1. **Syllabus for ENGINEERING DRAWING Subject-for the post of Instructor**
(Not applicable for Draughtsman trade Group)

Theory:

A. Mandatory for all Trades:

1. Engineering Drawing: Introduction to Engineering Drawing and Drawing Instruments:

- Conventions • Viewing of engineering drawing sheets. • Method of Folding of printed Drawing sheet as per BIS SP: 46-2003.

2. Drawing Instrument:

- Drawing board, T-square, Drafter (Drafting M/c), Set squares, Protector, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), pencils of different grades, Drawing pins/ Clips.

3. Free hand drawing of:

- Lines, polygons, ellipse etc. • Geometrical figures and blocks with dimension
- Transferring measurement from the given object to the free hand sketches.
- Solid objects – Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone with dimensions. • Free hand drawing of hand tools and measuring tools, simple fasteners (nuts, bolts, rivets etc.) trade related sketches.

4. Lines:

- Definition, types and applications in drawing as per BIS: 46-2003
- Classification of lines (Hidden, centre, construction, extension, Dimension, Section)
- Drawing lines of given length (Straight, curved) • Drawing of parallel lines, perpendicular line • Methods of Division of line segment.

5. Drawing of Geometrical figures:

- Definition, nomenclature and practice of-• Angle: Measurement and its types, method of bisecting. • Triangle: different types • Rectangle, Square, Rhombus, Parallelogram. • Circle and its elements • Different polygon and their values of included angles. Inscribed and circumscribed polygons.

6. Lettering & Numbering:

- Single Stroke, Double Stroke, Inclined.

7. Dimensioning and its Practice:

- Definition, types and methods of dimensioning (functional, non-functional and auxiliary) • Position of dimensioning (Unidirectional, Aligned) • Types of arrowheads • Leader line with text • Symbols preceding the value of dimension and dimensional tolerance.

8. Sizes and layout of drawing sheets;

- Selection of sizes • Title Block, its position and content • Item Reference on Drawing Sheet.

9. Method of presentation of Engineering Drawing:

- Pictorial View • Orthographic View • Isometric View.

10. Symbolic representation:

- Different symbols used in the trades • Fastener (Rivets, Bolts and Nuts) • Bars and profile sections • Weld, Brazed and soldered joints • Electrical and electronics element • Piping joints and fitting.

11. Projections:

- Concept of axes plane and quadrant • Orthographic projections • Method of first angle and third angle projections (definition and difference) • Symbol of 1st angle and 3rd angle projection in 3rd angle.

12. Orthographic projection from isometric projection.

13. Reading of fabrication drawing.

B. Optional-specific to mentioned trades only:

I. (Group - I)- Mechanical trade group – Fitter, Turner, Machinist, Machinist Grinder, Mechanic Machine Tool Maintenance, Operator Advance Machine Tool, Mechanic Motor Vehicle, Mechanic Agriculture Machinery, Ref. & A/C Mechanic, Central Air Conditioning Plant, Mechanic Mining Machinery, TDM (D&M), TDM (J&F), Marine Fitter, Aeronautical Structure, Spinning Technician, Textile Wet Processing Technician, Weaving Technician, Textile Mechatronics, Painter General, Mechanic Maintenance. (Chemical Plant), Refractory Technician.

Sl. No.	Topic
1	Construction of scales and diagonal scales
2	Conic sections (Ellipse and Parabola)
3	Sketches of nuts, bolt, screw thread, different types of locking devices e.g. Double nut, Castle nut, Pin, etc.
4	Sketches of foundation
5	Rivets and rivetted joints, welded joints
6	Sketches of pipes and pipe joints
7	Assembly view of Vee blocks, Bush & Bearing, Different types of Coupling viz., Muff coupling, Half Lap Coupling, Flange coupling, etc. Simple work holding device e.g. vice Drawing details of two mating blocks and assembled view
8	Sketch of shaft and pulley, belt, gear, gear drive

II. (Group - II)- Electrical, Electronics & IT trade Group – (Electroplater, Lift & Escalator Mechanic, Electrician, Tech. Medical Electronics, Technician Mechatronics, Wireman, Electrician Power Distribution, Instrument Mechanic, Technician Power Electronics System, Electronics Mechanic, Mechanic Consumer Electronics Appliances, Instrument Mechanic (Chemical Plant), Attendant Operator (Chemical Plant), Laboratory Attendant (Chemical Plant), Information & Communication Technology System Maintenance, Information Technology, Tech. Electronic System Design & Repair)

Sl. No.	Topic
1	Sign and Symbols of Electrical, Electronics and related trades
2	Sketch of Electrical and Electronics/ trade related components
3	Electrical and Electronics wiring diagram/ trade related Layout diagram
4	Electrical earthing diagram - Drawing the schematic diagram of plate and pipe earthing.
5	Electrical, Electronics/ trade related circuit diagram
6	Block diagram of Instruments/ equipment of related trades

2. **Syllabus for WORKSHOP CALCULATION & SCIENCE Subject-for the post of Instructor**

(For all engineering trades)

Theory:

1. 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 and Problems, Fractions–Addition, Subtraction, Multiplication and Division, Decimal Fractions-Addition, Subtraction, Multiplication and Division, Solving Problems by using calculator.

2. Square Root: Ratio and Proportions, Percentage:

   Square and Square Root, Simple problems using calculator, Application of Pythagoras Theorem and related problems, Ratio and Proportions, Direct and Indirect proportion, Percentage, Changing percentage to decimal.

3. Material Science:

   Types of metals, Physical and Mechanical Properties of metals, Types of ferrous and non-ferrous metals, Introduction of iron and cast iron, Difference between iron and steel, alloy steel and carbon steel, Properties and uses of rubber, timber and insulating materials.

4. Mass, Weight, Volume, and Density:

   Mass, volume, density, weight & specific gravity, Related problems for mass, volume, density, weight & specific gravity.

5. Speed and Velocity, Work Power and Energy:

   Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation, Related problems on speed and velocity, Potential energy, Kinetic Energy and related problems with related problems, Work, power, energy, HP, IHP, BHP and efficiency.

6. Heat &Temperature and Pressure:

   Concept of heat and temperature, effects of heat, difference between heat and temperature, Scales of temperature, Celsius, Fahrenheit, Kelvin and Conversion between scales of temperature, Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation, Co-efficient of linear expansion and related problems with assignments, Problem of Heat loss and heat gain with assignments, Thermal conductivity and insulators, Boiling point and melting point of different metals and Non-metals , Concept of pressure and its units in different system.

7. Basic Electricity:

   Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC and their comparison, voltage, resistance and their units, Conductor, Insulator, types of connections- Series and Parallel, Ohm's Law, relation between VIR & related problems, Electrical power, energy and their units, calculation with assignments, Magnetic induction, self and mutual inductance and EMF generation, Electrical Power, HP, Energy and units of electrical energy.

8. Mensuration:

   Area and perimeter of square, rectangle and parallelogram, Area an Perimeter of Triangle, Area and Perimeter of Circle, Semi-circle, circular ring, sector of circle, hexagon and ellipse, Surface area and Volume of solids- cube, cuboids, cylinder,

sphere and hollow cylinder, Finding lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels.

9. Levers and Simple Machines:

   Simple machines, Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relation between efficiency, velocity ratio and mechanical advantage, Lever and its types.

10. Trigonometry:

    Measurement of Angle, Trigonometrical Ratios, Trigonometric Table, Trigonometry-Application in calculating height and distance (Simple Applications).

11. Friction:

    Advantages and disadvantages, Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction, Friction – Lubrication, Co- efficient of friction, application and effects of friction in workshop practice.

12. Centre of Gravity:

    Centre of gravity and its practical application

13. Area of cut – out regular surfaces and area of irregular surfaces:

    Area of cut – out regular surfaces – circle, segment and sector of circle, Related problems of area of cut – out regular surfaces – circle, segment and sector of circle, Area of irregular surfaces and application related to shop problems.

14. Algebra:

    Addition, Subtraction, Multiplication &Divisions, Algebra – Theory of indices, Algebraic formula, related problems.

15. Elasticity:

    Elastic, plastic materials, stress, strains and their units and young modulus, Ultimate stress and working stress.

16. Heat Treatment:

    Heat treatment and advantages, Different heat treatment process – Hardening, Tempering, Annealing, Normalising, Case Hardening.

17. Profit and Loss:

    Simple problems on profit &loss, Simple and compound interest.

18. Estimation and Costing:

    Simple estimation of the requirement of material etc., as applicable to the trade, Problems on estimation and costing.

3. **Syllabus for EMPLOYABILITY SKILLS Subject -for the post of Instructor Theory:**

Syllabus for Employability Skills	
Module	Topics
1.BehaviouralSkills	
Expectation Setting	Creating a focused and responsible learning environment
Personal Strength Analysis/Strength Blindness	Self-awareness and confidence building
Perception Management	Display Professional is mat the in statute and workplace
Ethics, Values &Etiquette	Increased social initiations relationships and networks Acceptance of peers from different cultures and social groups and work with them. Collaboration with team to prioritize the common goal and compromise Individual priorities.
Social Etiquette	Characteristic of a responsible citizen-Display the same by respecting self, others, environment, care for duty and value for time.
Role Modelling	Adopting best practices and aspire to follow success stories of individual for personal development.
2.EnglishLiteracy	
Functional English	• Importance of Learning English. • Different Naming words, Words used for replacing names, Action words, Describing people, place and their use. • Introduction to punctuation - Comma, Full stop, Question mark. Singular plural. • Change of tense-Simple present, past; present, past progressive Construction of simple sentences – Kinds of sentences. • Usage of appropriate words to express themselves Greetings& Self Introduction. • Asking &responding to questions Sharing information with others Formal & Informal communication. • Speak and provide information about workplace. • Discussion son current happenings.
Reading	Reading simple sentences about: Self, Work and Environment.
Written English	Simple writing skills
3.CommunicationSkills	
Self-Introduction	Interview Skills/Confidence Building
Perception Management	Professionalism and Display of same at the institute and workplace
a. Verbal Communication	UnderstandtheusageofappropriatewordstoexpressthemselvesCommunicate effectively on telephone.
b. Non-Verbal Communication	Manage Personal Hygiene and Presentation
	Positive body language: adopt and use it appropriately to build a positive impression.
	Different spatial zones: Understanding and need to maintain it, create safe zones for communication.
	Maintaining appropriate eye-contact in building trust and confidence
	Impact of touch in a formal environment. Acceptable and unacceptable touch.
	Role of tone in any communication.

c. Campus to Work	Time Management and Planning Skills
	Interview skills-its phases & way Stoc rack interview.
	Handling setbacks/rejection and recover from it with an action plan.
	Developing strong professional contacts/network to gain support in learning process and career as a whole
4.I.T. Literacy	
Basics of Computers	Introduction to Computers and its applications. Hardware and peripherals. Starting and shutting down of computer. Basic of computer Networks.
Operating System	Basics of Operating System. Types of Operating Systems. User interface of Windows 10 OS/ latest. Create, Copy, Move and delete Files and Folders. Use of External memory like pen drive, CD, DVD etc, Introduction to inbuilt windows apps, Tools and features.
MS-Word	Basic operating of Word Processing. Creating, opening and closing Documents. Use of shortcuts, Creating and Editing of Text, Formatting the Text. Creating simple document like-resume, letter writing, job application etc., Printing document.
MS-Excel	Basics of Excel worksheet & its importance. Creating simple worksheets, Adding and average functions. Printing of simple excel sheets.
Web browsers & Search Engines	Introduction to world wide web (WWW), Useful websites, web browser -usage, search engine etc. Using popular sites like Bharat Skills, Skill Training related Government portals, Naukri. Command other job portals, CITS applications, Apprentice ship portal (NAPS), resize images, signing up, Online fund transfer using UPI gateway.
Email	Creating & using an email account –like Gmail or any other. Usage of CC & BCC, attaching documents, checking email and composing Email.
Mobile application	Scanning QR /AR code, sharing best practices and downloading trade related.
	videos using Wi-Fi, Fund transfer through App like BHIM.
5.EntrepreneurshipSkills	
Entrepreneur	Need of becoming entrepreneur.
	Ways to become a good entrepreneur.
	• Enabling environment available to become an entrepreneur. • Different Govt. institutions/schemes promoting Entrepreneur viz., Gramin banks, PMMY-MUDRA loans, DIC, SIDA, SISI, NSIC, SIDO. • Ways to set up an enterprise and different aspects involved viz., legal compliances, Marketing aspect, Budgeting, etc. • Day to day monitoring mechanism for Maintaining an enterprise. Different Government schemes supporting entrepreneurship. • Examples of successful and unsuccessful entrepreneurs.
6.MaintainingEfficiencyatWorkplace	
Maintaining Efficiency at Work place	Factors affecting productivity
	Improving Productivity
	Personal finance literacy Planning, Saving, Tax, Govt. schemes for financial safety e.g. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), etc.
7.Occupational Safety, Health and Environment Education	
Safety and Health	Introduction to Occupational Safety & health at workplace, Occupational Hygiene
Occupational Hazards	Basic Hazards. Chemical, Physical (Electrical, Temperature, Illumination), Ergonomic, Biological, Vibroacoustic, Mechanical, Psychosocial Hazards, Prevention of hazards

Accident and Safety	Different types of Personal Protective Equipment (PPE). Accident Prevention techniques.
First-aid	Care of injured & Sick at the work place. First-Aid & Transportation of sick person.
Basic provisions on safety and Health	Basic provisions of safety & health
Environmental Issues	Introduction to Environment, ecosystem and factors causing imbalance, Pollution and pollutants including liquid, gaseous, solid and hazardous waste Protecting the environment-Energy Conservation, ground water, global warming, Responsibility about the environment, Segregation and disposal of waste
Environmental ethics	Different actions people that affect others and the environment.
Disaster Management	Types, causes& effects, areas in India that are prone to be affected, preparedness & mitigation, dos and don'ts- Before, During and After any Disaster, how to reduce man-made disasters.
8.Essentialskillsfor success	
Essential skills for success	•Building basic skills to navigate life and career. •Self-Awareness, articulating personal values, Value-based decision making, Dilemma situations. •Identify sources and types of stress (positive/negative stress), Managing stress (long-term/short-term), Handling rejection and building resilience, •Identify day wasters.
9.LabourWelfareLegislation	
Labour Welfare Legislation	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Work men's compensation Act, POSH. Interpret applicable labour and industrial laws.
10.QualityManagement	
Quality Concept and Consciousness	Create awareness on introduction of quality Concepts.
Concept of Quality Management (QMS) & PDCA	Concept of Quality Management (QMS), PDCA, Fishbone,5S,5D, KAIZEN
Concept of ISO	Introduction of ISO
11.Preparationtotheworld of work	
Career Plan	Identify the difference between job and career
Basic Professional Skills	Job roles available in respective trades
Career Pathways	Awareness of industries, and the respective professional pathways
Search and apply for a job	Awareness of higher education/upskilling(short-term) options Steps involved in online application for Instructor course, Apprenticeship and different jobs in popular site like theindiajobs.com, naukri.com, monsterindia.com, Govt. website.
12.CustomerInteraction/service	
Greeting customers	Forms of greeting
Probing-understanding Customer requirements	Use of positive body language

Handling grievances	Handling grievances (Use of ask-listen-repeat technique)
Relationship building with customers	Relationship building with customers, importance of probing.
To identify the importance of probing	Use of open-ended/close-ended questions to gauge requirement

4. **Syllabus for ARCHITECTURAL DRAUGHTS MAN Trade-for the post of Instructor.**

Theory:

1. Draw different types of architectural symbols following safety precautions- Architectural signs and symbols and their uses in the drawings, sketching techniques- Elements of drafting, readability, clarity, accuracy and neatness, Pencil grades, Method of pencil uses, uses of different brushstrokes, Various types of lines used frsketching.
2. Plane geometry- Solids: Definition of solids – cube, square prism, hexagonal prism, triangular prism, square prism, triangular pyramid, hexagonal, pyramid, pentagonal pyramid, cylinder, sphere, cone., Basic system of measurement, dimensional control, location, dimensioning of different objects like lines, circle, curves and angles,Scale and proportion.
3. Introduction to orthographic projections: Types of projections - Projection planes, First angle projection, Third angle projection, Isometric view of geometrical solids.
4. Brick masonry: Technical terms, Sizes of brick and brick tiles, Principle of brick masonry construction, English and Flemish bond for one brick thick and one and half brick thick wall, Different types of bonds and their uses in construction, Hollow brick masonry, AAC Block, Fly-ash brick.
5. Stone masonry: Technical terms, Principles of stone masonry, Rubble masonry, Ashlar masonry, Composite masonry.
6. Foundation: Purpose of foundation Causes of failure of foundation Types of foundation – spread foundation, grillage foundation, pile foundation, raft or mat foundation.
7. Carpentry Joints: Technical terms Lengthening joints and their uses Bearing joints and their uses Framing joints and their uses Angle or corner joints and their uses Widening or side joints and their uses Oblique- shouldered joints and their uses.
8. Doors: Standard Sizes of doors Types of doors -panelled door, flush door, batten and ledged door.
9. Windows: Standard Sizes of windows Details of casement window, louvered window, ventilator Fixtures and fasteners, Types of joints (used in doors and windows).
10. Lintels: Purpose of lintel Types and uses of lintels – wooden lintel, stone lintel, brick lintel, steel lintel, RCC lintel, Chajjas.
11. Arches: Technical terms, Materials used for construction of arches, Types of arches and their uses – flat arch, semi-circular arch, segmental arch, semi elliptical arch, two cantered arch, three cantered arch.
12. Factors considered in architectural design: Understanding the basic elements of design like point, line, plane, figure, form and space, light and colour, texture.
13. Damp proof Course (DPC): Definition, Sources of dampness Prevention methods of dampness–integral treatment, surface treatment, membrane damp proofing, cavity

wall construction, Materials used in DPC – mastic asphalt, hot laid bitumen, metal sheets, PCC etc.

14. Anti-termite treatment: Types of Anti termite treatment, Treatment to basement in ordinary soil, Treatment to basement in damp soil.
15. Introduction to design: Design principles – balance, proportion, perspective, movement, rhythm, harmony, unity, symmetry and contrast
16. Preliminary drawing: Conceptual design ideas – site analysis, site planning, requirements, space designation, proportionately defined rooms, single line diagram, floor plan analysis, functional planning, typical vertical section of an external wall of two storied load bearing structure and RCC framed structure, pre-fabricated panels, GI Powder coated steel panels.
17. Stairs: Technical terms General dimensions and arrangements Requirements of good stairs Ashlar masonry Classification of stairs – straight flight stairs, dog legged stairs, newel stairs, open well stairs, geometrical stairs, circular stairs, bifurcated stairs, spiral stairs, stairs of different materials – wooden stairs, stone stairs, metal stairs, reinforced concrete stairs.
18. Floors and flooring: Components of floor – sub floor, floor covering, construction of ground floor, selection of floorings, suspended floors, Floor coverings Ground and basement floor.
19. History of Architecture (HOA):
    i. Egyptian architecture Characteristic features of Egyptian architecture Tombs mastaba pyramid – the great pyramid at cheops at giza the great sphinx of chephren.
    ii. Greek architecture Greek column like Doric order, ionic order, corian than order Characteristic features of the temple of Parthenon at Athens, Olympia stadium at Athens.
    iii. Roman architecture Characteristic features of the temples of Saturn at rome, thepantheonat Athens, basilica of Trajan at rome.
    iv. Indian architecture Stupas and its characteristic features and typical examples Typical Buddhist column or order Northern Indian style elements and characteristic features (lingaraja temple at Orissa, sun temple at konark, temple of khajuraho), Central hindu style elements and characteristic features (rock cut temples at badami and Humpi, hoysaleswar temple at halebid) South hindu or Dravidian style elements and characteristic features (shore temple at mahabalipuram, brihadesvar temple at tanjavur, temple of Madurai)
20. Factors considered in architectural design: Approaches to planning Open planning Closed planning, Circulation–horizontal circulation, through circulation, vertical circulation, open court circulation.
21. Environmental factors considered in architectural design: Orientation of building Effects of wind Window positioning Space designation Proportionately defined rooms.
22. Reading and interpretation of structural drawing: One-way slab, two-way slab. Single reinforced beam, Double reinforced beam, Column foundation, Stair case Waist slab.
23. Special doors: Louvered doors, collapsible doors, rolling steel shutter door, revolving door, sliding door, metal doors.
24. Special windows: Bay windows, dormer windows, sliding windows, metal windows.
25. Roof covering materials – wooden shingles, asbestos cement sheets, galvanized corrugated iron sheets, asphaltic roofing sheets.
26. Climatic responsive design: Study of climates in India, Sun path diagram and orientation of building with respect to the climate, Positioning of windows and open

spaces as per climatic need, Fundamentals of climate responsive planning, Passive solar design.

27. Expansion joints and construction joints: Need for expansion joints in building Construction joints – Contraction joints, isolation joints, dummy joints, sliding joints, position of construction joints, Expansion joints in walls and roofs, spacing of expansion joints, materials used in expansion joints.

28. Green Architecture/sustainable architecture: green building and its importance, Benefits of green building Fundamentals of green building, Material and resources, Water efficiency, Energy conservation Sustainable site selection, green building rating system– LEED/ GRIHA.

Practical:

1. Draw different types of architectural symbols following safety precautions.
2. Draw different types free hand sketches.
3. Draw different type of letterings.
4. Draw different types of plane geometry.
5. Draw orthographic projections.
6. Draw different sizes of Bricks and Brick Masonry.
7. Draw different types of Stone Masonry.
8. Draw different types of Foundation.
9. Draw different Carpentry Joints.
10. Draw different types of Wooden Doors and Windows.
11. Draw different types of Lintels.
12. Draw different types of Arches.
13. Draft in CAD.
14. Draw details of Damp proof Course (DPC) and Water Proofing Treatment at different locations.
15. Draw plan, elevation and side view of Solids in inclined positions and Section of Solids.
16. Illustrate design procedure of Residential Building.
17. Draw plan, elevation and section through toilet of the residential building and the site plan with landscape.
18. Draw typical vertical section of an external wall of two storied load bearing structure and RCC framed structure.
19. Draw Plan, elevation and Construction Details of different types of stairs.
20. Draw different types of flooring details.
21. Produce final project work applying advance CAD commands and File management.
22. Surface Development of geometrical solids.
23. Illustrate Design-Concept and visualization of design. Topic: Residential (single/ double storied), Post office, Farmhouse.
24. Draw sanction drawing with local authority bye laws.
25. Preliminary drawing of the Design project in AUTOCAD.
26. Read and interpret structural drawing.
27. Draw 3 D model by sketch up software along with rendering, walkthrough, animated view.
28. Draw details of different types of doors.
29. Draw details of different types of windows.
30. Draw details of roofs and roof covering.
31. Prepare final design drawings in AUTOCAD.
32. Draw working drawing set to the site to execution.
33. Draw the Anthropometrics & ergonomics of commercial building.
34. Draw Standard sizes of outdoor movements like swimming pool, basketball court, badminton court, play area etc.
35. Prepare design and the site plan with landscape of Residential Apartment/primary school in AUTOCAD.
36. Draw joints in structures (viz. Details of construction joints at various positions, Details of expansion joints in walls, roof.
37. Prepare 3D model and BOQ using BIM software (REVIT ARCHITECTURE).
38. Perform rendering in Photoshop (Convert the drawings in pdf and then render it in Photoshop with necessary details).
39. Prepare Working drawing – viz. Kitchen layout, Electrical layout, Plumbing Layout, DWV detail.

5. **Syllabus for COMPUTER HARDWARE & NETWORK MAINTENANCE Trade-for the post of Instructor.**

Theory:

1. Familiarization with the Institute and Safety: Safety in moving and shifting heavy and delicate equipment, First aid concept, about artificial respiration, Electrical Safety.
2. Basic Electrical concepts: concept of current and voltage. AC, DC Supply indicating lamps. Different types of Fuses and their applications. Different types of connectors, switches used in electrical and electronic applications. • Measuring circuit voltage and current using voltmeters and ammeters. AC and DC meters. • Measuring instruments, MC, MI type, Ammeter, Voltmeter, Multimeter for measuring voltage and current. Construction, characteristics/ features and specification. Digital Multimeter • Meaning of Circuit and basic electrical circuits. • Meaning of resistance, continuity and continuity testers. Multimeter for checking continuity. • Concept of Power and measurement using V&I meter and Power meter.
3. Introduction to Resistors • Classification, characteristics and application of different types of resistors. Carbon film, metal film, wire wound, cermets and surface mounted. • Colour coding of resistors. Calculating, measuring resistance value and its tolerance value. Wattage of resistors, specific resistance and their importance. • Resistors in series and parallel. • Soft soldering and precautions to be taken form a making a good solder joint. Types of solder and need of soldering paste. • Ohms law and Kirchooff's Laws, Printed circuit boards and its application. • De-soldering tools. • Temperature dependent resistors and their applications. (PTC and NTC). • Voltage dependent resistors (VDR). • Photoelectric effect, Light Dependent resistors. • Variable resistors, pots, presets, types and application. Log and Linear resistors.
4. Introduction to Inductor and Inductance • Definition of inductance. Properties. Types of inductors and their application. • Inductive reactance, measuring inductance and inductive reactance. Meaning of lead, lag. Effect of inductor on power factor. Frequency dependence of inductive reactance. • Self and Mutual inductance. Coefficient of coupling. • Transformers. Turns ratio. Transformer winding. Winding machines. • Transformer losses and efficiency. • Uses, losses, efficiency type of cores and uses for LF, HF, VHF transformer. • Transformers used in high, frequency applications • Basics of EMI, EMC, and MCB.
5. Introduction Capacitor, Capacitance and Resonance circuits • Working principle of capacitors. Electrostatic action, di-electric constant. Unit of capacitance and capacitive reactance. Types of Capacitors-electrolytic, ceramic, polyester, tantalum, mica, surface mounted. Colour coding, and tolerance. • Measuring capacitance and capacitive reactance. • Behavior of capacitance at different frequencies. • Capacitors in series and parallel. • Meaning of Resonance. Application of resonance. Series and parallel resonance circuits.
6. Electronic Components: Diodes. • Semiconductor, intrinsic and extrinsic semiconductors, P and N type semiconductor. Development of P.N. junction barrier potential. Effect of temperature. Breakdown voltage. • Different types of Diodes. Diode terminals. Diode specifications using data book. • Forward and

reverse characteristics of diode. Testing diodes using Multimeter. • Half wave and Full wave rectifiers using diodes. Transformer requirements. Calculating output DC, ripple factor. • Bridge rectifier. Calculating output DC, ripple factor. • Filters for rectifiers. Calculating output DC, ripple factor, Zener diode-Its characteristics and application for voltage regulation. Calculating the series resistor for required current rating. • Specifications of a regulated power supply and testing a power supply for its specifications.

7. Introduction to Transistor and Amplifiers • Working principle of PNP, Bipolar transistors. Types of transistors and applications. Leads of transistors and their identification. • Forward and reverse bias of transistor or Junction. General values of junction resistances. Quick testing a transistor-using Multimeter. • Transistor configuration -CB, CE, CC, alpha, beta. Types of Biasing of transistor amplifiers, comparison and applications. Thermal runaway. Steady and Dynamic characteristics. Testing- get frequency response, gain bandwidth product, signal to noise ratio.

8. Introduction to Power Supply • Unregulated, regulated DC power supply specifications. Application of different types of power supply for specific application types. • Series regulator using transistor. Short circuit protection. Overload protection. • Fixed Voltage regulators using IC's. • Variable voltage regulators using IC's, Mains voltage stabilizers. • Inverters and converters. • Un-interrupted power supply, types and applications.

9. Other Electrical & Electronics Accessories. • Relays, types and its working principles. • Basic LOGIC GATES and truth table.

10. Introduction to Computers • Introduction to computers, classification, generations, applications. Basic blocks of a digital computer. • Hand Tools Basics and Specifications. • Types of cabinets, relation with mother board form factor. Precautions to be taken while opening and closing PC cabinet. • Main devices, components, Cards, boards inside a PC (to card or device level only). • Types and specifications of the cables and connectors used for interconnecting the devices, boards, cards, components inside a PC. • Precautions to be taken while removing and/or reconnecting cables inside a PC.

