bicarbonate content); Unit of measurement of different mud parameters.

**Reservoir Section:** Permeability; Porosity; Calculation of Hydrostatic head of a certain height of Fluid column of a certain density.

**Cementing Laboratory:** Additives used to tailor-made the properties of comment slurry.

**Analytical and Environment Laboratory:** Parameters tested for a water sample: (BOD, COD, DO, Turbidity, Hardness, Salinity, pH, Mineral Oil, Alkali metals, heavy metals, toxic elements, organic, inorganic elements etc.) Acid-Base titrations; Redox titrations; Complex metric titrations etc.;

**OIL Laboratory:** Distillation of Crude Oil; Measurement of different parameters of Crude oil and other petroleum products like water/oil content, specific gravity, Density, API gravity, Wax content, Asphaltene content, Resin content, Sulfur content, Rheology of crude oil, Pour Point, Flash point etc.

**Natural Gas Analysis Laboratory:** Composition of Natural Gas; Chromatographic analysis of Natural Gas.

**GEOLOGY**

Earth and planetary system – terrestrial planets and moons of the solar system; size, shape, internal structure and composition of the earth; concept of isostasy; elements of seismology – body and surface waves, propagation of body waves in the earth's interior; Heat flow within the earth; Gravitational field of the Earth; geomagnetism and paleomagnetism; continental drift; plate tectonics – relationship with earthquakes, volcanism and mountain building; continental and oceanic crust – composition, structure and thickness.

2. Weathering and soil formation; landforms created by river, wind, glacier, ocean and volcanoes.

3. Basic structural geology - stress, strain and material response; brittle and ductile deformation; nomenclature and classification of folds and faults.

4. Crystallography – basic crystal symmetry and concept of point groups. Mineralogy – silicate crystal structure and determinative mineralogy of common rock forming minerals.

5. Petrology of common igneous, sedimentary and metamorphic rocks.

6. Geological time scale; Geochronology and absolute time. Stratigraphic principles; major stratigraphic divisions of India.

7. Mineral, coal and petroleum resources of India.

8. Introduction to remote sensing.

9. Engineering properties of rocks and soils.

10. Elements of hydrogeology.

11. Principles and applications of gravity, magnetic, electrical, electromagnetic, seismic and radiometric methods of prospecting for oil, mineral and ground water; introductory well logging.

12. **Geomorphology -** Geomorphic processes and agents; development and evolution of landforms in continental and oceanic settings; tectonic geomorphology.

13. **Structural geology** – Forces and mechanism of rock deformation; primary and secondary structures; geometry and genesis of planar and linear structures (bedding, cleavage, schistosity, lineation); folds, faults, joints and unconformities; Stereographic projection; shear zones, thrusts and superposed folding; basement-cover relationship. Interpretation of geological maps.

14. **Crystallography and mineralogy**- Elements of crystal symmetry, form and twinning; crystallographic projection; crystal chemistry; classification of minerals, physical and optical properties of rock-forming minerals.

15. **Geochemistry** – Cosmic abundance of elements; meteorites; geochemical evolution of the earth; geochemical cycles; distribution of major, minor and trace elements in crust and mantle; elements of high temperature and low temperature geochemical thermodynamics; isotopic evolution of the crust and the mantle, mantle reservoirs; geochemistry of water and water-rock interaction.

16. **Igneous petrology** – Classification, forms, textures and genesis of common igneous rocks; magmatic differentiation; binary and ternary phase diagrams; major and trace elements as monitors of partial melting and magma evolutionary processes. Mantle plumes, hotspots and large igneous provinces.

17. **Sedimentology**– Texture, structure and sedimentary processes; petrology of common sedimentary rocks; Sedimentary facies and environments, cyclicities in sedimentary succession; provencance and basin analysis. Important sedimentary basins of India.

18. **Metamorphic petrology** – Structures and textures of metamorphic rocks. Physico-chemical conditions of metamorphism and concept of metamorphic facies, grade and baric types; chemographic projections; metamorphism of pelitic, mafic and impure carbonate rocks; role of bulk composition including fluids in metamorphism; thermobarometry and metamorphic P-T-t paths, and their tectonic significance.

19. **Paleobiology** - Diversity of life through time, mass extinctions- causes and effects; taphonomy - processes of fossilization. Taxonomy. Morphology and functional morphology of invertebrates (bivalves, brachiopods, gastropods, echinoids, ammonites); microfossils (foraminifera, ostracoda, conodonts, bryozoa); Vertebrate paleonology (Equus, Probicidea, Human); Paleobotany (plant,

spores, pollens). Basic concepts of ecology/paleoecology; classification - ecological and taxonomic schemes (diversity and richness). Fossils and paleoenvironments.

20. **Stratigraphy** – Principles of stratigraphy and concepts of correlation; Lithostratigraphy, biostratigraphy and chronostratigraphy. Principles of sequence stratigraphy and applications. Stratigraphy of peninsular and extra-peninsular India. Boundary problems in Indian stratigraphy.

21. **Resource geology** - Ore-mineralogy; ore forming processes vis-à-vis ore-rock association (magmatic, hydrothermal, sedimentary, supergene and metamorphogenic ores); fluid inclusions as ore genetic tools. Coal and petroleum geology; marine mineral resources. Prospecting and exploration of economic mineral deposits - sampling, ore reserve estimation, geostatistics, mining methods. Ore dressing and mineral economics. Distribution of mineral, fossil and nuclear fuel deposits in India.

22. **Global tectonics** – Plate motions, driving mechanisms, plate boundaries, supercontinent cycles.

23. **Applied geology** – Physico-mechanical properties of rocks and soils; rock index tests; Rock failure criteria (Mohr-Coulomb, Griffith and Hoek-Brown criteria); shear strength of rock discontinuities; rock mass classifications (RMR and Q Systems); in-situ stresses; rocks as construction materials; geological factors in the construction of engineering structures including dams, tunnels and excavation sites. Analysis of slope stability. Natural hazards (landslide, volcanic, seismogenic, coastal) and mitigation. Principles of climate change.

24. **Hydrogeology** – Groundwater flow and exploration, well hydraulics and water quality.

25. **Basic principles of remote sensing** – energy sources and radiation principles, atmospheric absorption, interaction of energy with earth's surface, aerial-photo interpretation, multispectral remote sensing in visible, infrared, thermal IR and microwave regions, digital processing of satellite images. GIS – basic concepts, raster and vector mode operations.

**SYLLABUS: B.SC. (GEOLOGY) (BGE12023)**

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