11. Introduction to PC Hardware • Types of I/O devices and ports on a standard PC for connecting I/O devices. • Function of keyboard, brief principle, types, interfaces, connectors, cable. • Function of Mouse, brief principle, types, interfaces, connectors, cable. • Function of monitor, brief principle, resolution, size, types, interfaces, connectors, cable. • Function of Speakers and Mic, brief principle, types, interfaces, connectors, cable. • Function of serial port, parallel port, brief principle of communication through these ports, types of devices that can be connected, interface standards, connectors, cable. • Function of Post Error Debug Card and its use. • Function of SMPS Tester and its use. • Function of PCI slot testing tool and its use. • Precaution to be taken while connecting /removing connectors from PC ports. Method of ensuring firm connection.

12. Assemble Hardware • Specifications of processors (Intel Celeron, P4family, Xeon dual core, quad core, core2 duo, i3, i5, i7 and AMD). • Memory devices, types, principle of storing. Data organization 4bit, 8-bit, word. • Semiconductor memories, RAM, ROM, PROM, EMPROM, EEPROM, Static and dynamic. • Example of memory chips, pin diagram, pin function. • Concept of track, sector, cylinder. FD Drive components read write head, head actuator, spindle motor,

sensors, PCB. • Precaution and care to be taken while dismantling Drives. • Drive bay, sizes, types of drives that can be fitted. Precautions to be taken while removing drive bay from PC. • HDD, advantages, Principle of working of Hard disk drive, cylinder and cluster, types, capacity, popular brands, standards, interface, jumper setting. Drive components- hard disk platens, and recording media, air filter, read write head, head actuator, spindle motor, circuit board, sensor, features like head parking, head positioning, reliability, performances, shock mounting capacity. HDD interface IDE, SCSI-I/2/3 comparative study. Latest trends in interface technology in PC and server HDD interface. Concept of SATA and SACH. • Precautions to be taken while fitting drives into bays and bay inside PC cabinet. • CMOS setting. (restrict to drive settings only). • Meaning and need for Using Scan disk and defrag. • Basic blocks of SMPS, description of sample circuit. • Vendor/sources of PC hardware components.

13. Introduction to Hard disk Partition and formatting and OS installation • What's Inside a Hard Drive? How Hard Disks Work • Inside: Hard Drive Motherboard • Desktop Hard Drive Buyer's Guide • What is RAID? Using Multiple Hard Drives for Performance and Reliability • Partitioning a hard disk (primary and extended partitions). Bad Sectors in Hard disk, • Master Boot Record, in-place installation, Registry fixing, performance level check, Shortcut fixing, Fixing Startup process, log, difference between MBR and GPT etc. • Types of software. System software-OS, Compiler. Application software-like MS office. High-level, low-level language, Computer application scientific industrial and business.

14. OS features, System utilities • Functions of an operating system. Disk operating system. • Concept of GUI, Modes of starting on different occasions. • Desktop, Icon, selecting, choosing, drag and drop. • My computer (User folder in Desktop), network places. • Recycle bin, task bar, start menu, tool bar, and menus. • Windows Explorer. Properties of files and folders. • Executing application programs.

15. Device Driver, OS Update and Firewall Security • Properties of connected devices. • Applications under windows accessories. • Windows Help. Finding files, folders, computers. • Control panel. Installed devices and properties • Updating of OS, Different configurations of Computer system and its peripherals, Compatible with different hardware/software. • Pre-installation Prerequisites, install procedure, Rollback or Uninstall procedure, Tests of various device driver software.

16. User Account in Windows • Users and user account. Types of user accounts, user access levels, Privileges, types of privileges, various scope, permissions, permission parameters, user and group permission, time-based permission, expiration of permission etc.

17. Antivirus and Application Software • Version of a software, Service pack, Software Installation. • Post-installation – Backup procedure & specifications, Restore procedure, Periodical View check. • Awareness of legal aspects of using computers and software such as copyright, patent licencing etc. • Reliable sources of downloading software, antivirus etc.

18. Junk File • Junk files, deleted files, un deleting files, configuration of internet browser.

19. Data backup and data recovery software • Maintenance of Temp folder, internet history, cookies, bookmark, Concepts of SAN, NAS and cloud storage.

20. Introduction To Mail Client Software (Outlook) • Add and use contacts, Calendar basics, Recall and replace sent messages, Send automatic replies when you're out of the office, The ins and outs of BCC, Use Instant Search to find Calendar items, Use Instant Search to find contacts, Use Instant Search to find messages and text, Add holidays to your calendar, Create or delete a search folder, Import and export v Cards to Outlook contacts, Make the switch to Outlook 2013,Reach out with contact groups(distribution lists), Send or delete an email stuck in your outbox, Take calendars to the next level, Track email with read receipts, Password protect your mailbox, Use rules to manage your email.

21. Laptop and its internal structure • Introduction of laptop and comparison of various Laptops. • Block diagram of laptop & description of all its sections. • Study of parts of a laptop. Input system: Touchpad, Trackball, Track point, docking station, Upgrade memory, hard disk, replacing battery, Configuring wireless internet in a laptop, • Latest Tools & Gadgets for Desktop/Laptop Repairs.

22. Word processing Software • Introduction to word processing and comparison of features. Creating and saving document files, using Word Processing Software. • Formatting test and editing. • Setting page and margins. Tabs and indents. • Creating multicolumn documents. • Inserting pictures in documents.

23. Spreadsheet Software • Introduction to spread sheet. • Creating Worksheets using Spreadsheet Software. • Formatting cells. • Using formula in cells. • Graphs and tables. • Advanced features.

24. Power Point Presentation • Introduction to Power Point and its advantages. • Creating Slide Shows. • Fine tuning the presentation and good presentation technique.

25. Linux operating system • Basic Linux commands. • Linux file system, The Shell, Users and fill permissions, vi editor, X window system, Filter Commands, Processes. • Shell Scripting. • Concept of UNIX.

26. Printer and Plotters • Types of printers, Dot Matrix printers, laser printer, Ink jet printer, line printer. Block diagram and function of each unit head assembly, carriage, and paper feed mechanism. Front panel controls and interfaces. Pin details of interface port. • Installation of a printer driver and self-test. • Ribbon types used, refilling of ribbons. • Printer cable testing defects, effect and servicing. • Printer head, types, cleaning and replacing procedures. • Printer power supply, circuit analysis, defects, servicing, Carriage motor assembly, paper feed assembly, sensors Procedure for dismantling and replacing mechanical parts. • Printer control board, circuit, function, probable defects, servicing. • Working principle of LASER printer. • Refilling toner cartridges, equipment available for refilling and procedure. • Printer drum, function, cleaning and replacing procedure. • Mechanical parts and sensors on printer, function, replacement procedure. • Working principle of Inkjet / DeskJet printers. • Working principle of Plotter and its common faults.

27. Scanner and MFD • Working principles of Scanner, Barcode Scanner, Network Scanner. • Working principles and configuration of Multifunction Printer, Passbook printer, High Speed Printer, Line Printer, Network Printer.

28. Network Components • Introduction to Computer Networks – Advantages of Networking, Peer-to-Peer and Client/Server Network. • Network Topologies – Star,

Ring, Bus, Tree, Mesh, Hybrid. • Type of Networks – Local Area Networks (LAN), Metropolitan Area Networks (MAN), Personal Area Network (PAN), Controller Area Network (CAN), Wide Area Networks (WAN). • Internet, Ethernet, WI-Fi, Bluetooth, Mobile Networking, Wire and wireless Networking. • Difference between Intranet and Internet. Extranet, 3G, 4G.

29. Crimping & Punching • Communication Media and Connectors – Unshielded twisted-pair (UTP), shielded twisted-pair (STP), Fibre Optic and coaxial cable: RJ-45, RJ-11, BNC. • Understanding colour codes of CAT5 cable. 568A and 568B convention,

30. Network Cabling • Introduction to Data Communication – Analog and Digital Signals, Simplex, Half-Duplex and Full-Duplex transmission mode.

31. Network Model • The functions of different layers in OSI and TCP/IP model. • Concept of wireless networking, wireless survey.

32. Configuration of Data communication equipments • Network Components - Modems, Firewall, Hubs, Bridges, Routers, Gateways, Repeaters, Transceivers, Switches, Access point, etc. • Types, functions, advantages and applications of Network Component. • Layer 2 manage switch configuration and use it on network. • Latest emerging concepts using open-source simulators. • Layer 3 switch configuration. • VLAN Basic and configurations. • Understand the use of Network simulation software and the process of use it.

33. IP Addressing & TCP/IP • Protocols, TCP/IP, FTP, Telnet etc. • Classes of IP Addressing. • Setting IP Address (IP4/IP6) & Subnet Mask.

34. Other Network Protocols • Simple Mail Transfer Protocol (SMTP) • Telnet • File Transfer Protocol (FTP), • Hyper Text Transfer Protocol (HTTP) • Simple Network Management Protocol (SNMP). • LDAP (Lightweight Directory Access Protocol). • Introduction to Network Security. • Concept of Dynamic Host Control Protocol.

35. Sharing Resource & Internet connection: Concept of committed bandwidth. • Concept of Internet. • Architecture of Internet. DNS Server. • Internet Access Techniques. • ISPs and examples (Broadband, Dialup, Wifi). • Concept of Social Networking Sites, Video Calling & Conferencing. • Concept of Virus and its Protection using Anti-Virus, UTM and Firewall. • SSID • Concept of wireless controllers. • Concept of SD WAN. • Concept of resource sharing through network. • Working principle of Proxy Server. Objective of using it. Features of Proxy Server. • Concept of VPN.

36. Network Protection and troubleshooting • Collaborating using wired and wireless networks, Protecting a Network, Network performance study and enhancement. • Techniques & strategies to prevent various attacks on networking.

37. Control & monitoring of network devices • Remote desktop software like NetMeeting, Team Viewer etc. • Audit process of a switch/router/APs etc. • Surveillance using network devices, collaboration on network for team optimization and support activities. • Remote management of devices. • Network monitoring and maintaining techniques.

38. Introduction to Windows Server • Server concepts, installation step, configuration of server. • Concept of Active Directory and DNS. • Setting up of DHCP, Routing and remote access.

39. Linux Server • Basic configurations. • Editing /etc/hosts file. • Concept of DHCH, DNS, WEB SERVER(Apache), SUMBA • Linux package and package installer. • Concept of virtual server and containers, cloud computing.
40. Network Security • Modern Network Security. • Threats and the basics of securing a network. • Secure Administrative Access. • LAN security considerations. Aadhar based authentication. • Wi-Fi security considerations.
41. Internet and Web Browser • World Wide Web and website Web Browsing and popular web browsing software. Introduction to Search Engines, Popular Search engines. • Concept of Favourites Folder. • Concept of Electronic Mail. Email Addressing, BCC and CC, Inbox, Outbox, Address book, SPAM.
42. IT Act & Law • Introduction to Cyber Security. • Introduction to Cyber Laws & IT Act. • Importance of privacy and techniques to manage.

Practical:

1. Identify specification of different types of fuses, switches, Identify of meter types and measuring range, Construct a simple circuit using AC/DC supply, lamp, fuse and switch, Measure circuit voltage and current using voltmeters and ammeters and also check voltage between earth and neutral, Measure voltage and current using Multi-meter (analog-digital), Use Multi-meter to check fuses, lamps and switches, Measure DC and AC power using V-I method and using power meter, Identify different types of resistors from physical appearance, Identify resistor value and tolerance using colour code, Measure resistance using Multi-meter, Practice of soldering and de soldering techniques, practice using hook-up wires, Soldering resistors on Tag board. Practice using surface mount board/ device, Verify of Ohms Law and Kirchhoff's Laws, Practice of soldering resistors on PCB and De-soldering, Experiment using P.T.C and NTC resistors, Experiment to check VDR's, Experiment to check LDR's, Test Pots, Pre-sets.
2. Identification of different types of inductors and its specifications, Measure inductance using LCR meter. Calculate Inductive reactance at different input signal frequencies, Demonstrate self and mutual induction, Check step down Transformers, Rewind a transformer to given specification using winging machine, Finding losses and efficiency of given transformers, Identifying and testing high frequency transformers used in electronic circuits, Identify of different types of capacitors from colour code and typographic code, Test working condition of capacitor, Discharge first then test a charged capacitor, Measure capacitance using RLC meter, Measure capacitive reactance at different frequencies, Measure capacitance and capacitive reactance of capacitors in series and capacitors in parallel, Identify terminals of different types of diodes, Record its specifications referring to diode datasheet, Plot forward and reverse characteristics of diode Testing working condition of diodes, Construct and test a half wave and full wave diode rectifiers, Construct and test a Bridge rectifier with and without filter.
3. Draw Zener diode characteristics, Simple voltage regulator using zener diode, Transistor and Amplifiers, identify types transistors based on their physical appearance. Identify the leads of the given assorted types of transistors, Practice Quick test given transistors using multi-meter, identify opens, shorted junctions,

Test and measure various electronics components, Power supply, Assemble and test a fixed voltage regulator using 3pin IC, Assemble and test a variable voltage regulator using IC.

4. Assemble a simple inverter and converter for use with emergency lamp, Identify the parts and controls of a UPS, Practices switch-on and switch-off procedures, Other Electrical & Electronics Accessories, Identify and Test Sensors, Try to use it on electronic circuit, Identify and Test Relays, Try to use it on electronic circuit, Identification of digital circuits, Verify the truth table of two input OR, NOR, AND, NAND, NOT gates and test truth table of multiple input logic gates, Construct small circuit using digital electronic components.
5. Desk Top: PC Repair Safety, Identify Important Safety Basics, specification and application of basic hand tools, how to handle components to ensure their longevity, Know the danger of static electricity, Use of antistatic pads, anti-static wrist wraps. Steps to protect a PC from lightning strikes and power outages, Hardware Identification, Identify the front and rear panel ports and connectors on a PC cabinet, Open the cabinet and identify various motherboards components, connectors, slots, ports (USB, VGA, DVI, and HDMI), cables and Connectors, Collect data from circuit board, Check Power Supplies and Power Supply Connections, Identify Motherboard Components and connections, CPU (Processor), RAM (Memory), Hard Drive Connections Mechanical vs. Solid State Drives ROM Drives Graphic Cards, Sound Cards, Use Post Error Debug Card and understand error Code for fault troubleshooting, Use of SMPS Tester for fault troubleshooting, Use of PCI slot testing tool for fault troubleshooting, Identify connectors with data and power cables, connector used to connect external devices, Verify components with the configuration of CMOS BIOS set up, Install & configure add-on cards.
6. Hardware: Remove-Test Replace/Install, Check various front panel connections on motherboard (power switch, reset switch and HDD Led), Check power and reset switch connection, Replace faulty power switch from cabinet and assemble a new one, Check DDR3 and DDR4 RAM's FSB, Insert it on memory slot, Test and understand various beep sounds in case of trouble, Find the CMOS/ROM BIOS chip on mother board, Install a Hard Drive, Identify and check data and power cable and SATA and SACH ports in motherboards, Install internal and external DVD ROM Drive, Troubleshoot defects related to SMPS, its cable, connector and servicing procedure, Removing a Power Supply. Installing a Power Supply. Use SMPS tester, Install a Graphic and sound cards. Remove them safely, Install and removing cooling Fans on pc cabinet, Removing the Motherboard carefully and install it again, Removing the Processor, Installing the Processor, Understand and identify various different processor sockets, installing different type of CPU Cooler, Find the CMOS Battery. Test it with multi-meter. Replace it.
7. Boot the PC through a BOOTABLE DVD of OS, Partition the disk, Format the drive, Install Windows 7 and Windows 10 from DVD Disk, make bootable USB DRIVE (use any open source software) and install both OS again, Make Win-7 AND Win-10 dual boot properly, Practice on recovery partition, Make windows Linux dual boot, Understand Boot loader, The Windows boot manager vs. an alternative boot manager, Rectify errors in dual boot, Practice keyboard shortcuts of mouse activities, Understand the difference between UEFI firmware and tradition BIOS, Check various motherboard if it is UEFI supported or not, Install and boot Win-10 in UEFI mode, Use third party hard disk partitioning

applications, Imaging: create a Windows system image, How to Backup/Restore your Windows partition with the bootable image, Practise Windows 7 and 10 registry tweaks.

8. Open Personalize Setting and find Desktop icon setting, Screen Resolution and various other setting, Open windows explorer and find different drives, files and folders, their size and other properties, Do it through command prompt also, Open control panel and get familiar with different options and their appropriate use (taskbar and start menu, Programs and features, Display, System, Sound, Devices and Printers etc), Open command prompt in windows 7 and 10, Open disk drives, folders and files, Execute important commands like DIR, ATTRIB, DEL, RD, DISKPART, COPY, MOVE etc, Use Power shell commands.
9. Open Device Manager, find various devices and install appropriate driver software (audio, video, chipset, LAN, WLAN, printer and monitor), Use & practice WMIC console, Collecting and installing specific/compatible Device driver from internet, Update the driver software from internet, Uninstall and Rollback the driver, Understand process and services and open task manager and practice its use (Process, services, performance), Start and stop and change the priority of a process, Use event viewer, System Monitor and Performance Logs.
10. Boot in SAFE MODE, Disable and enable device driver from there, Understand the significance of Safe Mode, Fix the master boot record, Configure config.sys file, View System Information to check various configuration of the PC(check if the system is 32 bit or 64 bit), Use Disk clean up and Disk Defragmenter (Check if your hard drive has bad sectors using 3rd party open source software), Go to drive property, click on tool and check the drive for errors, Do this from command prompt through commands, Go to Windows Update in control panel, Check installed update, Change updates Setting, Open firewall option from control panel, Enable and disable firewall, Allow and block application and port, Navigate to WINDOWS SYSTEM32 folder and view and understand the importance of various system files and folders found there, Find the hosts file and understand LOCALHOST, open it on notepad and take backup, Use the hosts file to block any URL, View the content and find the difference between Program Files and Program Files (x86), Create a restore point, Practice System restore and try to restore system to a previous restore pint, Try it through command line.
11. User Account Customization, Create and configure user accounts in Windows 7/8/10, Create Administrator and Limited user account, Make Changes to an Account. Reset Limited user account password through administrative account, Change the storage location of the personal folders, Change the storage location of Installed software, Set Parental Controls in Windows 7, 8, 10, Use Fast User Switching in Windows, View Hidden Files and Folders Lock Down Windows 7/8/10 With User Account Control, Delete User Accounts in Windows.
12. Install any popular antivirus software, Online and offline updating of antivirus, View its various options. On and off Firewall option inside antivirus software, run a full system scan and booting in Safe Mode, set up Parental Controls using antivirus software, fix your browser from redirecting to other websites (browser hijack), Try to manually remove a virus through commands, trying to get rid of a nasty virus. Special utilities that work wonders, Install various application software programs in windows. Install Firefox and chrome browser, Run the programs from command prompt, Extract or uncompressed a compressed file,

how to compressor make files into one file (use program like WinZip/Winrar), Uninstall application software, Unable to remove a program from Windows Add/Remove programs then use registry to delete the program.

13. Junk File Removal, use various free and paid Disk clean up utility to remove junk files from hard disk, try to find out the folder in root directory where junk files are stored and delete them manually, find browser setting and clear history and temporary file, Data backup and data recovery software, Use various types of media to backing up your data, and when each method is appropriate, Create automated backups to ensure you always have a recent backup.
14. Learn how to manually backup data, how to make an exact copy (clone) of a hard drive, Use Data Recovery software. Recover emails, files, and data from a crashed hard drive or computer, Outlook Configure & Backup, configure outlook and connect with Gmail, use thunderbird IMAP/POP3 along with security features, Configuration of Browsers, Backup and Restore Outlook, how to restore the Outlook default installation, toolbars and settings, Restore Deleted Items from an Outlook PST-file.
15. Identify and use of tools and gadgets required for repair & servicing laptop, Safety precaution and handling components of laptops, identify of laptop sections, components and connector, Assemble and disassembling a Laptop, check of various parts of a laptop, Check of batteries and adaptors. Configuration of energy saving mode, replace different parts of laptops, Upgrade RAM, HDD and other parts, Test fault finding and troubleshooting techniques, POST codes and their meaning, fixing of problems based on codes. Check and configure CMOS BIOS set up, Enabling support for SATA technology. Installation of OS using SATA technology drivers, Configuration of camera, mic, WLAN and Bluetooth, touchpad, finger print scanner, Latest Tools & Gadgets for Desktop/Laptop Repairs, connecting external peripherals and their configuration, Use of KVM switch.
16. Using Office (Word, Excel, Power Point) package, Create and saving document files using Word Processing Software, Format text and editing. Set up page and margins. Tabs and indents, Create multicolumn documents. Insert pictures in documents, create tables, Practice Mail merge, modify page setup and print documents, Create Worksheets using Spreadsheet Software, Format cells and use formula in cells, create relation between sheets, Create Graphs and tables. Practice filtering and data sorting in excel, Print spread sheets, create power point presentation and familiarise with basic application components, Create Slide shows, insert picture, theme, format text, animation and object, modify slide page setup and print the slides.
17. Linux operating system, Install Linux (Ubuntu, Fedora, Debian, Red hat) OS from bootable USB drive and partition the hard disk manually, use disk part command, preparing functional system LINUX, adding new users, software, material components, making back-up copies of the index and files, Dealing with the files permissions and indexes, Practice important Linux commands.
18. Printer and Plotters, Testing front panel controls. Interface pins, cables, measurement of voltages and wave forms, Installing a printer and carrying self-test, Replacing ribbon in a DMP, Testing and rectifying defective cable, Removing, cleaning and replacing a new printer head, Testing and servicing Printer power supply, Changing rollers and other mechanical parts, Tracing the control board

and identifying defective components, Servicing of control board, Replacement of toner cartridge of laser printers, Refilling toner cartridge of laser printers, Drum cleaning and replacement laser printers, Testing and servicing Printer power supply of laser printers, Changing mechanical parts of laser printers, Tracing the control board circuit and identifying defective components, Servicing of control board of laser printers, Replacement of ink cartridge of Desk Jet/ inkjet printers, Refilling ink cartridge of Desk Jet/ inkjet printers, Drum cleaning and replacement in Desk Jet/ inkjet printers, Testing and servicing Printer power supply of Desk Jet / inkjet printers, Changing mechanical parts of Desk Jet /inkjet printers, Tracing the control board and identifying defective components. Servicing of control board of Desk Jet/ inkjet printers, Use of diagnostics software for serving printers, Replacement of mechanical parts and sensors of printer, installing plotter and rectify its common faults.

19. Scanner and MFD, Install a Scanner, configure it and use Automatic Document Feeder (ADF), OCR, Find and locate various Scanner related problems and troubleshoot them, Install Barcode and configure it, Troubleshoot barcode related faults, Install Network Scanner and configure it, Find Network Scanner related problems and troubleshoot, install Multifunction Printer and configure it, Find Multifunction Printer related problems and troubleshoot, Connecting and using high speed line printers, Replacing spares offline printers, Install Passbook Printer calibrate, configure, Find Passbook Printer related problems and troubleshoot, Install Network Printer and configure it, Find Network Printer related problems and troubleshoot.
20. Components of the Computer Network, identify various Network tools like: (a) Wire crimper, (b) Wire Map Testers, (c) Multifunction Cable Tester, (d) LAN Tester, (e) Tone Generator etc., Identify various Network device like: (a) Switch (Normal and Managed), (b) Router (Normal and wireless), (c) Rack, Patch Panel, i/o box, (d) Access Point etc., Understand the Layout of network on your lab and campus.
21. Crimping, Punching and Network configuration, Practice crimping with straight and cross CAT 6 cables, punching practice in IO Box and patch panel, create cabling using Fibre Optic cable and connectors, create cabling in a lab with HUB/Switch and IO Boxes and patch panel, Fit Switch Rack, Install &Configure a Peer to-Peer Network using Windows and Linux Software, connect computers using Bluetooth, WI-FI, hotspot.
22. Connect computers with Network with Drop cable and using Wi Fi configuration, Configure Basic Programmable switch (layer two) and practice to set up Spanning Tree Protocol (STP) from Command Line Interface (CLI), Configure Layer 3 Switch, Verify IP Routing Process, configure it from CLI in layer three switches, create simple VLAN and understand the concepts, Use Packet tracer Simulator Software, Use Packet tracer Simulator Software.
23. Practice IP Addressing technique (IPv4/IPv6) and Sub netting and Super netting the network, Install and Configure TCP/IP Protocol, Practice FTP, Telnet and NS lookup, Use popular TCP/IP (windows and Linux) Utilities like PING, IPCONFIG, HOSTNAME, ROUTE, TRACERT etc.
24. Practice to set up and use SMTP, TELNET, FTP, HTTP, SNMP, LDAP, SSH, NTP, IPP, HTTPS etc., Configure a wireless router in the lab and practice port forwarding with security features, Practice on configuring DHCP.

25. Configure internet connection to the pc through wire, Check its process, Find the fault and troubleshoot the problems, Configure internet connection to the PC using wireless technology and troubleshoot various connection related problems, Share the internet connection (wire and wireless) in the local network and access it from other machine in LAN, Configure Access Point, Configure both cloud based and frame based access point, Practice LAN controller of access point, Configure internet connection using L2 and L3 switch, Setup and Configure security features in wired and wireless LAN with internet connection, Sharing Resource and Advance Sharing Setting, Demonstrate MPLS network, Install Proxy Server and configure it, Use free VPN software, Set up basic protection using public keys and MAC address filters, Integrate wired/ wireless network, Understand and use Power over Ethernet (PoE), Troubleshoot wired and wireless network, Preventing various attacks on networking.
26. Setup of basic collaboration tool for activities like chat, application sharing, remote desktop access and control, VoIP, Setup IP camera for basic surveillance scenario, logging and monitoring of devices / locations, Use Linux Network Tools to check / maintain / Manage Network.
27. Install and configure Windows Server, configure services like Active Directory, DNS and DHCP, Configure IIS Web server (latest version), Configure of broadband modem and sharing internet connection.
28. Install and configure Linux Server, configure following on Linux Server: (a) /etc/hosts file, (b) DHCP, (c) DNS, (d) WEB SERVER, (e) NFS and SAMBA, find package installed on your system (DPKG, YUM, DNF) using system control command for configuration and monitoring daemon and services, Use of grep command for search.
29. Practice on firewall technologies to secure the network perimeter, Practice LAN security considerations and implement endpoint and Layer 2 security features, Configure Wi-Fi to implement security considerations.
30. Practice web browsing using popular web browsing software, configuring web browser, Search for content using popular search engines, Use favourite folder for browsing quickly, Download & Printing Web pages, Using e-mail: Opening and configuring email client, mailbox: inbox and outbox, Creating and sending email, replying to an e-mail message, Forwarding and e- mail message, Sorting and searching emails. Sending document/ softcopy by email, activating spell checking, using address book, Handling SPAM, Removal of Cookies.

6. **Syllabus forCIVIL ENGINEERING ASSISTANTTrade-for the post of Instructor.**

Theory:

1. Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.
2. Soft Skills: its importance and Job area after completion of training.
3. Introduction of First aid. Introduction of PPEs. Introduction to 5S concept& its application. Response to emergencies e.g.; power failure, fire alarm, etc.
4. Awareness about list of the Instruments, equipment and materials to be used during training.
5. Importance of B.I.S., Introduction of Code for practice of Architectural and Building Drawings (IS: 962-1989, SP-46:2003), Layout of drawing. Lines, Lettering, Dimensioning.
6. Knowledge of different types of scale. Principle of R.F., Different types of projection views: Orthographic, Isometric, Oblique and Perspective.
7. Building materials: Timber: Types, Structure, disease & defects, characteristic, seasoning, preservation and utility, Alternative material to Timber-Plywood, Blockboard, Particleboard, Fireproof reinforced plastic (FRP), Medium density fireboard (MDF) etc. Tar, bitumen, asphalt: Properties, application and uses.
8. Computer aided drafting: Operating system, Hardware & software. Introduction of CAD, Its Graphical User Interface, Method of Installation, Basic commands of CAD, Knowledge of Tool icons and set of Toolbars, Knowledge of shortcut keyboard commands.
9. Materials: Stones: characteristics, types & uses, Bricks: Manufacturing, characteristics of good bricks, types, uses and hollow bricks, Lime: characteristics, types, manufacturing & its uses, Pozzolanic: characteristics, types & uses, Cement*:* Manufacturing, characteristics, types, uses and test of good cement, building materials: Sand: characteristics, types & uses, Clay Products: types,earthenware,stoneware,porcelain,terracotta,glazing.Mortar&Concrete:Types, uses,preparation,proportion,admixtures and applications.
10. Building Construction: Foundation: Purpose of foundation, causes of failure of foundation, bearing capacity of soils, Dead and live loads, Examination of ground, Types of foundation – (Spread Footing, Grillage foundation, Pile foundation, Raft foundation, well foundation, Special foundation, drawing of footing foundation setting out of building on ground excavation, Simple machine foundation, Sequence of construction of a building, Name of different parts of building, Brick masonry, Terms, use and classification, Strength of walls, Strength of masonry, principles of construction of bonds, Tools and equipment used.
11. Plastering: Types, thickness in different position, materials, tools used, defects and remedies, surface preparation for rendering & wall cladding, Special materials used in plastering. Types of plaster finishes.

12. Protective materials: Paints: characteristic, types, uses. Varnishes: characteristics and uses.
13. Treatments of building structures: DPC Sources and effects of dampness, Method of prevention of dampness in building, Damp proofing materials– properties, function and types.
14. Floors –Types of flooring, Flooring- materials used types, prepare method of laying, grinding & polishing of floor and prepare a survey report on materials used in flooring, site visit to check the practical techniques of flooring.
15. Linear & Angular measurement by instrument i.e. Chain, tape, compass etc., Introduction, types of surveying, use, application principal, Main divisions (plane & geodetic), Uses of Chain/ tape, testing of a chain & correction. Ranging (direct & indirect), Principle of chain survey, application. Terms used in chain survey, types of offsets, limit of offset, field book, types of field book, entry of field book, method of chaining in slopping ground, Field procedure of chain survey errors in chain survey, plotting procedure. Calculation of area (regular & irregular figure), Knowledge of site plan. Knowledge of Mouza Map.
16. Surveying: Compass survey: Basic terms used in compass survey, Instrument &its setting up, Conversion of bearing web to R.B., Calculation of included angle from bearing local attraction, magnetic declination and true bearing, closing error, Adjustment of closing error, precaution in using prismatic compass, Plane table survey: Plane table survey, principle, merits & demerits, Instrument used in plane table survey setting up the plane table. (Centering, levelling, orientation), Methods of plane table survey (radiation, intersection, resection, traversing), Error in plane table survey.
17. Levelling: Auto level , dumpy Level, Tilting Level-introduction, definition, Principle of levelling, Levelling staffs, its graduation & types, Minimum equipment required Types, component/part and function, Temporary and permanent adjustment, procedure in setting up, Level & horizontal surface, Datum Benchmark, Focussing& parallax, Deduction of levels/ Reduced Level, Types of levelling, Application to chain and Levelling Instrument to Building construction, Contouring : Definition, Characteristics, Methods, Direct and Indirect, Methods Interpolation of Contour, Contour gradient, Uses of Contour plan and Map, knowledge on road project.
18. Introduction and Types of Theodolites, parts of Theodolite, Terms used in Theodolite survey, Temporary adjustment of Theodolite, Angle measurement process. Reading of angles, field book entry of measured angles, Permanent adjustment of Theodolite.
19. Total Station: Introduction, components parts, accessories used, characteristics, features, advantages and disadvantages, principle of EMD, Working and need, Setting and measurement, Electronic, display & Data reading, Rectangular and polar co- ordinate system, Terminology of open and closed traverse.
20. Common Indian Timbers-Defects in timber, diseases of timber, knots, shakes, grains etc., carpentry hand tools, measuring tools and uses, work holding devices, power tools, viz. saws, drills, etc., Description of Carpentry Joinery, Planning, Moulding, Rebating, Chamfering, Sawing, etc.
21. Type of different planes and their proper uses in wood work - Description, function and its size, setting, knowledge of sharpening and uses etc., knowledge of using marking gauges, Important instruments necessary for checking flatness and

twistiness of surface, Sharpening and grinding angle of cutter, Portable power planer - useful in modern wood work and new technology design.

22. Description of different types joint: Uses of joint, framing joint angle joint and lengthening joint, housing joint, broadening joint etc., Wood products- Industrial forms of timber, Veneer, Laminated sheet, Fibre board, Hard board, Plywood, Calculation of timber required for Wall Bracket.

23. Electrical Wiring: Safety precaution and elementary first aid, Artificial respiration and treatment of electrical shock, Elementary electricity and its units, General ideas of supply system, Wireman's tools kit. Wiring materials, Electrical fittings, System of wirings. Wiring installation for domestic lightings, Conductor, insulator, semiconductor, cable joints, measurement of cable, Types of Fuses, MCB soldering, ELCB, RCCB, ABCB, MCCB, AC and DC, AC fundamentals, poly phase, types of electrical wiring, Different Electrical wiring accessories, ISI rules of wiring, Illumination , Earthing, types of earthing ,Earthing Pit, Different electrical appliance, accessories, Voltmeter, Estimation and costing of wiring, Explanation and working of different type of transformers and its classification.

24. Plumbing tools, materials used in plumbing, Different types of pipes, fittings and Joints -GI, PVC, AC, SW, CI, lead, steel- Properties and use in plumbing work, Method of cutting and joining of pipes, Drills - types and uses, Tap and Dies - types and uses, calculation of Tap drill size, Sanitary Technical terms- sewer, sewage, sullage etc., Soil pipe and waste pipe fitting, Different types of water closets Different types of urinal port Kitchen sinks, Bath tub, Wash basin

25. Water meter-Installation of water meter, Removal of air lock Purification of water, Mineral matter, Hardness, Causes of Scale formation & their Removal, Water Purification: Treatment plants for different groundwater contaminants, Treatment plants for surface water, Types of damages in taps , valves , water meter and tanks-Method of rectification, Water supply-Sources of water, Storage of water Distribution of water Different types of valves used in Plumbing, Types of tanks R.C.C., P.V.C. Iron tanks etc.

26. CEMENT: Types of cement, relevant IS codes comparative study of their physical & chemical properties, significance of different properties, Hydration of cement, Selection of cement, Storage of cement, Factors affecting strength of cement, Rejection of cement, AGGREGATE- Classification (IS : 383), Grading, Characteristics(grading, fineness modules), Bulking of fine aggregate, Deleterious substances, Factors affecting strength of concrete, WATER-Quality, Water requirement for hydration & workability, Effect of impurities present in water, ADMIXTURE-Meaning of terms, Functions, Classification, Water proofing and permeability reducing admixture.

27. CONSTRUCTION CHEMICALS :Interpretation of specifications manufactures, Meaning of terms, Functions, Classification (IS : 4082), Water proofing and permeability, reducing admixture, Preparation of concrete Methods used, merits and demerits of methods, tools and equipment used and precautions to be taken for the processes :Batching, Mixing, Transportation, Placing, Compaction, Curing, Finishing, Strength & durability requirements (IS : 456 -2000), Stripping of form work, Application of Modern Power Tools, Classification& specifications of concrete, Classification of concrete according to grade, weight & methods of mixing, Ready mixed concrete, self-levelling concrete, nominal mixed and design mixed concrete, Properties of concrete -Workability & consistency, Segregation, Bleeding,

Strength, Durability, Impermeability, Volume stability, R.C.C. members for foundation, beams, columns, slabs, Retaining Wall etc.

28. Scaffolding & form work-Definitions of common technical terms used in Scaffolding, form work, Types & applications, Different materials used in form work, Methods and tools used for form work, Safety precautions to be observed in scaffolding and form work, Defects in form work, De-shuttering /removal of form work, Maintenance & repair of form work, Plain cement concrete (PCC) & Reinforced cement concrete (RCC), Properties of PCC & RCC in green state and hardened state, Importance of form work and reinforcement in construction.

29. Bar bending-Technical terms & their meanings, Symbols, conventions used in bar bending, Specifications of material, Physical properties of reinforcing bars, Estimate the quantity of material, Structural elements & characteristics (simply supported, continuous, fixed, cantilever, overhang), Importance of use of reinforcement in concrete, Tools used in bar bending, Correct use of tools, Different operation in bar bending (straightening of bars, cutting of bars, bending of bars, placing of bars, binding of bars, fixing of cover blocks), Use of relevant BIS codes & tables, Guidelines for laying reinforcement.

30. Arches: Technical terms- types, centring, Lintel: types, wooden, brick, stone, steel & RCC, Chajjas–characteristics, Centring & Shuttering.

31. Stairs: Technical terms, relation between tread & rise, Types of stairs, construction details of brick, stone & RCC stairs, Spiral stairs with precast concrete steps, Basic concept of lift and Escalator.

32. Pile foundation- uses of piles, types of piles, materials used in the construction of load bearing piles, Factors considered in selection of piles, Pile driving &equipment used for pile driving.

33. Introduction about building construction, Types of buildings, Structural system of building, Different parts of building, Site selection, Orientation and ventilation of building.

34. Building plans-Introduction, Types of plan-Typical floor plan, Foundation plan, Structural plan, Terrace plan.

35. Main considerations of architectural design, Bye-law of the locality, Climate and its effects, Materials and method of its construction, People and their requirements.

36. Steps in rate analysis, Material, Labour, Plant and machinery, Overhead charges, Profit, Specification, General and detailed specification, Estimating and costing Need and importance Types of estimate Items of work Measurement of items, Calculation of quantities of various items

37. Repair Plastering, white washing, painting flooring, replacing of glass, re polishing of floor, stain removal from floor, wooden works, Special repair, Foundation failure, Strengthening of foundation, Rectification of leaking roof, Repair to expansion joint.

38. Anti-termite treatment– objectives, materials, uses and applications, Pre construction treatment, Postconstruction treatment, Weathering course– objectives and materials required.

39. Plumbing, Layout of house plumbing and drainage plan, Tracing leakage, repair to service main, repairing of waste outlet, Cleaning of sanitary installation, Scrapping and painting of pipes.

40. Adhesive and joint filler, Introduction, Types, Adhesive used in timber construction, Adhesives used in ceramic tile fixing, Adhesives used in joining concrete, Joint fille, Sealing compound.
41. Construction equipment-Classification, Selection of equipment, Sources of equipment, Excavation Equipment-Tractor, Bull dozer, Excavator Hoisting equipment, Crane, Pulley, Cable way, conveying equipment-Belt conveyor, Rope way, Pumping equipment, Drilling Equipment-Types of drills, Classification of drill, Drill bits, Selection of drilling pattern.
42. Construction management, Management of manpower, materials, machines with economy.

Practical:

1. Importance of trade training, demonstrate tools &equipment used in the trade, Importance of housekeeping & good shop floor practices, Occupational Safety &Health- Introduction to safety equipment and their uses. Introduction of first aid, Health, Safety and Environment guidelines, legislations & regulations as applicable, Disposal procedure of waste materials of the trade, Personal protective Equipment(PPE): -Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message, Preventive measures for electrical accidents &steps to be taken in such accidents, Use of Fire extinguishers.
2. Awareness about the job sheets made by the ex. trainees., Use of drawing instruments and equipment with care, Method of fixing of drawing sheet on the drawing board, Layout of different size of Drawing sheets and folding of sheets, draw free hand sketch of hand tools used in civil work.
3. Symbols & conventional representation for materials in sections as per IS962-1989, SP-46:2003 for building drawings, draw types of Lines, lettering and numbering as per IS 962- 1989, SP-46:2003, Construction of plain geometrical figures.
4. Construction of scales – Plain, comparative, diagonal, Vernier & scale of cords.
5. Drawing of-Construction of solid geometrical figures, Three views in Orthographic Projection of Solid objects & section of solids.
6. Isometric, oblique and perspective views of geometrical solids, hollow and cut sections.
7. Component parts of a single storied residential building. (In sectional details) Showing Foundation, Plinth, Doors, Windows, Brick, work, Roof, Lintel and Chajjah, Arches, etc.
8. Function of keys and practice of basic commands, Use of elementary commands by CAD toolbar, Creation of objects in different layers on CAD workspace, plotting of drawing from CAD, 2D drafting of flash door, panel door, window, hand railing, wash basin, sewerage pipe joints, etc., Preparing Library folder by creating blocks of the above items.
9. Identify different types of bricks, uses and hollow bricks. Standard size of bricks available at local market, identify different types of stones, types and uses, identify different types of tiles, types and uses, identify different types of cement, types and uses, field test of cement. Etc., Identify different types of sand and aggregates, types

and uses, identify different types of lime, types and uses, identify different types of steel, types and uses, identify different types of timber, earthen ware, types and uses.

10. Setting out a building: Obtaining first, second, third & fourth lines, marking diagonals, setting out cross walls & offsets, marking excavation lines & fixing of plinth & floor levels, Set out foundation trench.

11. Demonstrate the use of brick masonry tools, Perform construction of wall header bond, stretcher bond, English bond, Flemish bond.

12. Make scaffolding and prepare surface for plastering, perform plastering operation at different surface-Plaster in two coats External finishes— sand finish, textured finish, Perform rendering & wall cladding.

13. Perform application of cement paint on different surfaces, perform application of plastic emulsion on different surfaces, perform application of enamel paint on different surfaces, Perform application Process of varnishing on different surfaces.

14. Perform Laying of D.P.C with proper methods and Materials.

15. Determination and Formation of slope / level, laying of Base Layers, laying of Topping, application of slurry for finishing, setting out of skirting, formation of spots for skirting, Use of screeds, formation of curve at the junction of skirting & floor.

16. Practice of folding & unfolding of chain, ranging (direct/ indirect) & distance measure with chain/ tape, offset taking & entering field book, chaining on sloping ground, conduct a chain survey of a small area with all details and plotting the map, Calculating the area of site, Prepare a site plan by the help of chain / tape.

17. Temporary adjustment of prismatic compass, Measure fore & back bearing, R.B., W.C.B. of a line, measure true bearing of a line, prepare a closed & open traverse using prismatic compass measure the bearings, entry into field book, calculation of correct bearing and adjust. (Local attraction), determine the closing error and adjust. Plotting the same.

18. Demonstration of instrument used for plane table surveying &their uses (alidade, U- fork trough compass) Set up the plane table- Centering, Levelling, Orientation, Practice the method of plane tabling-Radiation, Intersection, Resection Traversing, Determination of height by telescopic alidade.

19. Handling of levelling instruments & their settings, Temporary adjustment of a level, Simple levelling, Differential levelling (Fly levelling), Carry out Levelling field book, Equate Reduction of levels Height of collimation and Rise and Fall method – Comparison of methods, Solve problems on reduction of levels, Calculate Missing data and fill up calculations & Arithmetical check in various problems and its solution, Practice levelling with different instruments, Check levelling, Profile levelling or Longitudinal , plotting the profile, Surveying of a building site with chain and Levelling Instrument with a view to computing earth work, Contour - Direct and Indirect methods, Make Topography map, contours map, Solve trigonometric problems, Prepare a road project in a certain alignment.

20. Field work of theodolite, Measure Horizontal angle. Vertical angle, magnetic bearing of a line, Levelling with a theodolite, Calculation of area from traverse, Determination of Heights, Calculation of departure, latitude, northing and easting, Setting out work-Building work, etc.

21. Application of survey using Total Station, Field procedure for coordinate measurement, Field procedure to run open traverse and closed traverse, Transfer or establish Bench Mark. 92. Perform stakeout/demarcation of building layout/plot layout/ roads/ alignment.

22. Measure remote distance and elevation, calculate surface area on field/site, calculate volume of field/site, Procedure for down load and up load data, Simple survey map using Auto CAD.

23. Identify different wooden sample piece i.e.- soft wood & hard wood, Wooden grains etc. & their applications Annual ring, knots, shakes & chicks etc.), Demonstrate application of hand tools, measuring tools, and work holding devices, demonstrate use of different power tools, viz. saws, drills, etc., Perform sawing, planning, Moulding, Rebating, Chamfering, etc. using different types of saws, and plains, Sharpen and set different type saw blade and planer blade/ cutter.

24. Planning face, face edge, etc., Demonstrate the use of marking, mortise gauge etc., Test the accuracy of flatness and twist-ness of the surface by using try square, Demonstrate the use of winding strips, cross planning, edge planning.

25. Demonstrate portable power planer machine and its function. Prepare different wooden joints by using different tools –Make framing joint - Mortise and tenon Joint (Single and double, plain hunched, Mitre corner), Make Housing joints - Full housing, Bridle, stopped housing, make broadening joints, Simple butt joint, Riveted butt joint, etc., Lengthening Joints-End half lap joint, End overlap joint, End bends lap joint, slopping scarf, racking scared, half lapping scarf, table scarf joint etc.

26. Make joint on hard wood to make small frame., Stopped Tenon & Mortise joint on hard wood in the frame to set the selves, Make selves by six pieces of hard wood with single lapped half lap dovetail joint with frame (two nos. of selves).

27. Different Types doors including panelled, glazed and flush door, Different types windows and ventilators. Prepare terminations of cable ends, Practice on skinning, twisting and crimping, identify various types of cables and measure conductor size using SWG and micrometre. Make simple twist, married, Tee and western union joints, Make Britannia straight, Britannia Tee and rat tail joints, Practice in Soldering of joints / lugs.

28. Demonstrate different electrical wiring system with fixing of different accessories, make electrical Fuse joints, fixing MCB, connect lamps with switches, Stair case circuit wiring, Go down wiring, Hospital wiring.

29. Install earthing in different position, Install and connect electrical appliances and take reading with Voltmeter, prepare materials list and costing of wiring.

30. Identify transformer, test and use.

31. Perform Simple pipe connection using G.I. Pipes, socket, elbow, tee, reducing elbow, G.I. union, cap plug, reducer, three face elbows, reducing socket, plug, G.I. nipple etc. Perform Joining of pipe with – thread joint, lead joint, flange joint, cement joint, D. Joint etc.

32. Perform drilling and taping on pipe, Fix ferrule on pipe, Perform Joining of pipe with Elbow joint, socket joint, Tee joint, reducing elbow joint, floor trap joint, etc.

33. Layout of soil pipe and waste pipe to the sanitary fitting using different types of fitting viz. Door junction, door Bend, H.R. bend, Plain Bend, Double door junction, inverter junction, cowel, floor trap, Gully trap, P-trap etc, Fitting of I.W.C with high level cistern, Fitting of washbasin, Fitting of E.W.C. with low level cistern, Fitting of kitchen sink, Fitting of bath tub, Fitting of urinal pot with auto cistern.

34. Install water meter, Remove air lock, Determination of pH-by-pH meter. Analysis and treatment of Effluent water, recondition taps, valves & flushing tank, test for correct functioning, prepare a water supply pipe line system in residential buildings using different types of valves, fittings and appliances, Prepare different objects on 3D Modelling concept in CAD.

35. Test cement for consistency, setting times & strength, conduct field tests for adulteration, make proper arrangement to store cement at site, perform sieve analysis on aggregate, determine grading, fineness modulus, determine presence of silt and clay, perform test to determine shape & size of aggregate, perform test to determine bulking of sand, perform test and analyses the effect of water cement ratio (w/c) on strength of cement.

36. Prepare concrete and lay at required place using power tools, carry out all operations taking necessary precautions related to from work and reinforcement, Test strength of concrete, remove form work Properly.

37. Prepare reinforcement for foundation, beams, columns, slabs, Retaining Wall etc.

38. Select appropriate material for form work at different locations, Erect scaffolding & make form work at different locations, identify defects & rectify form work, prepare a bar bending schedule of different RCC members, demonstrate different operation in bar bending (straightening of bars, cutting of bars, bending of bars, placing of bars, binding of bars, fixing of cover blocks), Estimate quantity of steel and binding wire required for a given job.

39. Making of shuttering & supports with uprights and wedges for Arches, Lintels and Lintels with Chajjahs, Cutting, bending & placing of reinforcement, Mixing, placing & compacting concrete, spanning of opening with a semi-circular arch, making centering, cutting templates for voussoirs & preparing voussoirs, setting uprights of arch, Construction of arch & removing centering.

40. Layout different forms of vertical movements- As per shape - straight, open newel, dog- legged, geometrical and bifurcated stairs& spiral stairs, as per material - brick, wooden, steel & RCC stairs, Lay out of Lift and Escalator.

41. On site practical training of piling (Visit to new construction site at the time piling work or Demonstration through related video.

42. Prepare a Single Storied Residential Building Plan as per local by law including all details Plan, Elevation, Section through Staircase and Toilet & Kitchen, Terrace Plan, Structural Plan and other details i.e., Sanitary & Electrical items with proper symbols by using CAD.

43. Prepare simple drawing with ArchiCAD and 3D Max for Solid Modelling of Architectural/Civil 3D.

44. Prepare 3D model using 3d Max software, create 3D model from 2D plane, Lighting and rendering, Material editor using BIM software like Revit Quantity calculation of materials.

45. Prepare rate analysis of different item of works including material, Labour, Plant machinery, overhead charge, Profit with the details specification, Calculation of floor area and carpet area, Calculation of FAR.
46. Estimate of one room building by center line method and separate wall method, Calculation of different material from the quantities worked out in the estimate.
47. Perform repairing of plaster and different items of works, Use of Water proofing compound, Admixture, Perform white washing, floor polishing, stain removal form floor, wooden works.
48. Field Training to Strengthening of foundation, Rectification of leaking roof, Repair of expansion joint.
49. Market survey for different materials used for anti-termite treatment, Pre construction Anti-termite treatment Postconstruction Anti -termite treatment.
50. Visit to new construction site at the time laying of plumbing lines and sanitary fittings.
51. On Field work about use of Adhesive in imber, tile fixing, jointing in concrete, joint filler & sealing compound.
52. site supervision, work to assist a civil engineer and perform as trainee Site Supervisor.

7. **Syllabus for COMPUTER OPERATOR AND PROGRAMMING ASSISTANT (COPA)Trade-for the post of Instructor.**

Theory:

1. Introduction to Computer components: Introduction to computer system. Concepts of Hardware and Software, Function of mother board components and various processors, Various Input/ Output devices in use and their features.
2. Windows Operating System-Introduction to operating System, Main features of Windows OS, Concept of various shortcut commands.
3. Computer basics and Software Installation-Introduction to the booting process, Introduction to various types of memories and their features, Basic Hardware and software issues and their solutions, Usage of Application software and Antivirus.
4. Introduction to DOS Command Line Interface & Linux Operating Systems-Introduction to basic DOS Internal and External Commands, Introduction to Open-Source Software, Introduction to Linux Operating System features, structure, files and processes, Basic Linux commands.
5. Word Processing Software-Introduction to the various applications in MS office, Introduction to Word features, Office button, toolbars, Creating, saving and formatting and printing documents using Word, Working with objects, macro, mail merge, templates and other tools in Word.
6. Spread Sheet Application-Introduction to Excel features and Data Types, Cell referencing and linking Sheets, Introduction to various functions in all categories of Excel, Concepts of sorting, filtering and validating data, Analyzing data using charts, data tables, pivot tables, goal seek and scenarios.
7. Image editing, Presentations-Introduction to Open Office, Introduction to the properties and editing of images, Introduction to different formats of images and their uses, Introduction to Power Point and its advantages, Creating Slide Show Fine, tuning the presentation and good presentation technique.
8. Database Management Systems-Concepts of Data and Databases, Overview of popular databases, RDBMS, OODB and NOSQL, Rules for designing good tables, Integrity rules and constraints in a table, Relationships in tables, Introduction to various types of Queries and their uses, Designing Access Reports and Forms, Introduction to macros, designer objects controls, their properties and behaviour.
9. Networking Concepts- Introduction to Computer Networks, Necessity and Advantages, Client Server and peer to Peer networking concepts, Concept of Proxy Server and proxy firewall server, Concept of DHCP Server, Network topologies. Introduction to LAN, WAN and MAN, Network components, viz. Modem, Hub, Switch, Router, Bridge, Gateway etc, Network Cables, Wireless networks and Blue Tooth technology, Concept of ISO - OSI 7 Layer Model, Overview of various Network protocols Viz. TCP/IP, FTP, Telnet etc., Concept of Logical and Physical Addresses, Subnetting and Classes of Networks.
10. Internet Concepts- Introduction to www, Concept of Internet, Web Browsers, internet servers and search engines, Concepts of Domain naming Systems and E mail communication, Introduction to video chatting tools and Social Networking concepts.

11. Web Design Concepts-Concepts of Static and Dynamic Web pages, Introduction to HTML and various tags in HTML, Concepts of different controls used in Web Pages. Concepts of CSS and applying CSS to HTML, Introduction to open-source CMS viz, Joomla, Word press etc. and Web authoring tools viz. Kompozer, Front Page etc., Concept of good web page designing techniques.
12. Introduction to JavaScript- Introduction to Programming and Scripting Languages, Introduction to JavaScript and its application for the web, Introduction to Web Servers and their features, JavaScript Basics–Data types, Variables, Constants and Conversion between data types, Arithmetic, Comparison, Logical Operators in Java Script. Operator precedence, Program Control Statements and loops in JavaScript, Arrays in JavaScript – concepts, types and usage, The String data type in JavaScript. Introduction to String, Math and Date, Introduction to Functions in JavaScript, built in JavaScript functions overview, Concepts of Pop-Up boxes in JavaScript, Introduction to the Document Object Model, Concepts of using Animation and multimedia files in Java Script.
13. Introduction to VBA, Features and Applications- Introduction to VBA features and applications, Properties, events and methods associated with the Button, Check Box, Label, Combo Box, Group Box, Option Button, List Box, Scroll Bar and Spin button controls, VBA Data types, Variables and Constants, Operators in VBA and operator precedence, Mathematical Expressions in VBA, Introduction to Arrays in VBA, Introduction to Strings in VBA, Conditional processing in VBA, using the IF, Else-if, Select Case Statements, Introduction to Loops in VBA, VBA message boxes and input boxes, Introduction to Creating functions and Procedures in VBA, Using the built in functions, Introduction to Object Oriented Programming Concepts. Concepts of Classes, Objects, Properties and Methods, the user forms and control in Excel VBA, Introduction to Debugging Techniques.
14. Using Accounting Software- Basics of Accounting, Golden Rules of Accounting, Voucher Entry, Ledger Posting, Final Accounts Preparation, Cash Book. Ratio Analysis, Depreciation, Stock Management, Analysis of VAT, Cash Flow, Fund Flow Accounting, Introduction to ally, features and Advantages, implementing accounts in Tally, Double entry system of book keeping, Budgeting Systems, Scenario management and Variance Analysis, Costing Systems, Concepts of Ratios, Analysis of financial statements, Inventory Basics, POS Invoicing, TDS, TCS, FBT, VAT & Service Tax, Tally Interface in Different Languages.
15. E-Commerce-Concepts-Introduction to E-Commerce and advantages, Building business on the net, Payment and Order Processing, Authorization, Charge back and other payment methods, Security issues and payment gateways.
16. Cyber Security- Overview of Information Security, SSL, HTTPS, Security threats, information Security vulnerability and Risk management, Introduction to Directory Services, Access Control, Security, Privacy protection, Audit and Security, Introduction to IT Act and penalties for cyber-crimes.

Practical:

1. Visit COPA Lab. of the institutes and locate the electrical connections with computer system setup, identifying safety symbols and hazard identification, Practice safe methods of fire fighting in case of electrical fire, use of fire extinguishers, identify

computer peripherals and internal components of a disassembled desktop computer, Assemble components of desktop computer.

2. Practice on Windows interface and navigating windows, Practice on managing files and folders using removable drives, Customize the desktop settings and manage user accounts, View system properties and control panel details, Work with keyboard shortcut commands, Print and scan document using different commands.
3. View the BIOS settings and their modifications, Install Windows operating system, Format hard disk and create partition, Identify and rectify common hardware and software issues during OS installation, Install necessary application software for Windows i.e., Office Package, PDF Reader,

   Media Player etc., Configure Bluetooth and wi-fi settings, Install Drivers for printer, scanner, webcam and DVD etc., Burn data, video and audio files on CD/DVD using application software.
4. Use basic DOS commands for directory listing, manage files and folders using DOS commands, Install Linux operating system, Install necessary application software for Linux i.e. Office Package, PDF Reader, Media Player etc., Use Basic Linux commands for directory listing, file and folder management, password etc., Use the Linux graphical user interface for file and folder management, exploring the system etc., Customize desktop settings and manage user accounts in Linux, View system properties and manage system setting in Linux.
5. Open MS Word and familiarize with basic word components, Practice creating, saving and renaming of word documents, edit document using basic formatting tools, Practice Inserting and formatting tables and other objects, Work with Page layout settings and printing documents, use templates, autocorrect tools, and record and execute a macro, Use Mail merge tool. Use conditional Mail Merge, External Data Source. Practice Letters, Label & Envelop printing using Mail Merge, Use Table of Context, Indexing, Hyperlink, Bookmark, Comment, equation, symbols, citation, cross-reference, footnote, translate, synonyms, thesaurus, spell check &grammar, compare etc., Practice Typing using open-source typing tutor, Practice of using shortcut keys and use Open Office as word processor.
6. Open MS Excel and familiarize with basic application components, Practice creating, saving and formatting excel spread sheets.), Use absolute and relative referencing, linking sheets, conditional formatting etc., Practice Excel functions of all major categories i.e., Financial, Logical, Text, date & time, Lookup, Math, Statistical etc., Use various data types in Excel, sorting, filtering and validating data, Create and format various static and dynamic charts, Practice Importing & exporting excel data, Perform data analysis using “what if” tools and Pivot Table and record and execute a macro, Modify Excel page setup and printing and use open office as Spreadsheet application, Execute simple projects using Excel & Word.
7. Image editing and creating Presentations-Use Windows Paint or image editing software like Open Office Draw, GIMP, Irfan View or a similar tool, Perform Image editing using open source applications, Open power point presentation and familiarise with basic application components, Create Slide shows, Insert picture and theme, Add new slide, format text, link with word and excel documents, Practice animating slide transitions and objects, Create slide shows by inserting audio & video and synchronise with presentation, Modify slide page setup and print the slides, Create a simple presentation project using open office.

8. Database Management with MS Access- Create database and design a simple tables in Access, Practice enforcing integrity constraints and modify properties of tables and fields, Create relationships and join tables, Create and format Forms, Create simple queries with various criteria and calculations, Create Simple update, append, make table, delete and crosstab queries, Modify form design with controls, macros and events, Import and export data to and from Access and create and format various types of reports, Compress and Encrypt databases.
9. Configuring and using Network-View Network connections, connect a computer to a network and share Devices i.e., Printers, files, folders and drives, Work with various Network devices, connectors and cables. Create straight and cross cable and punch a UTP cable in the patch socket and test the connectivity, Practice IP Addressing and Subnet masking for IPV4/ IPV6 and pinging to test networks, Configure Hub and Switch, Set up and configure wired and wireless LAN in a Computer Lab within at least three computers, Use patch panel & I/O Box for wired LAN and installing & configuring Internet connection in a single PC and in a LAN, Set up a proxy server/ DHCP Server with firewall, Set up video conferencing using open source software, Use various tools (by open source /free) for network troubleshooting, maintenance and security for both Wired and Wireless, Browse the Internet for information (use at least 3 popular browsers).
10. Create and use e-mail for communication with attachment, priority setting, address book, communicate with text, video chatting and social networking sites, use online dictionary, translation software, storage space, share files with e-mail links, download manager, download & upload YouTube files, google map & earth etc. Update windows & other software, Configure Outlook, mail service in mobile phones. Use tools like Skype, Google+ etc., Browser setting for Bookmark, cookies, favourites and pop ups, default website, trusted site, restricted site, content, history and advanced setup.
11. Designing Static Web Pages-Practice with basic HTML elements (e.g. head, title, body), tag and attributes, Design simple web page with text, paragraph and line break using HTML tags., Format text, change background colour and insert pictures in web page, Design simple web page with tables and lists, Use marquees, hyperlinks and mail to link in designing web pages, Create frames, add style and design layout, Insert text box, check box and combo box in web page, Design web page using password field, submit button, reset button and radio button etc., Design a web page adding flash file, audio and video files, Design web page with forms and form controls using HTML tags, Create web page using Cascading Style Sheet (CSS), Use WYSIWYG (Kompozer) web design tools to design and edit web pages with various styles.
12. JavaScript & creating Web page-Practice with basic elements of JavaScript, Embed JavaScript in HTML to display information in web pages, documentation and formatting of HTML source code, Use JavaScript Variables, Data types, Constants and Operators, Use Control statements and Loops in JavaScript, Practice with switch case, loop controls and Errors in JavaScript, Practice with Arrays in JavaScript page, Practice with functions in JavaScript web page, Practice with String, Math and Date functions in JavaScript, Use online tool or open source software to develop and edit web pages containing Titles, different font sizes and colours, frames, lists, tables, images, image map, controls, CSS, forms, hyperlinks etc., use web template to create a web page of various styles, Develop a simple web project using HTML, JavaScript and host it in IIS and a registered domain.

13. Programming with VBA-Practice with basic functions of VBA Editor, Use form controls like buttons, Check boxes, Labels, Combo Box, Group Box, List Box, Option Button, Scroll Bar and Spin button, Modify object properties in VBA program, Write simple programs involving VBA Data types, Variables, Operators and Constants, Create Message boxes and Input boxes in VBA, Work with conditional statements like if, Else-if, and Select Practice with Loop, Loop Control and Case statements in VBA, Create and Manipulate Arrays in VBA, Practice with string variables in VBA programming, Write programs involving Mathematical, Conversion, Date and String Functions in VBA, Create Functions, Procedures, Passing Parameters and Using Returned Data, Practice with built in functions in VBA programs, Create and edit macros, Write code to work with Excel in VBA forms, Practice with methods and events in VBA Programming, Debug, Step through code, Breakpoints, find and fix errors while debugging, Develop a simple project involving MS excel and VBA.
14. Using Accounting Software- Practice Basic accounting with tally interface, Create Company, Account and Voucher entry in Tally, Generate reports for Invoice, Bill, Profit & Loss account etc., Perform Cost Centre & Cost Category management, Create and manage budgeting systems, Create Scenario and Variance Analysis, Use Tally for Costing, Ratio Analysis, Cash flow and Funds flow statements, Analyze and Manage Inventory control, Perform Point of Sales and Taxation (VAT, Excise, Service Tax), Perform System Administration and use other Utilities, Create users, take Backup& Restore of Company, Use Multilingual Functionality in Tally.
15. E Commerce-Browse E-commerce websites viz. ebay, Amazon, flipkart, OLX, quikr etc. and prepare comparative statement of the main features of these sites, Upload products for selling in E-Commerce Sites and make online purchase from E Commerce sites, Manage security issues in E-Commerce and payment operations.
16. Cyber Security- Protect information, computers and networks from viruses, spyware and other malicious code, provide firewall security for Internet connection and Network System, Protect the computer against various internet threats, make backup copies of important file, data and information, secure your Wi-Fi networks using password WEP, WPA-PSK, WPA2-PSK, SSID, MAC address filtering. Create individual user accounts for each member, Limit member access to data and information, and restrict authority to install unnecessary downloads.

8. **Syllabus for ELECTRICIAN Trade-for the post of Instructor.**

Theory:

1. Safety rules and safety signs. Types and working of fire extinguishers, First aid safety practice, Hazard identification and prevention, Personal safety and factory safety, Response to emergencies. g. power failure, system failure and fire etc., First aid safety practice, Hazard identification and prevention, Personal safety and factory safety, Response to emergencies e.g. power failure, system failure and fire etc., ElectricalCode-2011.
2. Allied trades: 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.
3. Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges Types, Uses, Care and maintenance, Sheetmetal 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.
4. Fundamentals of electricity, definitions, units & effects of electric current, Conductors and insulators, Conducting materials and their comparison.
5. Joints in electrical conductors- Techniques of soldering. Types of solders and flux.
6. Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables.
7. Ohm's Law; Simple electrical circuits and problems. Kirchoff's Laws and applications, Series and parallel circuits. Open and short circuits in series and parallel networks.
8. Laws of Resistance and various types of resistors, Wheatstone bridge; principle and its applications, Effect of variation of temperature on resistance, Different methods of measuring the values of resistance, Series and parallel combinations of resistors.
9. 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.
10. 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. Problems on A.C. circuits.
11. Advantages of AC poly-phase system, 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, Phase sequence meter.
12. Chemical effect 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. Basic principles of Electro-plating and cathodic protection, Grouping of cells for specified voltage and current, Principle and operation of solar cell.
13. I.E., rules on electrical wiring. Types of domestic and industrial wirings, Study of wiring accessories e.g., switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings, Principle of laying out of domestic wiring, Voltage drop concept.

14. PVC conduit and Casing- capping wiring system, Different types of wiring - Power, control, Communication and entertainment wiring. Wiring circuits planning, permissible load in sub- circuit and main circuit.
15. Estimation of load, cable size, bill of material and cost, Inspection and testing of wiring installations, Special wiring circuit e.g. go down, tunnel and workshop etc.
16. Importance of Earthing, Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.
17. 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.
18. 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, Measurement of energy in three phase circuit.
19. Errors and corrections in measurement, loading effect of voltmeter and voltage drop effect of ammeter in circuits, Extension of range and calibration of measuring instruments.
20. Working principles and circuits of common domestic equipment and appliances, Concept of Neutral and Earth.
21. Working principle, construction and classification of transformer. Single phase and three phase transformers, Turn ratio and e.m.f. equation, Series and parallel operation of transformer, Voltage Regulation and efficiency, Auto Transformer and instrument transformers (CT & PT).
22. Method of connecting three single phase transformers for three phase operation. Types of Cooling, protective devices, bushings and termination etc., Testing of transformer oil. Materials used for winding and winding wires in small transformer.
23. 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.
24. Armature reaction, Commutation, inter poles and connection of inter poles, Parallel Operation of DC Generators, Load characteristics of DC generators, Application, losses & efficiency of DC Generators, Routine & maintenance.
25. Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drops, speed and flux of DC motor, DC motor Starters, relation between torque, flux and armature current, Changing the direction of rotation, Characteristics, Losses & Efficiency of DC motors, Routine and maintenance.
26. Methods of speed control of DC motors, Lap and wave winding and related terms.
27. Working principle of three phase induction motor, Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque, Different types of starters for three phase induction motors, its necessity, basic contactor circuit, parts and their functions.
28. Single phasing prevention, No load test and blocked rotor test of induction motor, Losses & efficiency, Various methods of speed control, Braking system of motor. Maintenance and repair.
29. Concentric/ distributed, single/ double layer winding and related terms.
30. Working principle, different method of starting and running of various single-phase AC motors, Domestic and industrial applications of different single-phase AC motors, Characteristics, losses and efficiency, Troubleshooting of single-phase AC induction motors and universal motor.

31. Principle of alternator, e.m.f. equation, relation between poles, speed and frequency, Types and construction. Efficiency, characteristics, regulation, phase sequence and parallel operation, Effect of changing the field excitation and power factor correction.
32. Working principle of synchronous motor, Effect of change of excitation and load. V and anti V curve, Power factor improvement.
33. Rotary Converter, MG Set description and Maintenance.
34. Resistors– olour code, types and characteristics, Active and passive components. Atomic structure and semiconductor theory.
35. P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit-half wave, full wave, bridge rectifiers and filters. Principle of operation, types, characteristics and various configuration of transistor, Application of transistor as a switch, voltage regulator and amplifier.
36. Basic concept of power electronics devices, IC voltage regulators, Digital Electronics - Binary numbers, logic gates and combinational circuits.
37. Working principle and uses of oscilloscope, Construction and working of SCR, DIAC, TRIAC and IGBT, Principle, types and applications of various multi vibrators.
38. Study and understand Layout drawing of control cabinet, power and control circuits, Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc.
39. Wiring accessories: Race ways/cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc., Testing of various control elements and circuits.
40. Working, parameters and applications of AC / DC drive, Speed control of 3 phase induction motor by using VVVF/AC Drive.
41. Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS, Preventive and breakdown maintenance.
42. Conventional and non- conventional sources of energy and their comparison, Power generation by thermal and hydel power plants.
43. Various ways of electrical power generation by non-conventional methods, Power generation by solar and wind energy, Principle and operation of solar panel.
44. Transmission and distribution networks, Line insulators, overhead poles and method of joining aluminium conductors
45. Safety precautions and IE rules pertaining to domestic service connections. Various substations, Various terms like–maximum demand, average demand, load factor, diversity factor, plant utility factor etc.
46. Types of relays and its operation. Types of circuit breakers, their applications and functioning, Production of arc and quenching.

Practical:

1. Identify safety symbols and hazards, Preventive measures for electrical accidents and practice steps to be taken in such accidents, Practice safe methods of fire fighting in case of electrical fire, Use of fire extinguishers.
2. Practice elementary first aid, rescue a person and practice artificial respiration, Disposal procedure of waste materials, use of personal protective equipment, Practice on cleanliness and procedure to maintain it.
3. Identify trade tools and machineries, Practice safe methods of lifting and handling of tools & equipment, Select proper tools for operation and precautions in operation, Care & maintenance of trade tools.
4. Operations of allied trade tools, Workshop practice on filing and hacksawing, prepare hand coil winding assembly, Practice on preparing T- joint, straight joint

and dovetail joint on wooden blocks, Practice sawing, planning, drilling and assembling for making a wooden switchboard.

5. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting, Workshop practice on drilling, chipping, internal and external threading of different sizes, Practice of making square holes in crank handle, Prepare an open box from metal sheet.
6. Prepare terminations of cable ends, Practice on skinning, twisting and crimping, identify various types of cables and measure conductor size using SW Gand micrometer.
7. Make simple twist, married, Tee and western union joints., Make Britannia straight, Britannia Tee and rat tail joints, Practice in Soldering of joints / lugs.
8. Identify various parts, skinning and dressing of underground cable, make straight joint of different types of underground cable, Test insulation resistance of underground cable using megger, test underground cables for faults and remove the fault.
9. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyse by drawing graphs, Measure current and voltage in electrical circuits to verify Kirchhoff's Law, Verify laws of series and parallel circuits with voltage source in different combinations, Measure voltage and current against individual resistance in electrical circuit, Measure current and voltage and analyse the effects of shorts and opens in series circuit, Measure current and voltage and analyse the effects of shorts and opens in parallel circuit.
10. Measure resistance using voltage drop method, Measure resistance using wheat stone bridge, Determine the thermal effect of electric current, Determine the change in resistance due to temperature, Verify the characteristics of series parallel combination of resistors.
11. Determine the poles and plot the field of a magnet bar, Wind a solenoid and determine the magnetic effect of electric current, Measure induced emf due to change in magnetic field, Determine direction of induced emf and current, Practice on generation of mutually induced emf, Measure the resistance, impedance and determine inductance of choke coils in different combinations, Identify various types of capacitors, charging / discharging and testing, Group the given capacitors to get the required capacity and voltage rating.
12. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits, Measure the resonance frequency in AC series circuit and determine its effect on the circuit, Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits, Measure the resonance frequency in AC parallel circuit and determine its effects on the circuit, Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically, Measure Current, voltage, power, energy and power factor in three phase circuits, Practice improvement of PF by use of capacitor in three phase circuit.
13. Ascertain use of neutral by identifying wires of a 3- phase 4 wire system and find the phase sequence using phase sequence meter, Determine effect of broken neutral wire in three phase four wire system, Determine the relationship between Line and Phase values for star and delta connections, Measure the Power of three phase circuit for balanced and unbalanced loads, Measure current and voltage of two phases in case of one phase is short- circuited in three phase four wire system and compare with healthy system.

14. Use of various types of cells, Practice on grouping of cells for specified voltage and current under different conditions and care, Prepare and practice on battery charging and details of charging circuit, Practice on routine, care/ maintenance and testing of batteries, Determine the number of solar cells in series / parallel for given power requirement.
15. Identify various conduits and different electrical accessories, Practice cutting, threading of different sizes & laying Installations, Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, relays, MCB, ELCB, MCCB etc.
16. Draw layouts and practice in PVC Casing -capping, Conduit wiring with minimum to a greater number of points of minimum 15 Mtrs length, wire up PVC conduit wiring to control one lamp from two different places, wire up PVC conduit wiring to control one lamp from three different places, wire up PVC conduit wiring and practice control of sockets and lamps in different combinations using switching concepts.
17. Wire up the consumers main board with ICDP switch and distribution fuse box, Prepare and mount the energy meter board, Estimate the cost/ bill of material for wiring of hostel/residential building and workshop, Practice wiring of hostel and residential building as per IE rules, Practice wiring of institute and works hop asper IE rules, Practicetesting/faultdetectionofdomesticandindustrialwiringinstallation and repair.
18. Prepare pipe earthing and measure earth resistance by earth tester / megger, Prepare plate earthing and measure earth resistance by earth tester / megger.
19. Test earth leakage by ELCB and relay Install light fitting with reflectors for direct and indirect lighting, Group different wattage of lamps in series for specified voltage, Practice installation of various lamps e.g. fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide etc., Prepare decorative lamp circuit using drum switches, Prepare decorative lamp circuit to produce rotating light effect/running light effect, Install light fitting for show case lighting.
20. Practice on various analog and digital measuring Instruments, Practice on measuring instruments in single and three phase circuits e.g. multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter etc., Measure power in three phase circuit using two wattmeter methods, Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings, Measure electrical parameters using tong tester in three phase circuits.
21. Practice for range extension and calibration of various measuring instruments, determine errors in resistance measurement by voltage drop method, Test single phase energy meter for its errors, Dismantle and assemble electrical parts of various electrical appliances e.g. cooking range, geyser, washing machine and pump set, Service and repair of bell/ buzzer.
22. Service and repair of electric iron, electric kettle, cooking range and geyser, Service and repair of induction heater and oven, Service and repair of mixer and grinder, Service and repair of washing machine, Verify terminals, identify components and calculate transformation ratio of single-phase transformers, Perform OC and SC test to determine and efficiency of single-phase transformer, Determine voltage regulation of single-phase transformer at different loads and power factors, Perform series and parallel operation of two single phase transformers, Verify the terminals and accessories of three phase transformer HT and LT side.

23. Perform 3 phase operation by use of three single phase transformers-delta-delta, delta-star, star-star, star-delta, Perform testing of transformer oil, Practice on winding of small transformer, Practice of general maintenance of transformer.
24. Identify terminals, parts and connections of different types of DC machines, Measure field and armature resistance of DC machines, determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load, Test for continuity and insulation resistance of DC machine, Start, run and reverse direction of rotation of DC series, shunt and compound motors.
25. Perform no load and load test and determine characteristics of series and shunt generators, perform no load and load test and determine characteristics of compound generators (cumulative and differential), Practice dismantling and assembling in DC shunt motor, Practice dismantling and assembling in DC compound generator.
26. Conduct performance analysis of DC series, shunt and compound motors, Dismantle and identify parts of three point and four-point DC motor starters, Assemble, Service and repair three point and four-point DC motor starters.
27. Practice maintenance of carbon brushes, brush holders, Commutator and sliprings.
28. Perform speed control of DC motors - field and armature control method, carry out overhauling of DC machines, Perform DC machine winding by developing connection diagram, test on growler and assemble.
29. Identify parts and terminals of three phase AC motors, make an internal connection of automatic star-delta starter with three contactors, Connect, start and run three phase induction motors by using DOL, star- delta and auto-transformer starters, Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic.
30. Determine the efficiency of squirrel cage induction motor by brake test, Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test, Measure slip and power factor to draw speed- torque(slip/torque) characteristics, Test for continuity and insulation resistance of three phase induction motors, Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc.
31. Perform winding of three phase AC motor by developing connection diagram, test and assemble, Maintain, service and troubleshoot the AC motor starter.
32. Identify parts and terminals of different types of single-phase AC motors, Install, connect and determine performance of single-phase AC motors, Start, run and reverse the direction of rotation of single-phase AC motors, Practice on speed control of single phase AC motors, Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed, Carry out maintenance, service and repair of single-phase AC motors, Practice on single/double layer and concentric winding for AC motors, testing and assembling, Connect, start, run and reverse the direction of rotation of universal motor, Carry out maintenance and servicing of universal motor.
33. Install an alternator, identify parts and terminals of alternator, Test for continuity and insulation resistance of alternator, Connect, start and run an alternator and build up the voltage, Determine the load performance and voltage regulation of three phase alternator, Parallel operation and synchronization of three phase alternators
34. Install a synchronous motor, identify its parts and terminals, Connect, start and plot V- curves for synchronous motor under different excitation and load conditions.
35. Identify parts and terminals of MG set, Start and load MG set with3 phase induction motor coupled to DC shunt generator.

36. Determine the value of resistance by colour code and identify types, Test active and passive electronic components and its applications.
37. Determine V-I characteristics of semiconductor diode, construct half wave, full wave and bridge rectifiers using semiconductor diode, Check transistors for their functioning by identifying its type and terminals, Bias the transistor and determine its characteristics, Use transistor as an electronic switch and series voltage regulator.
38. Operate and set the required frequency using function generator, make a printed circuit board for power supply, construct simple circuits containing UJT for triggering and FET as an amplifier, Trouble shoot defects in simple power supplies.
39. Construct power control circuit by SCR, Diac, Triac and IGBT, construct variable D C stabilized power supply using IC, Practice on various logics by use of logic gates and circuits, Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO.
40. Design layout of control cabinet, assemble control elements and wiring accessories for: Local and remote control of induction motor, Forward and reverse operation of induction motor, Automatic star-delta starter with change of direction of rotation, Sequential control of three motors, Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channelling, tying and checking etc., Mount various control elements e.g. circuit breakers, relays, contactors and timers etc., Identify and install required measuring instruments and sensors in control panel, Test the control panel for its performance.
41. Perform speed control of DC motor using thyristors / DC drive, perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive, Construct and test a universal motor speed controller using SCR.
42. Assemble circuits of voltage stabilizer and UPS, prepare an emergency light, assemble circuits of battery charger and inverter, Test, analyze defects and repair voltage stabilizer, emergency light and UPS, Maintain, service and troubleshoot battery charger and inverter, Install an Inverter with battery and connect it in domestic wiring for operation.
43. Draw layout of thermal power plant and identify function of different layout elements, draw layout of hydel power plant and identify functions of different layout elements, visit to transmission / distribution substation, draw actual circuit diagram of sub-station visited and indicate various components.
44. Prepare layout plan and identify different elements of solar power system, prepare layout plan and identify different elements of wind power system, Assemble and connect solar panel for illumination.
45. Practice installation of insulators used in HT/LT line for a given voltage range, draw single line diagram of transmission and distribution system, Measure current carrying capacity of conductor for given power supply, Fasten jumper in pin, shackle and suspension type insulators.
46. Erect an overhead service, line pole for single phase 230V distribution system in open space, Practice on laying of domestic service line, Install bus bar and bus coupler on LT line.
47. Identify various parts of relay and ascertain the operation, Practice setting of pick up current and time setting multiplier for relay operation, Identify the parts of circuit breaker, check its operation, Test tripping characteristic of circuit breaker for over current and short circuit current, Practice on repair and maintenance of circuit breaker.

9. **Syllabus for MACHINIST Trade-for the post of Instructor.**

Theory:

1. Introduction of first aid. Operation of electrical mains and electrical safety, Introduction of PPEs, Response to emergencies e.g., power failure, fire, and system failure, Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application, Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable, Basic understanding on Hot work, confined space work and material handling equipment.
2. Linear measurements- its units, steel rule dividers, callipers– types and uses, Punch – types and uses. Uses of different types of hammers. Description, use and care of marking off table.
3. Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws, Files-elements, types, specification and their uses. Methods of filing. Care and maintenance of files, Measuring standards (English), Metric Units.
4. Pedestal grinding machine: Use, care and safety aspect, marking off and layout tools, scribing block, care & maintenance, try square, ordinary depth gauge, Care & maintenance of cold chisels- materials, types, cutting angles, Combination set- its components, uses and cares.
5. Marking media, Prussian blue, red lead, chalk and their special application, description. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.
6. Drill, Tap, Die-types & application. Determination of tap drill size. Basic terminology related to screw thread.
7. Reamer- material, types (Hand and machine reamer), parts and their uses, determining hole size for reaming, Reaming procedure. Vernier height gauge: construction, graduations, Vernier setting & reading. Care and maintenance of Vernier height Gauge.
8. Drilling machines-types &their application, construction of Pillar & Radial drilling machine. Countersunk, counter bore and spot facing -tools and nomenclature, Cutting Speed, feed, depth of cut and Drilling time calculations.
9. Interchangeability: Necessity in Engg., field, Limit- Definition, types, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero-line, tolerance zone, allowances. Different standard systems of fits and limits. (British standard system & BIS system).
10. Vernier calliper-its parts, principle, reading, uses & care, outside micrometre- its parts, principle, reading, uses, Reading of Vernier Micrometre, care & maintenance, Dial test indicator-its parts, types, construction and uses.
11. Getting to know the lathe with its main components, lever positions and various lubrication points as well Definition of machine & machine tool and its classification. History and gradual development of lathe. Introduction to lathe- its types. Centre lathe construction, detail function of parts, specification, Safety points to be observed while working on a lathe.
12. Lathe cutting tool-different types, material, shapes and different angles (clearance, rake etc.) and their effects, specification of lathe tools, grinding process of tools. Types of chips, chip breaker. Tool life, factors affecting tool life, driving mechanism, speed and feed mechanism of Lathe, Lathe operations-facing, turning, parting-off, grooving, chamfering, boring etc., Knurling-types, grade & its necessity.

13. Concept of Orthogonal and Oblique Cutting, Chucks & different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks, Vernier Bevel Protractor – parts, reading and uses.

14. Taper – different methods of expressing tapers, different standard tapers. Method of taper, turning, important dimensions of taper. Taper turning by swivelling compound slide, its calculation., Calculations of taper turning by off-setting tail stock, Sine Bar – description & uses. Slip gauge –description and uses.
15. Different thread forms, their related dimensions and calculations of screw cutting in a lathe (Metric thread on English lathe and English thread on Metric lathe). Measurement of threads by three wire methods. Use of Screw Pitch Gauge.
16. Slotter–Classification, principle, construction, Safety precaution, Introduction and their indexing process on a Slotter by its Rotary table graduations, driving mechanisms, quick return motion and speed ratio, Safety points to be observed while working on a Slotter.
17. Job holding devices-vice, clamps, V-block, parallel block etc., Slotting tools- types, tool angles, use of tool with holder for internal operations, Precautions to be observed during slotting internal operations, Use of circular marks on the table for slotting curves, Chain, Sprocket and their applications.
18. Spline – types and uses.
19. Coolant & lubricant – Introduction, types, properties, application & applying methods.
20. Milling Machine: Introduction, types, parts, construction and specification, Driving and feed mechanism of Milling Machine, Different types of milling cutters & their use. Cutter nomenclature, Different milling operations plain, face, angular, form, slot, gang and straddle milling etc., Up and down milling, Different types of milling attachments and their uses.
21. Jigs and Fixtures–Introduction, principle, types, use, advantages & disadvantages.
22. Properties of metals general idea of physical, mechanical properties of metals, colour, weight, hardness toughness, malleability, ductility their effect on machinability, Heat Treatment – Introduction, necessity, types, Purposes, different methods of Heat Treatment. Heat Treatment of Plain Carbon Steel.
23. Indexing-introduction & types. Indexing head-types &constructional details, function of indexing plates and the sector arms, Calculation for various types of indexing.
24. Turning of taper by taper turning attachment - advantages and dis- advantages, taper calculations, Mandrel, Lathe centres, Lathe dog, catch plate/Driving plate, Face plate, Rests, their types & uses.
25. Terms relating screw thread major/ minor diameter, pitch and lead of the screw, depth of thread. Simple gear train and compound gear train change gears for fractional pitches, square thread and its form and calculation of depth, core dia, pitch Día, Difference between single and multi-start threads- their uses, merits and demerits.
26. Grinding –Introduction, grinding wheel- abrasive, types, bond, grade, grid, structure, standard marking system of grinding wheel, selection of the grinding wheel. Wet grinding and dry grinding, various types of grinding wheels and their application, grinding defects and remedies, Tool & cutter grinder- Introduction, parts, construction, use and specification, different types of tool rest & them, Application, Various methods of cutter grinding, Various cutter grinding attachments and their uses.

27. Dressing, types of dressers, Glazing and Loading of wheels – its causes and remedies, Roughness values and their symbols. Explain the importance and necessity of quality.
28. Surface Grinder-Types, Parts, construction, use, methods of surface grinding, specification & safety.
29. Cylindrical grinder: Introduction, parts, construction, types, specification, safety, different methods of cylindrical grinding.
30. Cutting speed, feed, depth of cut, machining time calculation.
31. Geometrical tolerances, definition, symbol and their application, Depth Micrometer Parts, reading, uses and safety, Different types of micrometres and their uses, Inside Micrometer – its parts, reading and uses.
32. Bore Dial Gauge – its parts, reading (both in Metric and English system) and uses. Telescopic gauge, Gauges – different types and their uses, difference between Gauges and Measuring Instruments. Gear introduction, use and type. Elements of a spur gear. Gear tooth of each form's types, merits and demerits of each.
33. Rack – types, uses and calculations.
34. Selection of gear cutter type and form & various methods of checking gear and its parts, Vernier gear tooth caliper - its construction and application in checking gear tooth.
35. Spur gear calculations, curves and their uses, Use of radius gauges and template.
36. Vertical Milling Machine- its parts. Method of boring in Vertical milling. Difference between Horizontal and Vertical Milling Machine.
37. Helix and Spiral introduction, types and elements. Difference between helix & spiral. Difference between R.H. and L.H. helix, Helical gear- elements, application. Calculations for cutting helical gear.
38. Reamer – types, elements and uses. Calculations for cutting Reamer.
39. Twist drill-nomenclature, cutters election. Calculations for cutting twist drill.
40. Study of basic Electricals- Voltage – Current etc
41. Working of Solenoids, Inductors, Motors, Generator Based On Electromagnetic Induction Principle, Switches, Fuse and Circuit Breakers, Introduction To Sensors-Fundamental of Sensor, Proximity Sensors Classification and Operation-Proximity Sensor- Types Of Proximity Sensor And Their Working-Industrial Application, Sensors for Distance And Displacement -LVDT-Linear Potentiometer-Ultrasonic And Optic Sensors -Industrial Application.
42. Personal safety, safe material handling, and safe machine operation on CNC turning centers. CNC technology basics, Comparison between CNC and conventional lathes. Concepts of positioning accuracy, repeatability. CNC lathe machine elements and their functions-bed, chuck, tailstock, turret, ball screws, guide ways, LM guides, colant system, hydraulic system, chip conveyor, steady rest, console, spindle motor and drive, axes motors, tail stock, encoders, control switches, Feedback, CNC interpolation, open and close loop control systems. Machining operations and the tool paths in them – stock removal in turning and facing, grooving, face grooving, threading, drilling.
43. Concept of Co-ordinate geometry, concept of machine coordinate axis, axes convention on CNC lathes, work zero, machine zero, Converting part diameters and lengths into co-ordinate system points. Absolute and incremental programming, Programming – sequence, formats, different codes and words, ISO G codes and M codes for CNC turning, Describe CNC interpolation, open and close loop control systems. Co-ordinate systems and Points, Program execution in different modes like MDI, single block and auto, Canned cycles for stock removal (turning/facing),grooving, threading, for external and internal operations, Tool

nose radius compensation (TNRC) and why it is necessary. Find the geometry page in CNC machine, cutting tool materials, application of various materials, Cutting tool geometry for internal and external turning, grooving, threading, face grooving, drilling. Insert holding methods for each, Insert cutting edge geometry, ISO nomenclature for turning tool holders, boring tool holders, Indexable inserts, Cutting parameters- cutting speed, feed rate, depth of cut, constant surface speed, limiting spindle speed, Tool wear, tool life, relative effect of each cutting parameter on tool life, Selection of cutting parameters from a tool manufacturer's catalogue for various operations, Writing part programs as per drawing & checking using CNC program verification/ simulation software. Process planning, work holding, tool and cutting parameters selection according to the part geometry and dimensions. Collisions due to program errors, effects of collisions. Costs associated with collisions – tool breakage, machine damage, injuries.

44. Program execution in different modes like MDI, single block and auto, Process planning & sequencing, tool layout& selection and cutting parameters selection, Work and tool offsets, Inputs value to the offset/ geometry page into machine, turning in multiple setups, hard and soft jaws, soft jaw boring, use of tailstock and steady rest, Length to diameter (L/D) ratio and deciding work holding based on it. Machine operation modes – Jog, MDI, MPG, Edit, Memory, Entering and editing programs on machine console, entering offsets data in offsets page, Use of Emergency stop, Reset, Feed rate override, spindle speed override, edits lock on/off buttons and keys.
45. Program checking in single block and dry run modes – necessity and method, Tool offsets adjustment on first part for close tolerance dimensions, by over sizing (for outside dimensions) or under sizing (for inside dimensions) the dimension to prevent part rejection, Wear offset setting – necessity, relationship with tool wear, entering in offsets page, Process and tool selection related to grooving, drilling, boring and threading. Axes over travel, recovering from over travel, Collisions due to improper machine setup and operation – causes and effects. Recovering from collisions, find out alarm codes and meaning of those codes.
46. Safety aspects related to CNC VMC. CNC technology basics, Comparison between CNC VMC and conventional milling machines. Concepts of positioning accuracy, repeatability, CNC VMC machine elements and their functions - bed, chuck, Auto tool changer (ATC), ball screws, guide ways, LM guides, coolant system, hydraulic system, chip conveyor, rotary table, pallet changer, console, spindle motor and drive, axes motors, encoders, control switches, Feedback, CNC interpolation, open and close loop control systems, Machining operations and the tool paths in them - Face milling, Side milling, Pocket milling, Drilling, Counter sinking, Rigid tapping, floating tapping Reaming, Rough boring, Finish boring, Spot facing.
47. Concept of Co-ordinate geometry & polar coordinate points, concept of machine axis, axes convention on CNC lathes, work zero, machine zero, Converting part dimensions into coordinate system points. Absolute and incremental programming, Programming - sequence, formats, different codes and words, ISO G and M codes for CNC milling. Canned cycles for drilling, peck drilling, reaming, tapping, finish boring, Subprograms, Cutter radius compensation (CRC)and why it is necessary, cutting tool materials, application of various materials, cutting tool geometry for face mill, end mill, drill, countersink, tap, finish bore, reamer. Insert holding methods face mill, insert type end mill and insert type drill. Insert cutting edge geometry, Cutting parameters- cutting speed, feed rate, depth of cut, Tool wear, tool life, relative effect of each cutting parameter on tool life, Selection of cutting parameters from a tool manufacturer's catalog for various operations,

Writing part programs as per drawing & check using CNC program verification software, Process planning, work holding, tool and cutting parameters selection according to the part geometry and dimensions, Collisions due to program errors, effects of collisions. Costs associated with collisions - tool breakage, machine damage, injuries.

48. Program execution in different modes like manual, single block and auto, Process planning & sequencing, tool layout & selection and cutting parameters selection, Work offset, tool length offset, tool radius offset, Work holding with temporary holding and fixtures. Truing of part and fixture, Machine operation modes - Jog, MDI, MPG, Edit, Memory, Entering and editing programs on machine console, entering offsets data in offsets page, Use of Emergency stop, Reset, Feed rate override, spindle speed override, edit lock on/off buttons and keys.
49. Tool wear and necessity for wear offsets change, entering wear offsets in offsets page, Effects of sudden machine stoppage due to power shutdown or use of emergency stop, restarting machine from sudden stoppage, means of program transfer through electronic media, Productivity concepts, cycle time, machine down time, causes of down time-breaks, machine breakdown, inspection, part loading and unloading, chip cleaning, Effect of down time on profitability, reducing down time. Machine hour rate, components of machine hour rate-principal repayment, interest, overheads (power, tooling, space, salaries, indirect expenses). Calculation of machining cost, cost of down time.
50. Machine productivity concepts – cycle time, down time, cycle time estimation, Costing - machine hour rate, machining cost, tool cost, cost of down time, Importance of Technical English terms used in industry. Technical forms, process sheet, activity log, job card, in industry-standard formats, Lubricating system-types and importance.
51. Maintenance: Definition, types and its necessity, System of symbol and colour coding. Possible causes for failure and remedies.
52. Calculations for cutting helical slab/cylindrical cutter, Calculations for cutting End Mill cutter.
53. Bevel gear-elements, types, application, calculation for cutting bevel gear.
54. Cam-types, elements & application, Platecam-manufacturing & calculations. Drum cam- its calculation, advantages, types of follower & its purposes.
55. Worm wheel-application, elements & calculation, Worm- calculation.
56. Types of Keys and their uses. Variation - types and causes. Testing of Gear and error.

Practical:

1. Safety attitude development and use of Personal Protective Equipment (PPE), First Aid Method and basic training, Safe disposal of waste materials like cotton waste, metal chips/burrs etc., Hazard identification and avoidance, Identification of safety signs for Danger, Warning, caution & personal safety message, Preventive measures for electrical accidents & steps to be taken in such accidents, Use of fire extinguishers, Practice and understand precautions to be followed while working in fitting jobs, Safe use of tools and equipment used in the trade.
2. Study the drawing to plan the job/ work. Identification of tools & equipment's as per desired specifications for marking, filing& sawing, Visual inspection of raw material for rusting, scaling, corrosion etc., Familiarization of bench vice, Filing-Flat and square (Rough finish), Marking with scriber and steel rule, filing

practice, surface filing, marking of straight and parallel lines with odd leg callipers and steel rule.

3. Marking out lines, gripping suitably in vice jaws, hack sawing to given dimensions, sawing different types of metals of different sections, Marking practice with dividers, odd leg callipers, scriber and steel rule (circles, arc, parallel lines).
4. Grinding, centre punch, dot punch, chisel and scriber, marking off straight lines and arc using scribing block and dividers, Marking, filing, filing square and check using try-square.
5. Marking according to drawing for locating, position of holes, scribing lines on chalked surfaces with marking tools, finding centre of round bar with the help of 'V' block and marking block, prepare mushroom head and round bar and bending metal plate by hammering, Marking using scale, surface gauge and angle plate.
6. Chipping flat surfaces along a marked line, make a square from a round job by chipping up to 20mm length, Slot, straight and angular chipping, Mark off and drill through holes, Drill and tap on M.S. flat, cutting external thread on M.S. rod using Die, Punch letter and number (letter punch and number punch), Counter sinking, counter boring and reaming with accuracy +/- 0.04 mm, Drill blind holes with an accuracy 0.04 mm, Form internal threads with taps to standard size (blind holes). Prepare studs and bolt.
7. Make Male & Female 'T' fitting with an accuracy +/- 0.2 mm and 1 degree. Make male female square fit with accuracy +/- 0.1 mm, Make Male & Female Hexagon fitting with accuracy +/- 0.06 mm, Make Male & Female 'T' fitting with an accuracy +/- 0.2 mm and 1 degree. Make male female square fit with accuracy +/- 0.1 mm, Make Male & Female Hexagon fitting with accuracy +/- 0.06 mm.
8. Identify & function of different parts of lathe. Practice on operation of lathe (dry/idle run), Setting lathe on different speed and feed, Dismantling, assembling & truing of 3-jaw & 4-jaw chucks, Grinding of R.H. and L.H. tools, V- tool, parting tool, round nose tool, checking of angles with angle gauge/ bevel protractor, Grinding of "V" tools for threading of Metric 60-degree threads.
9. Perform facing operation to correct length, Centre drilling and drilling operation to required size, perform parallel turning and step turning operation.
10. Perform drilling, boring and undercut operation, parting, grooving, chamfering practice.
11. Measurement with steel rule and outside calliper with an accuracy of ± 0.5 mm, Perform different Knurling operation in lathe with accuracy of ± 0.5 mm, Perform Drilling & boring of blind hole with an accuracy of± 0.3 mm, Make taper turning by form tool with an accuracy of 1 degree, Make taper turning by compound slide swivelling with an accuracy of ± 30 minute, Make taper by off-setting tailstock with an accuracy of ± 30 minute, Checking taper by Vernier Bevel Protractor and sine bar & slip gauge.
12. Cutting V thread (internal) in a lathe and check with Screw Pith Gauge, Fitting of male & female threaded components.
13. Identification of slotting machine parts & its construction, use of rotary table. Practice on slotting key ways on pulley with accuracy +/- 0.04 mm, slotting a double ended spanner with accuracy +/- 0.1 mm, cutting sprocket teeth on slotting machine with accuracy +/- 0.04 mm, Cutting internal spline on slotting machine with accuracy +/-0.04 mm.
14. Identification of milling machine. Demonstrate working principle of Milling Machine. Set vice & job on the table of Milling Machine, Set arbor on the spindle of milling machine. Set the cutter on arbour. Safety points to be observed while

working on a milling machine, Demonstrate Up Milling and Down Milling Process. Sequence of milling six faces of a solid block. Check the accuracy with the help of try-square and vernier height gauge, Perform Step milling using side and face cutter checking with depth micrometer. Perform slot milling using side and face cutter Milling Machine with accuracy +/-0.02 mm, make concave surfaces with an accuracy +/-0.02 mm. Make convex surfaces with an accuracy +/-0.02 mm. Straddle milling operation with an accuracy +/-0.02 mm. Gang milling operation with an accuracy +/-0.02 mm.

15. Make Dovetail fitting (male & female) on Milling Machine with an accuracy +/-0.02, Make T-Slot fitting (male & female) on Milling Machine with an accuracy +/-0.02 mm.
16. Demonstrate indexing head. Set and align indexing head with reference to job on milling machine. Make square job by direct/ simple indexing method with an accuracy +/-0.02 mm, Make hexagonal job by simple indexing method with an accuracy +/-0.02 mm.
17. Checking of alignment of lathe centres and their adjustments. Turning practice-between centres on mandrel (gear blank) with an accuracy +/-30 minute. Taper turning by swivelling the cross slide, make square thread (external) on a lathe with an accuracy +/-0.02 mm, make square thread (internal) on a lathe with an accuracy +/-0.02 mm, check with thread gauge – grinding of tool & setting in correct position. Fitting of male & Female Square threaded components. Make multi-start V thread on lathe with Screw Pitch gauge, perform eccentric turning with an accuracy +/-0.02mm.
18. Identification of different types of grinding machine, Wheel balancing & truing. Dressing of grinding wheel. Grinding of block(Six sides) by surface grinding machine with an accuracy of +/- 0.01mm, surface grinding machine with an accuracy of +/- 0.01 mm. Grinding of slot block by surface grinding machine with an accuracy of +/- 0.01 mm. Set and perform angular grinding using universal vice/ sign vice to standard angle. Make slide fit with an accuracy ± 0.01mm (male female), Perform form grinding sake dovetail fitting with an accuracy ± 0.01mm (male & female).
19. Cylindrical grinding- External parallel cylindrical grinding (Both holding in chuck/ collet and in between centers, Plunge grinding Perform straight bore grinding , Perform step bore grinding , Internal taper bore grinding , Make male female fitting with an accuracy of +/- 0.01 mm, External step cylindrical grinding with an accuracy of +/- 0.01 mm, External taper cylindrical grinding with an accuracy of +/- 0.01 mm, Make Internal Grooving using milling Machine with an accuracy 0.02 mm. Make Straight Teeth Rack using Milling Machine with an accuracy 0.05 mm. Make Helical Teeth Rack using Milling Machine with an accuracy 0.05 mm one straight rack. Measurement of teeth by Vernier Gear Tooth Calliper Make spur gear using Simple indexingwith an accuracy 0.05 mm. Make spur gear using differential indexing with an accuracy 0.05 mm.
20. Perform Boring operation on Vertical Milling Machine with an accuracy 0.05 mm, make helical gear on milling machine with an accuracy 0.05 mm, make straight flute milling on Milling Machine with an accuracy 0.05 mm, Make helical flute on Milling Machine with an accuracy 0.02 mm.
21. Measure Current, Voltage and Resistance using Simple Ohm`s Law Circuit and Familiarizing Multi-meter. Soldering Techniques, Step up and step -down transformers. Working with Solenoids and Relays. Working of Motor & Generators. Behaviour of Proximity Sensors. Behaviour of ultrasonic sensors.

Logical Operation of Sensors. Limit & Level Control using Sensors. Interfacing of Sensors with Electrical Actuators.

22. Know rules of personal and CNC machine safety, safe handling of tools, safety switches and material handling equipment using CNC didactic/ simulation software and equipment, Identify CNC lathe machine elements and their functions, on the machine, Understand the working of parts of CNC lathe, explained using CNC didactic/ simulation software. Identify machine over travel limits and emergency stop, on the machine, decide tool path for turning, facing, grooving, threading, drilling, Identification of safety switches and interlocking of DIH modes.
23. Identify common tool holder and insert shapes by ISO nomenclature. Select cutting tool and insert for each operation, fix inserts and tools in tool holders, decide cutting tool material for various applications, Select cutting parameters from tool manufacturer's catalogue, Write CNC programs for simple tool motions and parts using linear and circular interpolation, check on program verification/ simulation software.
24. Write CNC part programs using canned cycles for stock removal, grooving, threading operations, with drilling and finish turning, Use TNRC commands for finish turning. Check simulation on program verification/simulation software, avoiding collisions caused by program errors, knowing causes and effects of collisions due to program errors, by making deliberate program errors and simulation on program verification/simulation software.
25. Conduct a preliminary check of the readiness of the CNC lathe - cleanliness of machine, functioning of lubrication, coolant level, correct working of sub-systems, on the machine, Starting the machine, do homing on CNC simulator, Entering the CNC program in EDIT mode for an exercise on Simple turning & Facing (step turning) without using canned cycles, on CNC simulator, Mounting jaws to suit the part holding area on CNC machine, Mounting tools on the turret according to part and process requirement, on CNC simulator &on CNC machine, Perform Work and tool setting: Job zero/work coordinate system and tool setup and live tool setup, Determining work and tool offsets using JOG, MDI, MPG modes, on CNC simulator, Entering the tool offsets, tool nose radii and orientation for TNRC in offsets page, on CNC simulator.
26. Program checking in dry run, single block modes, on CNC simulator & CNC machine, Absolute and incremental programming assignments and simulation, Checking finish size by over sizing through tool offsets, on CNC simulator, Prepare part program and cut the part in auto mode in CNC machine for the exercise on Simple turning & Facing (step turning), Recovering from axes over travel, on CNC simulator, Part program writing, setup, checking and Automatic Mode Execution for exercise on Turning with Radius/ chamfer with TNRC on CNC machine, Part program writing, setup, checking and Automatic Mode Execution for exercise on Turning with TNRC, grooving and threading, on CNC simulator & on CNC machine.
27. Checking finish size by over sizing through tool offsets, on the machine, Machining parts on CNC lathe with combination step, taper, radius turning, grooving &threading, with external and internal operations, first and second operation, on the machine, Machining long part on CNC lathe held in chuck and tailstock (between centers), Starting from interruption due to power shutdown, tool breakage, Changing wear offsets to take into account tool wear, Part program preparation, Simulation & Automatic Mode Execution of CNC Machine for the

exercise on Blue print programming contours with TNRC, Carryout Drilling/Boring cycles in CNC Turning.

28. Know rules of personal and CNC machine safety, safe handling of tools and material handling equipment, Using CNC didactic/ simulation software and equipment. Identify CNC vertical machining center machine elements and their functions, on the machine, understand working of parts of CNC VMC, explained using CNC didactic/ simulation software, identify machine over travel limits and emergency stop, on the machine, decide tool path for Face milling, Side milling, Pocket milling, Drilling, Counter sinking, tapping, Reaming, Rough boring, finish boring, Spot facing.
29. Identify common tools, tool holders and inserts, Select cutting tool, insert and holder for each operation, fix inserts and tools in tool holders, decide cutting tool material for various applications, Select cutting parameters from tool manufacturer's catalog, Write CNC programs for simple parts using linear and circular interpolation, absolute and incremental modes, check on program verification software.
30. Write CNC part programs for parts with face milling, pocket milling with subprograms. Check on program verification software. Write CNC part programs for pocket milling, drilling with canned cycle, countersinking with canned cycle, tapping with canned cycle. Check on program verification software. Avoiding collisions caused by program errors. Knowing causes and effects of collisions due to program errors, by making deliberate program errors and simulation on program verification software.
31. Conduct a preliminary check of the readiness of the CNC VMC - cleanliness of machine, functioning of lubrication, coolant level, correct working of sub-systems, On the machine. Starting the machine, do homing on CNC simulator, Entering the CNC program in EDIT mode for an exercise on face milling and drilling without using canned cycles, on CNC simulator, Mounting tools on the ATC according to part and process requirement, on CNC simulator & CNC machine, Determining work and tool offsets using JOG, MDI, MPG modes, on CNC simulator& CNC machine, Tool change in CNC milling and JOG, MDI, MPG mode operation, Entering the work offset, tool length offsets, tool radii and, on CNC simulator.
32. Program checking in dry run, single block modes, on CNC simulator, Checking finish size by over or under sizing through tool offsets, on CNC simulator, Prepare part programme, enter, edit and simulate, Carryout tool path simulation, Recovering from axes over travel, on virtual machine simulator, Part program writing, setup, checking and Automatic Mode Execution for exercise on side milling with CRC, on CNC simulator & CNC machine, Part program writing, setup, checking and Automatic Mode Execution for exercise on face milling, drilling, countersinking, tapping using canned cycle, on CNC simulator & CNC machine, Automatic mode execution of CNC Machine Exercises with Block Search and restart. Mounting clamps, locators, supports, truing part and fixture.
33. Machining parts on CNC VMC with combination face milling, side milling with CRC, drilling, countersinking, tapping, Use canned cycles and subprograms wherever possible, Machining of part with closely controlled slot dimension using CRC, Machining of part with pockets, End milling with polar co- ordinates, Part programs & Simulation Automatic Mode Execution of CNC Machine for the exercise on End milling with polar co- ordinates and practical on Simple drilling -G 81, Determining and entering wear offsets. Restarting machine from power shutdown or sudden stoppage, Program transfer to machine through electronic

media – USB and flash drive, Merging the work zero with program zero-point, geometry and wear offset correction, Practical on Chamfer and counter-sink drilling, Carryout Deep hole drilling G 83, Perform Threading and tapping G 84.

34. Carryout Boring cycles G 85 - G 89. Preparations of part programs for thread cutting/thread milling for CNC machining centres, drilling milling patterns, Thread milling etc. Circular and rectangular pockets machining, Calculation of machine hour rates for typical CNC lathe and VMC. Estimation of cycle time for parts with face milling, side milling, drilling, tapping operations.
35. Inspection of Machine tools such as alignment, levelling etc., Accuracy testing of machine tools such as geometrical parameter, Cutting teeth on helical slab/ cylindrical cutter and end mill cutter with an accuracy of +/- 0.05 mm, Cutting bevel gears on a milling machine with an accuracy of +/-0.05 mm, Cutting a plate cam with angular setting in milling machine with an accuracy of +/-0.05 mm, Cutting worm wheel on a milling machine with an accuracy of +/- 0.05 mm, Cutting worm thread on a milling machine with an accuracy of +/- 0.05 mm.

10.Syllabus for MECHANIC REFRIGERATION AND AIR CONDITIONER Trade-for the post of Instructor.

Theory:

1. History of Refrigeration and Airconditioning, Function, use and specifications of refrigeration tools, instruments and equipment, Grooming of technicians.
2. Fitting-Different types of Fitting hand tools, power tools their use, Function, construction, Specification & their application. Machineries and equipment used in fittings like drilling machines, grinding machines – types, specifications and care and maintenance. Precision measuring instruments–Function, construction, Specification & their application.
3. Sheet Metal-Function, construction, working, use, and application, specification of Sheetmetal tools, instruments and equipment, Care and maintenance of tools, Types of sheet metal joints (cold and hot) and their use, Rivet & riveting- their types and use. Solder and its composition.
4. Electrical-Electrical terms such as AC and DC supply, Voltage, Current, Resistance, Power, Energy, Frequency etc., Safety precautions to be observed while working on electricity. Conductors and Insulators, Materials used as conductors, Series and parallel circuit, open circuit, short circuit, etc., Measuring Instruments such as voltmeter, ammeter, ohm meter, watt meter, energy meter and frequency meter. Earthing and its importance. Earth resistance, Insulation and continuity test, Inductors and capacitors, Effects of inductor and capacitors in an AC circuit, Inductive reactance, capacitive reactance, Impedance and power factor. Lagging and leading power factors. Single phase and Three phase supply system, Star and Delta connection and their comparison. Line voltage, Line current, Phase voltage and Phase current. Methods of improving power factor.
5. Electronics- Introduction to Electronics, Basic Principles of semiconductors,

Principles and application of Diodes, Solder–its composition and paste, Rectification, Zener diode as voltage regulator–transistors parameters-CB, CE, CC, configuration, amplification. SCR Photo diodes, photo transistors, multi – vibrator, CR & LR circuit, SCRs, UJTs, ICs.

6. Welding-Introduction to basic principles of commonly used Welding processes, oxy fuel gas welding / cutting, brazing & soldering, nozzles, base metal and filler metal, Use of flux, Welding tools and equipment type specification and use, Safety method in welding, Method of gas welding, gas used and flames adjustment and pressure setting of O2 and DA, Difference between soldering and Brazing in terms of temperatures, filler materials, joint strengths and applications, Use of Oxy Acetylene, Oxy LPG, Air LPG and two stage regulator for brazing/soldering. Description of back fire arrester.
7. Basic Refrigeration-Basic principle of refrigeration, working, use, specifications of refrigeration tools, instruments and equipment. Fundamentals of Refrigeration, units and measurements, Pressure & its Measurements, 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– LiBr combination. Study the construction and working of vapor compression cycle, low side & high side of vapour compression system., Applications of vapour compression cycle, Coefficient of Performance (COP), Ton of Refrigeration, Construction and working of V.C Cycle, fundamental operations, sub cooling and super heating. Study of Ph, Ts, Pv diagram.
8. Refrigerator (Direct cool)- Function, construction, working of single door direct cool refrigerator, specifications, troubleshooting, care and maintenance, Requirement of Vacuum and level of vacuum, Study the construction & working of direct cool Refrigerator, Study the electrical components of refrigerator, Study the mechanical components of refrigerator and their types, Study the heat exchanger, door gaskets, Heat Insulation materials. Care and maintenance of refrigerator, Importance of flushing in evaporator and condenser, use of dry nitrogen for flushing, necessity of replacing capillary and drier. Evacuation, leak testing, gas charging method in refrigerator, Refrigerants used in Refrigerators and its properties. Desiccant drying agent.
9. 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
10. Refrigerator (Inverter Technology) Study the construction and its working of two and three door frost free refrigerator, Care and maintenance, installation method.
11. Compressor-Function, construction, working, application of compressor, (Fixed speed and variable speed compressor) like Reciprocating, rotary, scroll and inverter type.
12. Study the construction & working of reciprocating, rotary, scroll, screw and centrifugal compressor, wobble & swash plate compressor, Compressor efficiency factors, wet compression, oil, properties, lubrication methods, AC motors and their types. Advantages of AC motor over DC motor, Revolving field

theory, Phase splitting theory, Capacitor method and inductor method used to split the single phase, Torque –starting torque and running torque, Split phase induction motors, working principle and construction.

13. Starting winding and running winding, starting current and running current, Method of changing the direction of rotation, (DOR), Capacitor starts induction run motor, working principle and construction.
14. Centrifugal switch and its function, Starter and its necessity, DOL starter and the safety devices incorporated in it, Description of hermetic compressor motor, Capacitor starts capacitor run motor, working principle and construction. Starting capacitor and running capacitor Shaded pole motors, working principle and construction, Torque comparison among various single-phase AC motors. Common faults, causes and remedies in motors.
15. Motors-Motors used in refrigeration And Air conditioning system, types, construction, working & their starting methods, Function of Starting relay, Capacitors, OLP's, Production of rotating magnetic field by three phase AC supply. Working principle of three phase induction motor, Terms such as torque, slip, rotor frequency and their relation, Construction of squirrel cage induction motor. Importance of phase sequence, Construction of slip ring induction motor Comparison between SCIM and SRIM, Three phase motor starters such as DOL starter, Star – Delta starter, Auto transformer starter and Rotor resistance starter. Common faults, causes and remedies in three phase AC motors
16. Working principle of inverter technology, advantages of variable speed technology over fixed speed, Working principle of control system for inverter Air Conditioners (ACs). Printed circuit board (PCB), including power PCB, filter PCB, heat sink and reactor, Wiring diagram.
17. Condenser-Function of condenser, types, Construction of air-cooled condenser. Effect of chocked condenser. Advantages, de scaling of air-cooled condenser. Effects of air fouling and bypass air in condenser, Types of water-cooled condenser, application, and advantages. Liquid receiver, pump down, application, types, function and working, Description of water-cooled condenser.
18. Drier-Function of drier, types, application and its advantage, Description of desiccants.
19. Expansion Valve-Expansion valve used in domestic refrigeration and air conditioning systems, Capillaries, Automatic and Thermostatic Ex. Valves, and electronic expansion valves.
20. Evaporator-Working principle, Function, types of evaporators used in refrigerator, water coolers, bottle coolers, window and split A.C, Super heating in evaporators, Function of accumulator and types, Methods of defrosting.
21. Refrigerant-Classification of refrigerants, nomenclature of refrigerants including chemical name and formulas, hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and hydro Fluor olefins (HFOs), blends of HFCs and blends of HFCs/HFOs. Climatic impact of 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 of refrigerants; environment related properties: Ozone Depleting Potential (ODP), GWP; ODP and GWP of various refrigerants, thermo chemical properties: flammability and toxicity of refrigerants, lower flammability limit

(LFL) and upper flammability limit of A3 and A2L refrigerants, Thermo physical properties: pressure temperature of different refrigerants.

22. Safe handling of flammable refrigerants-Refrigerant leak detection methods, evacuation and charging of refrigerant, temperature glides of refrigerant blends, procedure of charging of refrigerant blends especially the zeotropic blends, hydrocarbon blends, HFC blends (R- 404A, R-407C, R-410A) and blends of HFC/HFO.
23. Retrofitting- Changes of components & practices while retrofitting CFC appliances with HC Refrigerants, Properties of HCs.
24. Thermal Insulation-Function, types, thermodynamic properties of heat insulation materials used in refrigeration and Air Conditioning systems. Introduction of polyols and foam blowing agents (HCFC-141b, cyclopentane, water, C02, methyl formate, HFO-1233zd(E), HFO-1336mzz(Z)).
25. Window Air Conditioner- Study of construction and working principle of window AC andits components; electrical controls and wiring. Installation, troubleshooting and servicing, Energy Efficiency Ratio (EER) - Energy-efficiency labelling on ACs.
26. Installation of Window AC -Advantages of proper installation of window AC with emphasis on proper functioning and avoidance of leakage of refrigerant. Selection of installation location considering safety, exclusive availability of power point and obstruction-free air flow from condenser. Step by step procedure for proper installation, and proper inclination of AC cabinet backward/out ward for drainage of condensate.
27. Split AC-Construction and working principle, types, troubleshooting& care and maintenance, Energy Efficiency Ratio (EER) - Energy-efficiency labelling on ACs, Advantages of proper installation with emphasis on proper functioning and avoidance of leakage of refrigerant, Selection of location of indoor and outdoor units ensuring minimum distance between the units, away from flammable materials, if any, good air flow within the cooling space as well as over the condenser. Locate power supply point considering safety and exclusiveness, Step by step procedure for installation both for indoor and outdoor unit. Ensure convenient access for drainage of condensate from the cooling coil.
28. Split AC (Wall Mounted) -Construction and working principle, types, trouble shooting, Description of electrical components used in split A.C., Study the wiring circuit.
29. SPLIT A.C. (floor, Ceiling/Cassette mounted Split A.C)- Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C., Study the wiring circuit.
30. 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.
31. MULTI SPLIT A.C-Study the construction and working, various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, troubleshooting.
32. 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 Seasonal Energy Efficiency Ratio ISEER). Energy Efficiency levelling on inverter AC.
33. CAR AIR CONDITIONING-Study various components, electrical circuits and wiring diagram, testing components, fault detection, leak testing, Study of good

service practice, evacuation, gas charging, Installation, trouble shooting, Magnetic clutch operation, free movement of flywheel (non-functioning of clutch), care and maintenance.

34. COMMERCIAL COMPRESSOR- (Fixed& Variable)-Function, types, Construction & working, applications of compressors used in commercial refrigeration. Volumetric efficiency, Capacity control, factor influencing volumetric efficiency, 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 and Sealed type) (Reciprocating, centrifugal, screw, scroll compressor).
35. WATER COOLED CONDENSER-Study the water-cooled Condenser, its type and capacity, construction and working, de scaling, application.
36. Evaporative condenser- Types and their function, construction and application. Liquid receiver, function. Drier, types and application.
37. COOLING TOWER-Cooling tower,types, Construction, capacity, advantage & disadvantages of different types of cooling tower. Efficiency, approach and Cooling tower range.
38. WATER TREATMENT- Necessary, causes of water contamination control of scale deposit, corrosion and algae, Water softening and De-scaling method, pump and fan used. Regenerate and backwash.
39. EXPANSION VALVE-Types and function, construction, working principle, & their advantage & disadvantages, Thermostatic Expansion Valves (TXV), Automat Expansion Valves (AXV), Float valves, fixed and modulating orifice controls & electronic Expansion Valves, LMC (level master control), Selection of Expansion valves and capillaries for various Refrigeration and Air Conditioning applications.
40. EVAPORATOR-Function, types, Plate & Tube forced air DX evaporators, Types of Defrost system, Water/ Brine chillers, Types of brine used as secondary refrigerant. Accumulator, its function.
41. Liquid-suction-liquid Heat-exchanger, their function, construction, application & advantages, Study of Accumulator and Oil separator.
42. WATERCOOLER &WATER DISPENSER-Study the refrigeration cycle of water cooler and dispenser, types, construction & working, Capacity & applications. Study the electrical and mechanical components of storage type water cooler and Bubble type water dispenser, Insulation material used in water cooler and dispenser, refrigerant used in the system. UV and RO type water coolers and dispensers.
43. VISIBLE COOLER AND BOTTLE COOLER-Visible cooler & bottle coolers. Description, construction & working, with HFC-134a and hydrocarbons, safety especially for flammable refrigerants, maintenance, testing of mechanical and electrical components including sealed electrical components fitted in appliances using flammable refrigerants.
44. DEEP FREEZER/DISPLAY CABINET-Description, Construction, working, specifications, function, care and maintenance, faults and remedies.
45. ICE CUBE MACHINE-Description, Construction, working, reverse cycle functioning & Circuit diagram, installation method.
46. SOFTY MACHINE -Description, Construction and function.
47. ICE CANDY PLANT-Function, construction, working principle, Circuit diagram, capacity & types of compressors used. Brine composition to maintain required temperature. Operation, maintenance, retrofit.
48. ICE PLANT-Details about components of Ice plant their functioning, working

principle, Circuit diagram, capacity & types of compressors used, agitator functioning, temperature maintaining, Properties and handling of ammonia and other flammable low-GWP refrigerants.

49. WALK IN COOLER & REACH IN CABINET-Details about components, their functioning, working principle, Circuit diagram, capacity & types. Care and maintenance.
50. 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 in different places. Types of cold storage and its details, Properties of commonly used refrigerants like ammonia and its safe handling, Cold storage- type construction, capacity and specification. Use of vibration eliminator and shock absorber, Study the lay out and electric wiring of the storage plant, Mobile refrigeration in transport vehicles.
51. Method of pressure testing, evacuation & charging to the system and testing efficiency, Cold storage plant operation, its common trouble & remedies, Deep freezing, freezing tunnel, blast freezer its function and working, its application.
52. 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, dew point, and specific humidity.
53. 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.
54. DUCT-Function, types, materials, duct designing, duct insulation, properties of insulating materials 'K' factors, Acoustic insulation, air distribution methods, air flow, AHU,FCU, fan, blower.
55. AIR FILTERS-Function of air filters, types, construction, maintenance, effect of chocked Air filter, Hepafilters.
56. PACKAGE AC (with Air Cooled Condenser)-Study the Package AC (with Air Cooled Condensers), its Construction and working principle, types, trouble shooting. Study Package AC, types, construction and working principle, trouble shooting, and various applications. Duct system, AHU, Careand maintenance, Installation method.
57. SPLIT PACKAGE-Construction and working principle, types, Study various electrical and mechanical components, trouble shooting.
58. CENTRALISED/INDUSTRIAL AIRCONDITIONING-Construction and working principle, types, maintenance of Industrial Air-conditioning plant. Humidification and dehumidification methods. AHU, description of FCU, Temperature and pressure controls used in AC plant, its construction, working, safety devices, cooling towers, piping lines.
59. DIRECT EXPANSION SYSTEM-Study Direct expansion system. Operation & Preventive Maintenance Schedule of central AC plant. Maintain log book for daily operation.
60. VRF / VRV system–description and function of different parts. Details of piping have and controls system, Common reason for error code, types of ODU and IDU.
61. INDIRECT/CHILLER SYSTEM-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.
62. Study of Humidification & De-humidification, Humidifiers & De-humidifiers.

Humidity control. Use of hygrometer.

63. Construction and study of commercial A.C plant, package chillers, screw chillers, reciprocating chillers.
64. Controls used in AC system, Electromechanical, pneumatic and electronic.
65. Detail study of heat load calculation for commercial and industrial buildings.
66. MOBILE AC (Bus, train)- Study there frigeration cycle in automobile AC, its Construction, working of bus AC, Magnetic clutch operation, freewheeling (de engaging clutch). Refrigerants used HCFC- 22,HFC-134a,HFOs,blends of HFCs and HFOs.
67. Construction & working of train AC and its operation. Trouble shooting in train A.C.
68. Planning for Preventive maintenance and scheduling of maintenance activities in large AC and Refrigeration plant.

Practical:

1. Identify workshop & machineries, Demonstrate Safety precautions and First aid, demonstrate firefighting, demonstrate working at height using PPE's and identify the hazards and take personal safety precautions, Identify general tools, instruments &equipment. Care and maintenance of tool, instruments and equipment, perform flat filing, marking, punching and hack sawing to make a job as per drawing, perform flat filing, marking, punching, hack sawing, drilling, tapping, reaming, dieing to make a job as per drawing and check using precision measuring instruments Viz. Vernier calliper, Micrometer, etc.
2. Perform Sheet Cutting by straight snip as per drawing, Perform Sheet Cutting by bent snip as per drawing, Bend, fold and join metal sheets in different process. Join sheet metal by using rivet set and snap. Solder sheets of metal. Prepare a box or funnel with sheet metal as per drawing.
3. Demonstrate Electrical safety precautions and First aid, Identify, use and maintain electrical tools, Prepare simple twist joints of wires, Prepare married joints of wires, Measure current, voltage, resistance, power, frequency, energy using analog and digital meter through a single-phase circuit, Test insulation and earth resistance using Megger, Star & Delta connection on a three-phase motor and show line voltage, line current, phase voltage and phase current, Three phase power & power factor measurement.
4. Identify electronic components, tools & instrument, Colour coding of resistors, Verify Ohm's Law, use voltmeter, ammeter and multimeter, Practice soldering & de- soldering, identify transistors, resistors, capacitors, diodes, S.C.R., U.J.T., amplifier and I.C., Construct and test full wave rectifier using diodes, Construct and test a bridge rectifier, Construct and test series voltage regulator circuit, Construct and test power supply using fixed voltage regulator Ics. Identify and test SCR, Construct and test an electronic timer using UJT & SCR, Apply OP-AMP, photo transistor and test performance, identify gas welding equipment& accessories, demonstrate safety precaution in handling of Oxy-acetylene cylinders, regulators etc., Setting up of AIR-LPG, O2-LPG and O2-C2H2 using can type portable flame set, Oxy-acetylene gas welding, brazing and cutting on thin sheet metal.
5. Demonstrate Care & Safety of welding tools and equipment, Back fire arrester, Set Oxy-acetylene plant, use two stage regulator, adjustment of flame, gas pressure – O2 and DA, perform brazing between Cu to Cu and Cu to MS, Cu to aluminium pipes, join metal plates by using gas welding (lap joint, butt joint, etc.).

6. Basic Refrigeration-Identify & use of general hand tools, instruments & equipment used in refrigeration work, Identify & use of special tools, instruments &equipment used in refrigeration work, Demonstrate Care & Safety of welding tools and equipment, Back fire arrester, Identify various refrigeration equipment and components of vapour compression system like compressor, condenser, expansion device and evaporator, Identify and Check vapour absorption refrigeration cycle (VARC), Set Oxy-acetylene plant, use two stag regulator, adjustment of flame, gas pressure – O2 and DA, Perform brazing between Cu to Cu and Cu to MS, Cu to aluminium pipes, Join metal plates by using gas welding (lap joint, butt joint, etc.).
7. Unroll, cut and bend soft copper tubes, Swage and make a brazed joint on copper tubing, make flare joints and test them with flare fittings, pinch off copper tubing, use lock ring tool and various fittings of lock ring for servicing of appliances Brazing of Cu to Cu, Cu to steel, Cu to brass using AIR LPG suitable in RAC machine, Brazing of Cu to Cu, Cu to steel, Cu to brass using Oxy- LPG. Brazing of Cu to Cu, Cu to steel, Cu to brass using Oxy- Acetylene.
8. Refrigerator (Direct cool)-Identify electrical and mechanical components of refrigerator, Check and replace electrical components of refrigerators, Leak test, evacuation, gas charging in refrigerators, Wiring circuit of refrigerator. Installation of refrigerator, identify electrical components of direct cool refrigerator, Identifymechanical components of direct cool refrigerator, Installation of refrigerator. Checking door alignment, adjustment of door switch operation & replacing of gaskets, Tracing the mechanical components of refrigerator, Check, Find Fault and test the electrical and other system components of refrigerator, Testing of compressor. Identification of motor terminals, start of compressor with and without relay, Test performance of direct start refrigerator, Cleaning and flushing of evaporator and condenser with dry nitrogen, Replacement of capillary tube and drier, Installation of gauge manifold in the system, Leak testing, evacuation and gas charging in refrigerator, Check electrical wiring of refrigerator.
9. Frost Free Refrigerator- Tracing electrical circuit of Frost-Free refrigerator, Checking, fault finding and testing of electrical accessories like thermostat, timer, defrost heaters, bi-metal, air louvers etc. and other system components, checking air distribution system, Servicing of refrigerator, Testing the performance of refrigerator.
10. Refrigerator (Inverter Technology)-Identify three and four door no frost refrigerator, stripping of components, Tracing electric circuit, Testing components, Leak testing, evacuation, gas charging.
11. Acquainting with hermetic compressor of Refrigerator or window type AC., Cut the compressor and dismantle, identify different compressor and Service it, lap necessary parts and cut the gasket, Assemble the compressor with the new gasket.
12. Dismantle rotary / wobble plate/ swash plate/scroll compressor, identify different parts of dismantled compressor, Rectify defects and repair accordingly.
13. Identify terminal sequence of hermetic compressor motor by using digital multimeter and start by DOL starter and measure starting current and running current by using ammeter and AVO meter, Identification of terminal sequence of CSIR motor by using digital multimeter and start by DOL starter and measure starting current and running current by using Ammeter and AVO meter. Direct start using ammeter and voltmeter.

14. Start CSR motor through DOL starter and measure starting current and running current and changing of DOR, start shaded pole motor through DOL starter and measure starting current and running current and changing of DOR, dismantle motor identify parts and assemble.
15. Select a hermetic compressor of any kind, Start the compressor motor by RSIR, CSIR, PSC & CSR method by using different type relay, capacitors, OLP's, etc., Check and Test different type relay, Capacitors, OLP's, find out fault, rectify and install.
16. Identify the terminals of a Squirrel cage induction motor, Start the motor through DOL starter and measure starting current, running current and show changing of DOR, Start the motor through Star Delta or Auto transformer starter and measure starting current, running current and show changing of DOR, Familiarise with Slip-ring induction motor and identify it's terminals, Start the Slip-ring induction motor through Rotor resistance starter and measure starting current, running current and show changing of DOR, Rectify fault through insulation test, continuity test, open circuit test and short circuit test.
17. Explain control circuit of variable speed air conditioners (Inverter ACs), Identify components of control system of Inverter ACs including printed circuit board (PCB) NTC,PTC e.g. Power PCB, Filter PCB, Heat sink reactor, Wiring of the control system.
18. Condenser- Familiarise with different types of condensers used in refrigerators, Bottle coolers, visible coolers, deep freezers, Window and Split AC, Clean, flush, service and leak test different type of air-cooled condensers, micro channel condensers. Remove dust from fins in air cooled condenser, micro channel condensers, identify with different types of water-cooled condensers like Shell and Tube type, Tube within tube type, shell, coil & evaporative type, etc., Identify different items necessary for de-scaling like diluted Hcl, Pump & motor, hose, etc., Dilute acid and water according to amount of scaling and perform de-scaling, Fit the pump motor with condenser and start. Take safety measure on concentration of acid which may damage tube, identify drier and capillary tube used in different cooling machines, Replace drier and capillary tube at the time of gas charging according to manufacturer's direction.
19. Expansion Valve- Install different diameter capillary tube used in different type of cooling machines, install with different types of expansion valves used in small cooling machines and central plant like Automatic expansion valve, Thermostatic expansion valve, hand expansion valve, and electronic expansion valves. etc., Test and adjust the expansion valves fitted with machines.
20. Evaporator- Identify and service different types of evaporators like plate and tube type, Fin and tube type, etc. fitted in refrigerators, bottle coolers, water cooler, Window and split AC, perform leak test, flush to remove oil by dry nitrogen, Demonstrate different type of defrosting in different machines.
21. Refrigerant- Identify and explain different colour code of different type refrigerant cylinder like HCFCs (HCFC-22, HCFC-123). HFCs (HFC-134a, HFC-32, R-410A, R- 407C and R-404A) and low- Global Warming Potential (GWP) refrigerants like ammonia, R-290, HFC-32, blends of HFCs (R-410A, R- 404A, R-407C etc.) and hydro Fluor olefins (HFOs: HFO- 1234yf, HFO-1234ze, HFO- 1233zd, HFO-1336mz), blends of HFCs and HFOs, Identify unknown refrigerant by its idle pressure using head pressure gauge, Recover refrigerant from a faulty machine, Transfer/ Recycle refrigerant from one cylinder to another using ice, Measure pressure-temperature of refrigerants including HCFC- 22, ammonia, R-290,

HFC-32, HFC-134a, R-404A, R-407C and R-410A, HFOs, Identify flammability and toxicity of A3and A2L of refrigerants.

22. Demonstrate safe handling of refrigeration cylinders, demonstrate handling of cylinder valves, good servicing practices on Test leak, evacuation and charge refrigerant in refrigerator by weight in capillary system, Recover CFC by recovery pump and cylinder on CFC filled domestic refrigerator.
23. Flush the system with dry nitrogen. Evacuate and charge hydrocarbons, Test and Use sealed component (Electrical) like thermostat, relay, overload protector etc., Identify insulating foam (polyurethane rigid foam and polystyrene), Fill with insulation material like PUF and glass wool, Pack insulation inside door panel and adjust gasket to prevent air leak.
24. Window Air Conditioner- Acquainting with electrical and mechanical components used in window air-conditioner, Acquainting with electrical components like selector switch, thermostat switch, relay, starting capacitor, running capacitor, overload protector, remote and PCB control, etc., Demonstrate working of mechanical components like compressor condenser, expansion valve (capillary) and evaporator, Trouble shooting, installation, tracing wiring circuit, Leak testing, evacuation and gas charging.
25. Installation of Window AC, Hands on practice on installation of window AC following step by step procedure, install gauge manifold in the system, show discharge pressure and sanction pressure during running time, Check performance of different parameters i.e., pressure, temperature, pull down time, air flow and current drawn.
26. Split AC-Identify various components of split AC like mounted, floor and ceiling mounted, duct able and multi split AC., Identify electrical circuits, test different components and fault finding, Leak testing of the system, evacuation and gas charging, Hands on practice on Installation and trouble shooting.
27. Identify various mechanical components used in car AC, Identify various electrical components used in electrical circuits in car AC, Testing of system components & fault finding, Install gauge manifold to check suction and discharge pressure in charging time and running time, Leak testing using dry nitrogen, evacuation and gas charging(HFC-134a, HFO-1234yf and blends of HFCs and HFOs), Installation and troubleshooting, Testing magnetic clutch, compressor overhauling, condenser cleaning and add refrigerant, Regular maintenance.
28. Commercial compressor (Fixed & Variable)-Familiarization with commercial type reciprocating compressor and centrifugal compressor, Dismantling and checking of compressor & accessories, Check and service valve plate and piston assembly, Lapping valve plate, Prepare gasket and refit, Check belt tension and replace, Check and test lubricating system, Servicing of filter and oil pump, Checking and servicing of capacity control of compressor, Measure power consumption of compressor with respect to the evaporator/condenser temperature variation, Checking and servicing of main end and rear end bearing and shaft seal assembly, Cutting gasket, Fitting and testing, Assemble compressor and Test overall efficiency.
29. Water cooled condenser- Servicing of water cooled condenser and receiver, Testing its performance by inlet and outlet pressure and temperature, Necessary repairing for tube leakage, De-scaling by diluted HCl to increase efficiency, Pump down the gas for necessary servicing and repairing, Servicing and repairing evaporative type condenser, Test efficiency of condenser, Servicing of natural draft, forced draft and induced draft cooling tower, Clean its nozzles, louvers,

sumps, strainers etc thoroughly, Remove algae and fungi from different parts, Assemble and test performance, Dismantle water circulating pumps, Identify different parts of pump, service the impeller of different types, Change or repair defective parts, Assemble and test performance.

30. Dismantle water circulating pumps, Identify different parts of pump, service the impeller of different types, Change or repair defective parts, Assemble and test performance, Identify automatic expansion valve, Fitting and checking its efficiency, Install and fitting of high side and low side float valves, Checking its efficiency, Identify extended surface forced air- cooled evaporators, Service air cooled evaporator by blower, Service water cooled or brine cooled chiller, Check de-frosting system and anti-freeze thermostat, Oil removing from coil.
31. Servicing of liquid-suction heat exchanger used in central plant, Service suction liquid heat exchanged used in small machines, Service accumulator and check its functionality, Service oil separator and check its functionality, Identify parts, control, electric circuit, accessories of storage type water cooler and Bubble type water dispenser, Solder copper tube on stainless steel, Trouble shoot of commonly faced problems like condenser fan motor failure, corrosion etc., Install gauge manifold, Leak test and refrigerant charging after evacuation, Installation, servicing and maintenance of water cooler and dispensers.
32. Visible cooler and bottle cooler -Checking and servicing of visible cooler and bottle cooler and its parts, Preventive maintenance and troubleshooting, Evacuation, flushing with dry nitrogen, Retrofit the machine with HFC 134a, R-600a, R- 290, Check wiring circuit, test components & replace, Install and Test performance of the machine.
33. Deepfreeze/ display cabinet-Checking and servicing of horizontal and vertical deep freezer/display cabinet and their different parts, Preventive maintenance and troubleshooting, Check wiring circuit, test and replace defective components, install gauge manifold, evacuate and gas charge, Install and test performance.
34. Checking and servicing of ice cube machine and its different components, Check and service flow system of gases and preventive maintenance and troubleshooting, Check Electric circuit and four-way solenoid valve, Test leakage, evacuation and charge gas, Check defrosting system and overall performance.
35. Identify different parts, controls and accessories used in ice-candy plant, prepare brine solution, function of agitator and temperature maintained in brine, Check wiring circuit, service, test, trouble shoot, and replace defective components. Retrofit R22 with R134a, install gauge manifold, leak test, evacuate and gas change, Install and Test performance.
36. Identify parts, accessories and controls of ice plant, maintain temperature in brine and check function of agitator, Check motor and wiring circuit, service and trouble shoot, test component and replace defective parts, Evacuate and charge gas, Install and test performance.
37. Identify parts, accessories, controls and operation of walk-in cooler and reach in cabinet, Preventive maintenance, trouble shooting and servicing of components, Service and trouble shoot, check wiring circuit, Test component and replace defective parts, install gauge manifold, leak test, evacuate and gas charge.
38. Identify parts, controls and accessories of Cold storage plant, Service and operation of cold storage plant, Test electrical controls and cooling system, Charge refrigerant and oil, Test leak, evacuation and gas charging, Periodic maintenance, Install ammonia compressor, Check Electrical wiring of the compressor and plant, Check the refrigeration system of the plant, Perform cold storage servicing , Measure pressure and temperature, Evacuation by two stage

rotary vacuum pump, Gas charging and performance testing, Operate and maintain cold storage plant.

39. HVAC (Plant) -Find out DBT, WBT, RH & other properties by using psychrometric chart, use psychrometer, Use Anemometers for measuring air flow, Use pitot tube for air flow measurement, Service of fans and blowers used in air-conditioning system, Service of motors used in air-conditioning system.
40. DUCT-Install Ducts, Construct Ducts as per duct layout drawing, Insulate Ducts, Longitudinal and transverse joints, Service and maintain different filters, Placing of filters.
41. PACKAGE AC (with Air Cooled Condenser)-Identify various components of Package AC (with Air Cooled Condenser), Identify Electrical circuit of Package AC (with Air Cooled Condensers), Leak testing, evacuation, gas charging, Commissioning and troubleshooting, identify various components of package AC, Water cooled condenser, Electrical circuit of package AC, Descale the Water-cooled condenser, Leak testing, evacuation, gas charging, Trouble shooting.
42. SPLIUT PACKAGE- Identify various components of split package AC, Electrical circuit of split package AC, Testing components, Leak testing, evacuation, gas charging, Installation and troubleshooting.
43. CENTRALISED/INDUSTRIAL AIRCONDITIONING. Identify various components of central AC plant, Electrical circuit of central AC plant, Testing components, gas charging, Servicing AHU including fire dampers, Checking airflow, damper, temperature and pressure, De-scaling condenser and cooling tower, Pump down gas from central AC plant, Add oil to compressor, Top up gas to the central AC system, Check temperature and pressure control.
44. DIRECT EXPANSION SYSTEM- Identify various components of direct expansion type central AC plants, Electrical circuit of direct expansion type central AC plants, Testing components, Leak testing, evacuation, gas charging, Trouble shooting, Operation & Maintenance of central AC plants, Identify VRF / VRV system, Check and service VRF / VRV system, connect master unit and IDU, Identify the location of ODU, Identify the size of piping's and laying work, Check control system, Identify error code.
45. INDIRECT/CHILLER SYSTEM- Identify various components of indirect expansion type central AC plants, Electrical circuit of indirect expansion type central AC plants, Testing components, Leak testing, evacuation, gas charging / top up gas, Trouble shooting, insulate chilled water piping's, Servicing of FCU and water control valves, mixing dampers, Bypass dampers checking.
46. Servicing and troubleshooting of direct expansion AC plants, Servicing and troubleshooting of indirect expansion AC plants, Erection of commercial type condensing unit, Vibrating eliminator, water proofing insulation.
47. Check different controls used in central AC system, Trouble shooting of central AC, install compressor and other components, Electrical wiring in central AC, Estimate the capacity of AHU, CFM of air and find the tonnage of cooling & heating load effect in a duct-based AC.
48. MOBILE AC (Bus, train)- Repair and maintenance of bus AC system, Servicing and testing magnetic clutch operation, Compressor overhauling, Leak testing, evacuation, gas charging, oil charging, Testing wiring system, Repair and maintenance of train AC system, Leak testing, evacuation, gas charging, Checking air flow, Measure temperature and pressure, Check solenoid valve.
49. Study/execute repair of different commercial units at site, Study/execute preventive maintenance of different commercial units at site.

11. Syllabus for MECHANIC DIESEL Trade-for the post of Instructor.

Theory:

1. Elementary First Aid, Occupational Safety & Health, Knowledge of Personal Safety &Safety precautions in handling Diesel machine, Concept about House Keeping & 5S method, Energy conservation process, Safety disposal of Used engine oil, Electrical safety tips, Safe handling of Fuel Spillage, Knowledge of Fire Safety &Fire extinguishers used for different types of fire, Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment.
2. Hand & Power Tools: Marking scheme, marking material-chalk, Prussian blue, cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber, Punches- prick punch, centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade, Screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C- clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open-end spanner. Sockets & accessories, Pliers - Combination pliers, multi grip, long nose, flat- nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers, Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers-Gear and bearing.
3. Systems of measurement-Description, Least Count calculation, care & use of - Micrometers-Outside, and depth micrometre, Micrometer adjustments, Description, Least Count calculation, care & use of Vernier Calliper, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
4. Different types of metal joint (Permanent, Temporary), methods of Bolting, Riveting, Soldering, Brazing, Seaming etc.
5. Fasteners-Study of different types of screws, nuts, studs & bolts, locking devices, such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of Gaskets, Selection of materials for gaskets and packing, oil seals. Types of Gaskets–paper, multi-layered metallic, liquid, rubber, copper and printed, Thread Sealants-Various types like, locking, sealing, temperature resistance, antilocking, lubricating etc.
6. Cutting tools-Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
7. Limits, Fits & Tolerances-Definition of limits, fits &tolerances with examples used in auto components.
8. Drilling machine-Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.
9. Taps and Dies-Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors.
10. Hand Reamers-Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
11. Sheet metal-State the various common metal Sheets used in Sheet Metal shop Sheet metal operations, Shearing, bending, Drawing, Squeezing Sheet metal

joints, Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints, Sheet and wire- gauges, The blow lamp its uses and pipe fittings.

12. Basic electricity-Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy, Voltmeter, ammeter, Ohmmeter, Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings, Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series- parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel, Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermo couples, Electro chemical energy, Photo-voltaic energy, Piezo- electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
13. Introduction to welding and Heat Treatment Welding processes- Principles of Arc welding, brief description, classification and applications, Manual Metal Arc welding principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques; Basic knowledge about advance welding process & equipments like MIG, TIG, Spot Welding, Plasma Cutter, Heat Treatment Process-Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering, Case hardening, Nitriding, Induction hardening Flame, Hardening process used in auto components with examples.
14. Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT, Liquid penetrant and Magnetic particle testing method – Portable Yoke method, Introduction to Hydraulics & Pneumatics-Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear Pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves- 2/2, 3/2, 4/2, 4/3-way valve, Pressure relief valve, non-return valve, Flow control valve used in automobile.
15. Auto Industry - History, leading manufacturers, Development in automobile industry, trends, new product, Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP) & Automobile Association, Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description, Uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.
16. Introduction to Engine: Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4-stroke diesel engine (Compression ignition Engine (C.I)),Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Main Parts of IC Engine, Direct injection and indirect injection, Technical terms used in engine, Engine specification, Study of various gauges/ instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light, Different type of starting and stopping method of Diesel Engine, Procedure for dismantling of diesel engine from a vehicle.

17. Diesel Engine Components: Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets, Importance of Turbulence, Valves & Valve Actuating Mechanism -Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads, importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve-timing diagram, concept of Variable valve timing, Description of Camshafts & drives ,Description of Overhead camshaft (SOHC and DOHC), importance of Cam lobes, Timing belts & chains, Timing belts & tensioners.
18. Description & functions of different types of pistons, piston rings and piston pins and materials, used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy, Compression ratio, Description & function of connecting rod, importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins.
19. Description and function of Crank shaft, camshaft, Engine bearings classification and location materials used & composition of bearing materials-Shell bearing and their advantages-special bearings material for diesel engine, Application bearing failure & its causes-care & maintenance, Crank-shaft balancing, firing order of the engine.
20. Description and function of the fly wheel and vibration damper, Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc., Function of clutch & coupling units attached to flywheel.
21. Description of Cylinder block, Cylinder block construction, Different type of Cylinder sleeves (liner).
22. Engine assembly procedure with aid of special tools and gauges used for engine assembling, Introduction to Gas Turbine, Comparison of single and two stage turbine engines, Different between gas turbine and Diesel Engine.
23. Need for Cooling systems- Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, Basic cooling system components, Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo- switch.
24. Need for lubrication system-Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system, Lubrication system components, Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes &galleries, Oil indicators, Oil cooler.
25. Intake & exhaust systems–Description of Diesel induction& Exhaust systems. Description & function fair compressor, exhauster, Supercharger, Intercoolers, turbo charger, variable turbo charger mechanism, Intake system components-Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material, Exhaust system components-Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers-Reactive, absorptive, Combination of Catalytic converters, Flexible connections, Ceramic coatings, Back- pressure, Electronic mufflers.
26. Fuel Feed System in IC Engine(Petrol & Diesel)-Gravity feed system, Forced feed system, main parts, Fuel Pumps- Mechanical & Electrical Knowledge about function, working & types of Carburettor, Diesel Fuel Systems-Description and

function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology &Clean diesel technology, Diesel fuel system components-Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection, Electronic Diesel control-Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.

27. Marine & Stationary Engine: Types, double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, Reduction gear drive, electromagnetic coupling, Electrical drive, generators and motors, supercharging.
28. Emission Control: Vehicle emissions, Standards- Euro and Bharat II, III, IV, V Sources of emission, Combustion, Combustion chamber design, Types of emissions-Characteristics and Effect of Hydrocarbons, Hydro carbon sin exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, controlling air- fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic, Reduction (SCR),EGR VS SCR.
29. Basic Knowledge about DC Generator & AC Generator-Constructional details of Alternator, Description of charging circuit operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system, Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.
30. Troubleshooting: Causes and remedy for Engine Not starting, Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.

Practical:

1. Demonstration of Machinery used in the trade, Identify safety Gear/PPE (Personal Protective Equipment) and their use, Importance of maintenance and cleanliness of Workshop, Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil, Demonstration on health hazards, occupational safety &first Aid, Demonstration fire service station to provide demo on Fire safety, Perform use of fire extinguishers, Energy saving Tips of ITI electricity Usage.
2. Perform marking using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, chisel etc. on MS Flat/Sheet Metal, measure a wheel base of a vehicle with measuring tape, Measure valve spring tension using spring tension tester, perform to remove wheel lug nuts with use of an air impact wrench, Operate General workshop tools & power tools.
3. Perform measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers, Perform measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer, Perform measuring practice on valve spring free length, Perform measuring practice on cylinder bore, Connecting rod bore, inside

diameter (ID) of a camshaft bearing with Telescope gauges, Perform measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges, Perform measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator, Perform measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge, Perform measuring practice to check the end gap of a piston ring, piston-to- cylinder wall clearance with feeler gauge, Perform practice to check engine manifold vacuum with vacuum gauge, Perform practice to check the air pressure inside the vehicle tyre is maintained at the recommended setting.

4. Perform practice on general cleaning, checking and use of nut, bolts, & studs etc., Perform removal of stud/bolt from blind hole, perform practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding, perform practice on Hack sawing and filing to given dimensions, Perform on Soldering & Brazing, perform practice on making various Gaskets like oil sump, intake manifold, water pump, tappet cover etc.
5. Perform practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine, perform practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, use of stud extractor, perform practice cutting Threads on a Bolt/ Stud. Adjustment of two-piece Die, reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.
6. Sheet metal- Perform practice on making Rectangular Tray, perform pipe bending, fitting nipples union in pipes, Perform Soldering and Brazing of Pipes.
7. Basic electricity- Perform practice in joining wires using soldering Iron, Prepare simple electrical circuits, measuring of current, voltage and resistance using digital multimeter, Perform practice continuity test for fuses, jumper wires, fusible links and circuit breakers, Perform diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, Perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, Check circuit using of service manual wiring diagram for troubleshooting Execute cleaning and topping up of a lead acid battery, Perform testing battery with hydrometer, Perform connecting battery to a charger for battery charging and checking & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key- off battery drain (parasitic draw) and do corrective action, Perform test of relay and solenoids and its circuit.
8. Introduction to welding and Heat Treatment, Welding processes, perform practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding, Set Gas welding flames and perform practice to make a straight beads and joints by Oxy – Acetylene welding.
9. Non-destructive Testing Methods- Perform liquid penetrant testing method and Magnetic particle testing method, Identify of Hydraulic and pneumatic components used in vehicle, Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit, Identify components in Air brake systems.
10. Identify of different types of Vehicles, demonstrate of vehicle specification data, identify of vehicle information Number (VIN), Demonstrate of Garage, Service station equipment- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands, Identify the different parts of IC Engine, Identify the different parts in a diesel engine of LMV/ HMV, perform practice on starting and stopping

of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition, Practice on dismantling Diesel engine of LMV/HMV as per procedure.

11. Diesel Engine Components: Perform Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, perform practice on removing rocker arm assembly manifolds, perform practice on removing the valves and its parts from the cylinder head, cleaning, Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide – Replacing the valve if necessary, Check leaks of valve seats for leakage – Dismantle rocker shaft assembly - clean & check rocker shaft-and levers, for wear and cracks and reassemble, Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments, Perform Overhauling piston and connecting rod assembly. Use of service manual for clearance and other parameters, Perform Practice on removing oil sump and oil pump – clean the sump, perform removing the big end bearing, connecting rod with the piston, perform removing the piston rings; Dismantle the piston and connecting rod. Check the side clearance of piston rings in the piston groove & lands for wear. Check piston skirt and crown for damage and scuffing, clean oil holes, Measure -the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing, Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.
12. Perform Overhauling of crankshaft, Use of service manual for clearance and other parameter, Perform removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine, Inspect oil retainer and thrust surfaces for wear, Measure crank shaft journal for wear, taper and ovality, Demonstrate crank shaft for fillet radii, bend & twist, Inspect flywheel and mounting flanges, spigot and bearing, Check vibration damper for defect, Perform removing cam shaft from engine block, Check for bend & twist of camshaft. Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift, Fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit, Perform cleaning and checking of cylinder blocks, Surface for any crack, flatness measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line, Perform bore – de-scale water passages and examine, Removing cylinder liners from scrap cylinder block, Perform practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners.
13. Engine assembly Perform reassembling all parts of engine in correct sequence and torque all bolts and nuts as per workshop manual of the engine, perform testing cylinder compression, check idle speed, perform removing & replacing a

cam belt, and adjusting an engine drive belt, replacing an engine drive belt.

14. Need for Cooling systems- Perform practice on checking &top up coolant, draining & refilling coolant, checking replacing a coolant hose, Perform test cooling system pressure, Execute on removing & replacing radiator/ thermostat check the radiator pressure cap, Test of thermostat, Perform cleaning &reverse flushing, Perform overhauling water pump and refitting, Perform checking engine oil, draining engine oil, replacing oil filter, & refilling engine oil, Execute overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary.
15. Intake & exhaust systems –Execute dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine.

    Execute dismantling & assembling of turbocharger, check for axial clearance as per service manual, Examine exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage, Perform practice on exhaust manifold removal and installation, practice on Catalytic converter removal and installation, Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage.
16. Fuel Feed System in IC Engine(Petrol & Diesel)- Perform work on removing &cleaning fuel tanks, checking leaks in the fuel lines, Perform soldering & repairing pipe lines and Unions, brazing nipples to high pressure line studying the fuel feed system in diesel engines, draining of water separators, Execute overhauling of Feed Pumps (Mechanical & Electrical), Perform bleeding of air from the fuel lines, servicing primary & secondary filters, Execute removing a fuel injection pump from an engine-refit the pump to the engine re- set timing - fill lubricating-oil start and adjust slow speed of the engine, Execute overhauling of injectors and testing of injector, General maintenance of Fuel Injection Pumps (FIP).
17. Marine & Stationary Engine-Types- Execute Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking, verify performance of engine with off load adjusting timings. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine, Check performance for missing cylinder by isolating defective injectors and test-dismantle and replace defective parts and reassemble and refit back to the engine.
18. Emission Control- Vehicle emissions- Monitor emissions procedures by use of Engine gas analyser or Diesel smoke meter, Checking & cleaning a Positive crank case ventilation (PCV) valve. Obtaining & interpreting scan tool data. Inspection of EVAP canister purges system by use of scan Tool, EGR /SCR Valve Remove and installation for inspection, perform removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles, Practice on removing starter motor Vehicle and overhauling the starter motor, testing of starter motor.
19. Execute troubleshooting in LMV/HMV for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.

12.Syllabus for PLUMBER Trade-for the post of Instructor.

Theory:

1. Scope of a plumbing work, Types of services have to plan, Basic Bench fitting.
2. Plumber's common hand tools-names, description and material from which they are made, Description, types and uses of holding device, hammers & cold chisels, cutting tools.
3. Description of simple fitting operation shack sawing, punching and filing, Types of files used commonly, marking instruments and their use of simple drilling machine, Method of using drills, Description of simple bench drilling Machine, Description of Grinding and Chisel, Description of different types of locking and fastening devices.
4. About different types of pipes-GI, CI, DI, PVC/CPVC, PPR, AC and HDPE etc., About different Types of Pipe Fittings: Socket, Elbow, Tee, Union, Bend, Cap, Plug, Cross, Ferrule etc., About different types of Thread cutting.
5. Carpenter works-Description and uses of Carpenter's hand tools used for simple operations such as marking, sawing, planning and making simple joints, Common types of wood-their description and use.
6. Gas Welding-Purpose of Gas welding, Method of gas welding**,** Safety precautions to be observed -Methods of soldering and brazing- fluxes used & Types of fluxes precautions to be observed, Hard & soft solders-their properties, composition and uses.
7. Mason's works**-**Names and description of Mason's hand tools and their uses, Method of making holes in walls and floors, Types of tools used and various Processes, Concept of bricks, lime and cement, Preparation of mortars with various materials of varying composition, Common brick joints, Description of bonds, Scaffolding& plastering, Define Plain cement concrete, RCC and its proportion, Grades of coarse aggregate and fine aggregate, Knowledge of water proofing compound, Knowledge of Building Plan and Cross section of wall, Identify plumbing services required for each type of building according to usage.
8. Description of plumber tools and Equipment-Ratchet brace, Threading die, Pipe wrench, sliding wrench, Spanner set, Chain Wrench etc. and their safety, Care & use of tools, Pipes of different kinds, Method of Pipe bending in different dia, Plumbing Symbols and Code for Tools & Materials on water line.
9. Equipment and tools for hot gas welding and electric hot plate for PPR pipe joints.
10. Types of fittings for different joints & different pipes-CI, HCI, AC, AC Pressure, DI, GI Pipes. Joints: Flange joint, Socket joint with lead, Detachable joint, Socket& Spigot joints etc., Description of pipe fittings, Methods of joining and their uses, Precautions to be taken while fixing.
11. Different kinds of Joints, Fittings and Materials in joining pipes-PVC/CPVC, PPR and HDPE etc.
12. Composition of Water**-** Sources of water**,** Hard &Soft water, temporary hardness & permanent hardness, Impurities of water–organic and in organic impurities, Water purification stages and methods, Static water pressures and measurement of pressures. Bursting pressure, Expansion of water on freezing and heating, Bernoulli's principles, Pascal's law, Pressure of water on the sides of cistern or tank. Water hammer in pipes.
13. Use of hummed and asbestos pipes of different sizes, Method of laying out pipes alignment and joining.

14. Description of various pipe joints-straight, Branch, Taft and blow, Expansion joints. Solders and fluxes used in joints.
15. Description of Plumber's materials Lead, tin, Zinc, solder, copper, red lead etc. and their uses, Water supply system of small-town.
16. Description and types of pumps viz. Suction pump, Centrifugal pump etc. Contamination of water in a well.
17. Description of pipe dies, their uses, care and precaution, Metric specification of various pipes, Standard pipe threads, Method employed for bending, Joining and fixing PVC pipe, joining material for water and gas pipes, Use of blowlamp.
18. Inspection chamber, septic tank, description of drains, cesspools, soak pits etc., Types of traps layout of drainage system.
19. Method of bending pipes by hot and cold process, Method of testing drainage lines.
20. Method of dismantling and renewal of the valves and pipes, Leaks in pipes and noise sin plumbing, Installation of water meters, Air lock in pipes and its removal.
21. Description of cocks & valves-their types, materials & advantages for particular work.
22. Erecting rain water and drainage pipe system, Installation of sanitary fittings, inspection and testing of water supply system, Pipe alignment and slope, Prevention of water hammer, Storage tanks for general water supply propose, Test for water supply pipes, Description of sanitary fittings, general points to be observed when choosing sanitary.
23. Method of bending galvanized and other heavy pipes.
24. Domestic drainage system-General layout, one pipe system, specifications of Materials required, Method of testing leakage, Different types of traps, ventilation, anti-syphon age and sinks, About Fire hydrants and their fittings.
25. Concept of heat and Temperature, Method of transmission of heat, Heating system by different thermal units, Domestic hot and cold water. Generally, out, 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 again stair Poisoning.
26. Fixing of solar water system.
27. Plumbing and sanitary symbols and plumbing codes for all tools and materials.
28. Sensor system for urinals and washbasin, etc., Corrosion-causes and remedies, prevention.
29. Corrosion due to electrolytic action Effect of water and frost on materials, Layout of pipes as per drawing, Analysis quantity measurement and abstract rate of plumbing and sanitary work.
30. Bill of Quantity and Estimation-Preparation of bill of quantity, Preparation of Estimation.

Practical:

1. Importance of trade training, List of tools & Machinery used in the trade, Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE), First Aid Method and basic training, Safe disposal of waste materials like cotton waste, metal chips/burrs etc., Hazard identification and avoidance, Safety signs for Danger, Warning, caution & personal safety message, Preventive measures for electrical accidents & steps to be taken in such accidents, Use of Fire extinguishers. Practice and understand precautions to be followed while working in the trade, Safe use of tools and equipment used in the trade.

2. Use Steel rule and Steel Tape for measuring, Use Scriber and Divider for marking on raw materials, demonstrate use of different types of Vice: - Bench vice, Pipe vice, Chain Vice, Hand vice, Chain Wrench, demonstrate use of various Hand Tools: - Different Files, Hammer, Centre Punch, Hacksaw, Chisel, Callipers, Pipe Wrench, Stock & Dies, Taps and Holders.
3. Inspect raw material for rusting, scaling, corrosion etc., Mark out lines, gripping suitably in vice jaws, hack sawing to given dimensions, Sawing different types of metals of different sections, Filing- Flat and square (Rough finish), Filing practice, surface filing, marking of straight and parallel lines with odd leg callipers and steel rule, Marking with dividers, odd leg callipers and steel rule (circles, ARCs, parallel lines), Marking off straight lines and ARCs using scribing block and dividers, Chipping flat surfaces along a marked line with hammer, Grinding of Chisel, Marking, filing, filing square and check using tri- square, Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools, Finding centre of round bar with the help of 'V' block and marking block, Joining straight line to an ARC. Punch letter and number (letter punch and number punch). Mark off, punch marking lines and drill through holes on M.S. flat.
4. Thread Inner on M.S. flat by using Tap, Outer thread on Studs by using Die, use various locking device, Inner thread on Pipes by using Tap, Outer thread on Pipe by using Die, Fixing of different Pipe fittings in different position of Pipe.
5. Cutting wood by Sawing as per marking, Use of Jack Plane for planning the job, use marking gauge for marking on job, make groove on wood by Firmer/ appropriate Chisel as per drawing and measurements, make a "T" joint as per drawing, Make a Cross joints as per drawing.
6. Cutting different diameter of MS pipes in different angles, Joining of Pipe in same dia by gas welding, Joining of Pipes in different dia by gas welding, Joining of Pipes 90-degree, 45 degree and 22.50-degree angle, joining of pipes for 90-degree bend by gas welding, do some repair work by welding, join sheet by soldering, Brazing on Sheet, make a job by Soldering and Brazing.
7. Demonstrate proper handling of Mason's hand tools: - Straight edge, Spirit level, Plumb bob, Square, Trowel etc., Setting out work with Tape, Rule, Square, Line pin and level as per drawing, Cutting Bricks and Stone to given size and template by cutting tools, Prepare Cement mortars in different proportions to suit various purposes, Construct various Types of Brick wall, Prepare Plane Cement Concrete and RCC in different proportions to suit various purposes, RCC casting various sizes of plate, Benching and Channelling of base plate, Damp proofing, Plastering the walls, Cutting of Masonry wall for concealing with Electric Cutting Tools.
8. Demonstrate proper handling of Plumber's Tools &Equipment, Use and care of Plumber's Tools and Equipment, Cutting of G.I Pipes of different Diameter and Sizes by cutting tools, Cutting of C.I Pipe of different Diameter and Sizes by cutting tools, Cutting of AC Pipe of different Diameter and Sizes by cutting tools, Cutting of all kinds of PVC Pipe of different Diameter and Sizes by cutting tools, Bending of G.I Pipe as per drawing using Bending Machine up to 50 mm dia, Bending of Steel Pipe as per drawing using Bending Machine up to 50 mm dia, Bending of PVC Pipe as per drawing using heat process up to 50 mm dia.
9. Preparation of PVC pipe & Fittings in different dia, Preparation and precaution of Electric Hot Plate, PVC Pipe welding various dia, using welding machine, Weld various type of PVC Pipe with various dia, using welding machine, PPR pipe welding joint various dia of pipe using welding machine.

10. CI/HCI Pipe Flange joint with Bend and Tee, Socket joint of CI Pipes with lead, Detachable joint of AC pressure Pipe, Titan/Socket & Spigot joint of Ductile Iron (DI) Pipe with Rubber ring, Prepare and Study the drawing of Pipe line circuit and schedule use of Tools and accessories, Make a Pipe line circuit on GI Pipe with Socket, Elbow, Bend, Flange, Tee, Union etc. And Fixing Cocks & Valves as per drawing.
11. PVC pipe cutting & shaping in various dia, using Hacksaw and Pipe cutters, Preparation of PVC pipe and Fittings with emery paper, Use & fixing of PVC fittings use Solvent Cement etc., Layout of PVC pipe according to drawing.
12. Preparation of Water and Water analysis kit, Water Analysis Test by Analysis Kits, pH, TDS, Temperature etc., Preparation of Hydraulic Pressure Test Machine, Static water pressure test by Hydraulic Pressure Test Machine apply on Plastic Water bottle, Static water pressure test by Hydraulic Pressure Test Machine apply on Cistern and Tank, Steps of simple pipe line connection as per drawing, Make a pipe line for water distribution as per drawing, Make a pipe line for OHR water distribution system as per drawing.
13. Interpret drawing of sanitary plumbing, Lay & align pipe, Lay & align humid and asbestos pipe, Demonstrate use of specific dia in different location.
14. Use various sanitary fitting, use various fitting of different materials, Use joining materials of pipe, join pipe as per laid down Procedure.
15. Demonstrate use of different pump, demonstrate installation of electric pump, demonstrate maintenance of electric pump, demonstrate working process of centrifugal, reciprocating, submersible pump, Demonstrate delivery of water to overhead tank through pump, presser head, delivery pipe, suction pipe, etc, Contamination of water in a well.
16. Produce metric & BSP thread on pipe, Produce Internal and external thread on PVC pipes of different dia, Join PVC pipe with thread, Join PVC pipe with solvent cement and heat process, Join PVC pipe as per layout.
17. Demonstrate inspection chamber, manhole, gully trap, septic tank, soak pit, Construct inspection chambers, cesspool, septic tank, soak pit etc.,
18. Demonstrate drawing layout of drainage pipe line, perform testing for smoke test, water test, smell test, ball test mirror test, join heavy cast iron socket pipe, Sealing of heavy cast iron pipe joint with lead & caulking tools.
19. Identify location of leakage pipe, removing out leakages pipe, removing of air locks, demonstrate rain water harvesting system.
20. Demonstrate different cocks & valves including materials, employ cocks & valves at different place, employ different cock & valve with sensor system, demonstrate maintenance of different cocks & valves, Demonstrate use of packing washer gasket of different cock & valve.
21. Demonstrate location of meter. Fitting of water meter, bath tub, wash basin, install water metre, bath tub, hand wash basin, water closet urinal, sink etc with sensor system, demonstrate maintenance of water metre, bath tub, hand wash basin, water closet urinal, sink etc., Demonstrate testing of water metre, Bath Tub, Hand wash basin, Erect rain water and drainage pipe system.
22. Demonstrate bending of pipes in bending machine, Bend GI pipe of different diameter in different angle, Bend G.I. pipe as per drawing and measurement, Bend PVC pipe of different diameter in different angle with dry sand by heating.
23. Demonstrate process of C.I pipe cutting & joining, Process of C.I. pipe fitting for waste pipe line in different section, Employ Process of fixing of external soil pipe, demonstrate process of fixing of rain water gutter outlet and ground pipe, Demonstrate process of measurement of waste pipe line.

24. Demonstrate working of solar water heating system, analyse temperature of water (hot and cold), Layout pipe line for hot and cold-water distribution as per drawing, install pipe line for distribution of hot & cold water, install hot water system & solar water heating system, Symbolise distribution of hot &cold-water pipe line.
25. Perform fitting of different trap, valve, cistern etc., Demonstrate construction of overhead tank as per measurement, Maintenance and recondition pipe line, Perform pressure test by hydraulic test machine.
26. Demonstrate cleaning of sanitary pipe line, perform cleaning of sanitary pipe line, remove corrosion from pipe line, demonstrate scraping & painting, perform scraping & painting of pipe line, Maintenance of broken or cracked sanitary fitting, Estimate and work out abstract cost of plumbing work as per drawing/layout.

13. Syllabus for SURVEYOR Trade-for the post of Instructor.

Theory:

1. List of the instrument equipment to be used in Surveyor, Layout of drawing sheet, Dimensions of drawing sheet, Details layout of lettering, lines & dimensioning system.
2. Introduction of surveying, types of surveying, use, application principal.
3. Knowledge of different types of scales, determine of R.F & uses of scales.
4. Different types of projection views orthographic, sectional, isometric view.
5. Use & application of conventional signs & symbols.
6. Uses of Chain/ tape, testing of a chain & correction, Ranging(direct & indirect), Principle of chain survey, application, Terms used in chain survey,Offset,typesofoffsets,limitofoffset,fieldbook,typesoffieldbook,entryoffiel dbookmethodofchainingin slopping ground, Field procedure of chain survey errors in chain survey, plotting procedure, Calculation of area(regular & irregular figure), Knowledge of site plan.
7. Basic terms used in compass survey, Instrument & it setting up. Conversion of bearing web to R.B, Calculation of included angle from bearing local attraction, magnetic declination and true bearing, closing error, Adjustment of closing error, precaution in using prismatic compass.
8. Introduction to Auto CAD. Use Auto CAD command.
9. Plane table survey, principle, merits & demerits, Instrument used in plane table survey setting up the plane table (cantering, levelling, orientation), Methods of plane table survey (radiation, intersection, resection, traversing), Error in plane table survey.
10. Introduction to Theodolite, Types of Theodolite, parts of Theodolite, Terms used in Theodolite survey, Temporary adjustment of Theodolite, Angle measurement process, Reading of angles, field book entry of measure dang les, Permanent adjustment of Theodolite, Traversing using theodolite (closed & open),traverse computation, determination of consecutive coordinates, independent co-ordinate, checking & balancing of traverse, preparation of gales traverse table, computation of area using co-ordinates, calculation of omitted measurement.
11. Introduction to levelling. Types of levelling instrument, Technical term used in levelling, Temporary& permanent adjustment, Different types of levelling

Entry of level book (Reduced level calculation method), Curvature & refraction effect sensitivity of bubble tube, Common error and their elimination, Degree of accuracy.

12. Introduction of tachometry & terms use advantages and disadvantages, Tachometric constants & its determination, Determination of horizontal & vertical distances by various methods.
13. Use Auto CAD command for drawings.
14. Contouring, contour intervals election of contour interval, characteristics of contour, uses of contour contouring by various method. Interpolation of contour by various methods, drawing of contours, computation of volume establishment of gradient by abney level.
15. Curves, Purpose, Types of curves–simple, compound, reverse, transition, vertical. Elements of simple curve, computation of elements of simple curve. Various methods for setting out simple, compound, reverse, transition & vertical curve.
16. Familiarization with modern survey instruments. Parts of Total station, temporary adjustment of T.S, working procedure of T.S.
17. Familiarisation with cadastral map, term used in cadastral survey, preliminary knowledge for prepare site plan. Calculation of area by digital planimeter.
18. Types of surveys for location of a road. Points to be considered during reconnaissance survey. Classification of roads and terms used in road engineering, alignment of roads relative importance of length of road, height of embankment depth of cutting & filling, road gradients super elevation etc.
19. Details knowledge for preparation of topographical map. Details knowledge for preparation of cadastral map. Details knowledge for preparation of a road project.
20. Use auto cad command survey software for survey drawing.
21. Importance of cartographic projection, Uses of various types of cartographic projection for mapping.
22. Introduction of GIS & GPS. Elements of GPS/DGPS. Observation principles. Sources of error & handling of error in GPS. Various type of GPS application. Concept & use of survey software.
23. Introduction to hydrographic survey, practice various methods of water depth measurement process, floe velocity measurement & determination of cross-sectional area of a river, Handling of eco so under, current meter.
24. Basic terms used in transmission line survey, justification criteria for con structing new line, marking process of tentative alignment, selection process of a good alignment. Process of detail survey & final location survey. Use of sag template, Various type of tower, construction of tower foundation.
25. Basic terms used in railway line project survey, justification criteria for constructing newline, marking process of tentative alignment, selection process of a good alignment. Process of detail survey & final location survey.
26. Specification & uses of various types of building materials, types of foundation, knowledge of R.C.C. works, & other construction related items. Procedure of prepare a detail estimate.

Practical:

1. Demonstrate of tools & equipment used in the trade. Occupational safety & Health. Introduction of safety equipment and their uses, Introduction of first aid, health, safety& environmental guidelines, legislations & regulations as applicable, Personal Protective Equipment (PPE), Hazard identification and

avoidance, Safety signs for Danger, Use of drawing instruments and equipment with care, Method of fixing of drawing sheet on drawing board, Layout of different size of drawing sheet and folding of sheets, Layout of different size of drawing sheet and folding of sheets.

2. Lettering& numbering (Single & double stroke, Types of lines and dimensioning. Construction of plain geometrical figures, curves & conics. Drawing of: -Construction of scales – plain, diagonal, vernier, Drawing of three views in orthographic projection of point, line, plane, solid objects. Section of solids. Isometric projection of geometrical solids, Drawing of conventional signs & symbols. Free hand sketch of liner measurement instruments.
3. Practice of folding & unfolding of chain. Equipment and instrument used to perform surveying & testing of chain. Ranging (direct/ indirect) &distance measure with chain/ tape. Offset taking & entering field book, overcoming obstacles in chaining, Chaining on sloping ground, conduct a chain survey of a small area with all details and plotting the map, Calculating the area of site. Prepare a site plan by the help of chain / tape.
4. Temporary adjustment of prismatic compass. Measure fore & back bearing of a line, measure true bearing of a line, prepare a closed & open traverse using prismatic compass measure the bearings, entry into field book, calculation of correct bearing and adjust. (Local attraction), determine the closing error and adjust. Plotting the same, Practice with Auto CAD using commands.
5. Demonstration and practice with Auto CAD using commands.
6. Demonstration of instrument used for plane table surveying & their uses (alidade, U-fork, trough compass), Set up the plane table-Cantering, Levelling, Orientation, Practice the method of plane tabling: Radiation, Intersection, Resection, Traversing, Determination of height by telescopic alidade
7. Practice to set up the Theodolite, Reading the vernier & booking (hor./ver.) Angle, perform permanent adjustment of Theodolite, Measurement of horizontal angle by various methods, Setting out the angles. Measurement of vertical angle, deflection angle, Prolongation of line by various methods, Determination of height of inaccessible object by the theodolite.
8. Traversing (closed& open) using Theodolite & tape/chain, Measurement of horizontal angles & bearing of a line, Computation of coordinates from the bearing, angle length, Preparation of gales traverse table, Computation of area using co-ordinates, Determine omitted measurements.
9. Practice in setting up of dumpy level and performing temporary adjustments, Practice in staff reading. Practice in simple levelling, Practice differential level (fly levelling), Practice reciprocal levelling, Carryout levelling field book.
10. Equate reduction of level (rise fall method, height of instrument method) comparison of method, solve problems on reduction of level, Practice levelling with (auto / digital level), Practice profile levelling or longitudinal & cross section levelling, plotting the profile, Check levelling.
11. Determination of horizontal and vertical distances by tachometric method. Determination of stadia constants of a tachometer.
12. Prepare traverse drawing using Auto cad. Prepare a simple building. Drawing using Auto cad.
13. Prepare contour (direct/ indirect method), Interpolation of contour, draw contour lines, locating contour gradients, Preparation of section from contour map, Computation of volume (prismoidal / trapezoidal) formula, Establishment of gradient by abney level, Make a topography map with contours. (Indirect method).

14. Computation of elements of simple curve, Set out of simple curve by linear method, Set out of simple curve by instrument method, Set out of compound curve by instrument method, Set out of reverse curve by instrument method, Set out of transition curve by instrument method, Set out of vertical curve by instrument method.
15. Temporary adjustment of Total station, Measurement of angle & coordinates and heights, Traversing using Total station, Download survey data and Plotting.
16. Prepare a site plan by the help of mouza map, Calculate the plot area by digital planimeter.
17. Road project reconnaissance. Preliminary survey, Final location survey including preparation of route map, Profile or longitudinal &cross-sectional levelling & plotting.
18. Prepare topographical map (direct & indirect method). Make a cadastral/ mouza map &calculate the plot area, Prepare a detail road project more than 1KM.
19. Survey drawing practice using AutoCAD commands
20. Drawing of Simple conical projection, polyconic, lambert's& UTM (Universal Transverse Mecrcator), Construction of UTM Grid, use datum defining system 1984(WGS-84).
21. Setting of GPS/DGPS, Data collection (measurement of line & calculation of area), Data collection in DGPS mode, Processing of GPS data in software, Plotting the contour lines with the help of Auto Civil/ Civil 3D Software/any other software.
22. Determine hydro graphic depth by (sounding method)/ eco sounder, Measure the velocity of flow, Determine the cross- sectional area of a river.
23. Calculate the discharge of a river Justify constructing a new transmission line, marking of tentative alignment on existing topographical map, Conduct reconnaissance /preliminary survey & select a good alignment, conduct detailed survey, prepare a profile drawing using sag template, Conduct final location survey. Mark tower foundation pit point (as per type of tower).
24. Justify to construct a new Railway line, marking of tentative alignment, conduct reconnaissance /preliminary survey & select a good alignment, conduct detailed survey, prepare of drawing including design of curves with setting out table, Conduct final location survey.
25. Draw a double storied residential building plan, elevation, cross section, site plan, lay out plan, foundation details etc., Prepare a detail estimate of this building.

14.Syllabus for WELDER Trade-for the post of Instructor.

Theory:

1. Elementary First Aid, Importance of Welding in Industry, Safety precautions in Shielded Metal Arc Welding, and Oxy- Acetylene Welding and Cutting.
2. Introduction and definition of welding, Arc and Gas Welding Equipments, tools and accessories, Various Welding Processes and its applications, Arc and Gas Welding terms and definitions.
3. Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc., Types of welding joints and its applications, Edge preparation and fit up for different thickness, Surface Cleaning.
4. Basic electricity applicable to arc welding and related electrical terms & definitions, Heat and temperature and its terms related to welding Principle of arc welding. And characteristics of arc.
5. Common gases used for welding & cutting, flame temperatures and uses, Chemistry of oxy-acetylene flame, Types of oxy-acetylene, flames and uses, Oxy-Acetylene, Cutting Equipment principle, parameters and application.
6. Arc welding power sources-Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance, Advantages and disadvantages of A.C. and D.C. welding machines.
7. Welding positions as per EN &ASME: flat, horizontal, vertical and overhead position, Weld slope and rotation, Welding symbols as per BIS & AWS.
8. Arc length – types – effects of arc length, Polarity: Types and applications, Weld quality inspection, common welding mistakes and appearance of good and defective welds, Weld gauges & its uses.
9. Calcium carbide properties and uses, Acetylene gas properties and generating methods, Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor.
10. Oxygen gas and its properties, Production of oxygen by Air liquefaction, charging process of oxygen and acetylene gases, Oxygen and Dissolved, Acetylene gas cylinders and Colorcoding for different gas cylinders, Gas regulators, types and uses.
11. Oxy acetylene gas welding Systems (Low pressure and High pressure), Difference between gas welding blow pipe (LP &HP) and gas cutting blow pipe, Gas welding techniques. Rightward and Leftward techniques.
12. Arc blow–causes and methods of controlling, Distortion in arc & gas welding and methods employed to minimize distortion, Arc Welding defects, causes and Remedies.
13. Specification of pipes, various types of pipe joints, pipe welding all positions, and procedure, Difference between pipe welding and plate welding.
14. Pipe development for Elbow joint, T joint, Y joint and branch joint, Manifold system.
15. 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.
16. Electrode- types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, Effects of moisture pick up, Storage and baking of electrodes, Special purpose electrodes and their applications.
17. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.

18. Classification of steel, Welding of low, medium and high carbon steel and alloy steels, Effects of alloying elements on steel, Stainless steel types- weld decay and weldability.
19. Brass– types–properties and welding methods, Copper – types – properties and welding methods.
20. Aluminium and its alloys, properties and weldability, Welding methods, Arc cutting &gouging,
21. Cast iron and its properties types, Welding methods of cast iron.
22. Types of Inspection methods, Classification of destructive and NDT methods, Welding economics and Cost estimation.
23. Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding, Introduction to GMAW-equipment–accessories, Various other names of the process. (MIG/MAG/CO2 welding.).
24. Advantages of GMAW welding over SMAW, limitations and applications, Process variables of GMAW, Modes of metal transfer – dip or short-circuiting transfer, spray transfer (free flight transfer) and globular transfer (intermittent transfer) and Pulsed metal transfer.
25. Wire feed system–types–care and maintenance, Welding wires used in GMAW, standard diameter and codification as per AWS.
26. Types of shielding gases and gas mixtures used in GMAW and its applications, Flux cored arc welding – description, advantage, welding wires, coding as per AWS.
27. Edge preparation of various thicknesses of metals for GMAW, GMAW defects, causes and remedies.
28. Heat input and techniques of controlling heat input during welding, Heat distribution and effect of faster cooling.
29. Pre heating & Post Weld Heat Treatment, use of temperature indicating crayons.
30. Submerged arc welding process–principles, equipment, advantages and limitations, Electro slag and Electro gas welding processes– principles, equipment, advantages and limitations.
31. Thermit welding process-types, principles, equipment, Thermit mixture types and applications, Use of backing strips and backing bars.
32. GTAW process-brief description. Difference between AC and DC welding, equipment, polarities and applications, Various other names of the process (TIG, Argon arc), Power sources for GTAW-AC &DC.
33. Tungsten electrodes – types & uses, sizes and preparation, GTAW Torches-types, parts and their functions, GTAW filler rods and selection criteria.
34. Edge preparation and fit up, GTAW parameters for welding of different thickness of metals, Pulsed TIG welding-brief description, pulse parameters slope up and slope down.
35. Argon/Helium gas properties – uses, GTAW Defects, causes and remedy.
36. Friction welding process- equipment and application, Laser beam welding (LBW)and Electron beam welding (EBW).
37. Plasma Arc Welding (PAW) and cutting (PAC) process, equipment and principles of operation, Types of Plasma arc, advantages and applications.
38. Resistance welding process, types, principles, power sources and welding parameters, Applications and limitations.
39. Metalizing–types of metalizing principles, equipment, advantages and applications, Manual Oxy–acetylene powder coating process- principles of operation and its applications.

40. Welding codes and standards, Reading of assembly drawing, Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR),
41. Hard facing/ surfacing necessity, surface preparation, various hard facing alloy and advantages of hard facing.

Practical:

1. Demonstration of Machinery used in the trade. Identification to safety equipment and their use etc. Hack sawing, filing square to dimensions. Marking out on MS plate and punching.
2. Setting of oxy-acetylene welding equipment, Lighting and setting of flame. Perform fusion run without filler rod on MS sheet 2mm thick in flat position. Setting up of Arc welding machine & accessories and striking an arc. Deposit straight line bead on MS plate in flat position.
3. Depositing bead with filler rod on M.S. sheet2 mm thick in flat position. Edge joint on MS sheet 2 mm thick in flat position without filler rod.
4. Straight line beads on M.S. plate 10 mm thick in flat position, Weaved bead on M. S plate 10mm thick in flat position.
5. cutting regular geometrical shapes and irregular shapes, cutting chamfers by gas cutting.
6. Circular gas cutting on MS plate 10 mm thick by profile cutting machine. Marking and perform radial cuts, cutting out holes using oxy- acetylene gas cutting. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts; poor draglines; rounded edges; tightly adhering slag.
7. Square butt joint on M.S. sheet 2 mm thick in flat Position, Fillet "T" joint on M.S. Plate 10 mm thick in flat position, Open corner joint on MS sheet 2 mm thick in flat Position.
8. Fillet lap joint on M.S. plate 10 mm thick in flat position, Fillet "T" joint on MS sheet 2 mm thick in flat position, Open Corner joint on MS plate 10 mm thick in flat position.
9. Fillet Lap joint on MS sheet 2 mm thick in flat position, Single "V" Butt joint on MS plate 12 mm thick in flat position, Testing of weld joints by visual inspection. Inspection of welds by using weld gauges.
10. Square Butt joint on M.S. sheet.2 mm thick in Horizontal position, Straight line beads and multi-layer practice on M.S. Plate 10 mm thick in Horizontal position, Fillet "T" joint on M.S. plate 10 mm thick in Horizontal position.
11. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position, Fillet Lap joint on M.S. plate 10 mm thick in horizontal position.
17. Fusion run with filler rod in vertical position on 2mm thick M.S sheet.
18. Square Butt joint on M.S. sheet. 2 mm thick in vertical position, Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position.
19. Weaved bead on M.S Plate 10mm in vertical position, Fillet "T" joint on M.S sheet 2 mm thick in vertical position, Fillet "T" joint on M.S. plate 10 mm thick in vertical position.
20. Structural pipe welding butt joint on MS pipe Ø 50 and 3mm WT in 1G position,

Fillet Lap joint on M.S. Plate 10 mm in vertical position, Open Corner joint on MS plate 10 mm thick in vertical position.

21. Pipe welding - Elbow joint on MS pipe 50 and 3mm WT, Pipe welding “T” joint on MS pipe 50 and 3mm WT, Single “V” Butt joint on MS plate12 mm thick in vertical position, Pipe welding 45 ° angle joint on MS pipe 50 and 3mm WT, Straight line beads on M.S. plate 10mm thick in overhead position.
22. Square Butt joint on S.S. sheet, 2 mm thick in flat position, Square Butt joint on S.S. Sheet 2 mm thick in flat position, Square Butt joint on Brass sheet 2 mm thick in flat position, Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing in flat position, Single “V” butt joint C.I. plate 6mm thick in flat position, Arc gouging on MS plate 10 mm thick, Square Butt joint on Aluminium sheet. 3 mm thick in flat position.
23. Introduction to safety equipment and their use etc. Setting up of GMAW welding machine & accessories and striking an arc, Depositing straight line beads on M.S Plate. Fillet weld – “T” joint on M.S plate 10mm thick in flat position by Introduction to safety equipment and their use etc.
24. Repair welding of broken C.I. machine parts by oxy-acetylene welding with C.I and bronze filler rod, Repair welding of broken C.I machine parts by C.I. electrode.
25. Hard surfacing practice on M.S round rod Ø 25 mm by using Hard facing electrode in flat position.

15.Syllabus for BASIC COSMETOLOGY Trade-for the post of Instructor.

Theory:

1. Personality Development- Hygiene rules, Basic of good grooming, Posture, Wardrobe planning, Motivation, Beauty as a career Communication Skills, Professional ethics, Client consultation, Telephone etiquettes, Sterilization and Sanitization-Purpose, Definition, Methods, Procedure Safety precautions.
2. Temporary removal of Superfluous hair, Hair growth cycle, Purpose of removing superfluous hair, Definition and Methods of Epilation and Depilation, Product Knowledge, Allergy test, Client consultation, Procedure, Contra-actions, Contra-indications, Safety precautions.
3. Threading, Tweezing and Bleaching-Purpose, Definition, Types and methods, Client consultation, Product knowledge, Patch Test-Procedure, Contra-actions, Contra-indications, Safety precautions, After care/Home care.
4. Manicure and Pedicure-Anatomy of Nail, Classification and identification of nail diseases and disorders, Purpose of manicure and pedicure-Definition and Types, Tools, equipment& product knowledge, Client consultation, Procedure-Contra-actions, Contra-indications, Safety precautions.
5. Facials-Anatomy of Skin- Skin structure, Functions of skin, Types of skin, Classification & identification of common skin problems-Acne, Blackheads, Whiteheads, Disorders of sweat glands, Disorders of oil glands, Meaning of Massage, Types and benefits of massage, Client consultation, Skin analysis, Tools, equipment& product knowledge, Basic and deep cleansing, Procedure-Contra-actions, Contra-indications, Safety precautions.
6. Hair-Science of Hair, Structure of hair root & hair shaft, Chemical composition, Hair growth cycle, Types of hair-Hair texture, density, Elasticity & porosity, Common hair problems- Dandruff, Hair falling, Split ends, Pediculosis.
7. Head Massage, Shampooing, Conditioning & Deep- conditioning-Purpose, Product knowledge Procedure, Benefits Precautions.
8. Hair Cutting & Blow dry, Facial shapes Knowledge-Sectioning, Elevation/Angles, Length & perimeter, Basics of Blow dry, Tools knowledge, Hair cutting techniques, Safety precautions.
9. Yoga and its Components-Purpose, Definition, Benefits, Precautions, Yogic diet.
10. Yogic Suksham Vayayam-Procedure, Benefits, Precautions Surya Namaskar Yogic, Sthool Vayayam-Procedure, Benefits.
11. Make-up-Purpose, Effects of Light on makeup, Color theory, Basic facial shapes knowledge, Types of brushes knowledge for make-up, Product knowledge, Types of make-up Day Time-Evening and Party, Bridal, Procedure of CTM, Basic corrective make-up for-Cheeks, Nose, Lips, Jaws, Make-up removal-Tools &equipment, hygiene, Safety precautions.
12. Hair Styling-Purpose, Types of hairstyling-Thermal styling, Wet styling, Roller Setting, Artificial Aids-Thermal Styling, Blow drying, Ironing/ Crimping, Tongs, Wet styling, Pin curls, Finger waving, Roller setting, Artificial Aids, Cleaning & maintaining of artificial aids, Safety precautions.
13. Hair Colouring-Science of colour, Basic law of colour (colour wheel), Classification of hair colour-Temporary, Semi-permanent, Permanent, Types of hair colour-Chemical, Vegetable, Techniques-Pre-lightening, Global colour, High lightening, Numbering system, Product Knowledge, Allergy Test procedure, Procedure of applying all types of hair color-Contra-actions, Contra-indications Safety precautions.

14. Perming-Definition, Knowledge of Bonds, Basic Perm technique, Types of perm rollers, Client consultation, Scalp analysis, Product knowledge, Strand test knowledge & procedure, Step by step procedure of perming-Contra-actions, Contra-indications, Safety precautions, Aftercare/Homecare.
15. Straightening/ Rebonding/ Smoothening- Definition, Knowledge of Bonds, Client consultation, Scalp analysis, Product knowledge, Strand test knowledge &procedure, Step by step procedure of Straightening/Rebonding / Smoothening, Contra-actions, Contra-indications, Safety precautions, Aftercare/Homecare.
16. Asanas-Purpose, Definition, Asanas for- Spine stretching, Stress management, Different body ailments, Obesity, Diabetics, Joints pain, Hypertension, Thyroid, Benefits, Safety precautions.
17. Yoga for different age groups- Children, Old citizens, Pregnant women, Benefits, Safety precautions, Height, Weight Management Chart related to Ht &Wt.
18. Tratak-Definition, Procedure, Benefits, Safety precautions, Meditation-Definition, Procedure, Benefits, Safety precautions.

Practical:

1. Personal grooming. Telephone etiquettes. Working on improving poise, Trolley setting. Use of different sterilizing gadgets, Practice in disinfection procedures, Trolley setting, Client consultation, Allergy test procedure, Practice in waxing-hot, cold & warm wax. Practice by chemical depilation method, Trolley setting. Client consultation. Practice of Waxing, Threading, depilation &tweezing the eyebrows.
2. Patch test procedure. Bleaching procedure, Trolley setting. Client consultation. Filling of record card. Use of tools & equipment.
3. Practice of Massage-Hands, Arms, Legs, Practice in different types of basic nail shapes, Practice in different types of manicure &pedicures.
4. Nail art, Tools knowledge, Product knowledge, Basic nail art techniques-Free hand Application of different types of packs & masks according to skin type, Trolley setting, Client consultation, Scalp analysis. Practice in using gadgets-High frequency, Infra-red lamp, Scalp steamer. Safety precautions/Do's & Dont's, after care- Trolley setting, Client consultation, Scalp analysis, Procedure, Trolley setting, Client consultation, Scalp analysis, Practice in different types of cuts: -One-length cut, Diagonal cut, Graduated cut.
5. Special cutting techniques as—Precision hair cutting, Notching Slicing, Trolley setting. Client consultation, Filling of record card, Use of tools & equipment.
6. Trolley setting. Client consultation. Skin analysis: -Naked eyes, Magnifying glass, Filling of record card, cleaning procedure.
7. Practice in facial with the help of different equipment: - Vapozone, High Frequency, Brushing Unit, Galvanic, Ultrasonic, Vacuum & Spray, Faradic Current.
8. Application of different types of packs & masks according to skin type, Trolley setting. Client consultation. Scalp analysis. Practice in using gadgets: -High frequency, Infra-red lamp, Scalp steamer, Safety precautions /Do's & Dont's. After care, Trolley setting. Client consultation. Scalp analysis, Procedure, Trolley setting. Client consultation. Scalp analysis. Practice in different types of cuts: -One-length cut, Diagonal cut Graduated cut, Special cutting techniques as—Precision hair cutting, Notching, Slicing.
9. Stamina building exercises, Deep breathing exercises, Practice in SukshamVayayam, Practice in Surya Namaskar, Practice in all SthoolVayayam.

16.Syllabus for FRONT OFFICE ASSISTANT Trade-for the post of Instructor.

Theory:

1. Introduction to Hotel Industry/Importance of Front Office, Orientation programme on the course and related job opportunities by the industry expert / instructor, Different types of Hotels, Importance of grooming & Hygiene/Fire Fighting & First-Aid.
2. Coordination of departments & importance of team work, Organizational hierarchy of FRONT OFFICE Department in any star hotel, Personality Development and communication skills.
3. Duties and responsibilities of a Front Office service personnel, Attributes of FRONT OFFICE services personals, Procedure of welcoming & receiving a guest.
4. Type of Rooms, Room plans and room rates, importance of tariff, Modes of reservation requests and handling reservations, Importance of Key Control at Front Office.
5. Different Types of Computers, Introduction of Personal Computer /Microcomputer and Operating System (UNIX, WINDOWS, MS DOS, NETWARE), Profiling an Operating System, Booting Sequence: Operating System files and command Processor file, Definition of a file; File names, Booting from CD and HDD, Warm and Cold reboot.
6. Microsoft- Word Processing Package-Opening Documents and Creating Documents, Saving Documents/Quitting Documents, Cursor Control, text selection, Printing Documents, Using the Interface (Menu, Toolbars), Editing documents, Finding and Replacing Text, Spell Check / Auto Correct Feature, Grammar Facility, Auto text, Character and page formatting.
7. Functions of Computer Peripherals, Laser Printer, DOT Matrix, INKJET Printer, COLOR LASER printer, Introduction to MS- Excel, Fundamentals of MS- Excel, Spreadsheet, Features & Description, An overview of Power Point-Presentation & Slides and Handouts.
8. Introduction to MS-Access-Fundamental of MS- Access, types of access., naming of different data bases, Creating Data Base, Retrieving & Inserting Information from an Access Data Base.
9. Networking and Internet Communication Concept-Knowing about how to set up an internet connection, connect using a dial-up modem/Broadband connection with username and password, Internet Explorer and its features, Introduction to the uses of World Wide Web and Internet Browser, Introduction to the Search Engine Google & its features, creating an email ID, knowing about the "Outlook Express", Sending mail through outlook express, File attachment with the email.
10. Procedure of preparation of- Arrival list, Departure list, Room availability chart, Procedure of Preparation of-Different Guest Folios with Performa, Handling Guest arrivals- Work Flow with all Perform as.
11. Telephone manners-Procedure of preparation of guest registration card & importance of the data in it, 'C' form importance & its usages, preventing common reservation problems, Receiving, welcoming of guest and assigning rooms, Managing the guest bills. (Property management system).

12. People skills i.e., Time management, Team building, Inter personal skills, Motivation, Conflict management, Currency exchange procedure, Room change procedure, Handling complaints and situations.
13. Duties and responsibility of concierge & bell service, Marketing and up-selling techniques & procedures, Procedure of handling mail & parcels for the guest & in the office, Preparation of procedure of handling guest departure.
14. Workflow at the Front Office reception, Cashiering procedures, Observations during situations and better ways of situation handling as per the students, Handle accidents and emergency situations.
15. Preparation & Analyzing of data in front office related to Night Auditor's Report, Process room and rate change, Check room status discrepancy.
16. Procedure of handling guest feedback & complaints, Procedure of Paging System, Process of guest cycle system in a hotel.

Practical

1. Body Language and power of smile, Demonstrate First Aid, Fire Prevention and Fire Fighting, Cross Cultural non-verbal communication, Managing Coordination between departments in a Hotel-Role Play, develop personality &team work, Analyse the conflict and manage the common ethical issues encountered.
2. Telephone Handling and Telephone Etiquettes, Business communication - Oral and Written, Welcoming and Receiving Guests, Giving Information to Guest about tourist Places, Duties and responsibilities of a Front Office Assistant with regards to registration.
3. Type of rooms with specifications, Room Rates and Tariff cards, Reservation enquiry over telephone and mail, Different types of keys and lock systems.
4. ComputerOperational Skills, Demonstration and identification of different input /output devices - CPU, VDU, Keyboard, Interconnecting Cords, Hard disk, CD ROMs etc., Key Boarding Skills. Pen drive, other USB based devices, Demonstration on Window O.S. Booting practice, Use of task bar, menu bar, start button, title bar, mouse options and window's help, using My Computer and Recycle bin etc., Opening and closing different windows, creating and renaming files and folders, Hands on practice of basic files, Directory manipulation commands - Introduction to Linux O.S.
5. Demonstration Practice on MS Office: Word Processing (MS Word), Creating, Saving, quitting& Opening Document, Moving Around Document, manipulating document page using tool bar, Editing Text - Insert, delete, move, copy, paste, Finding, replacing text, spell check, grammar check etc., Inserting and modifying Tables, Creating and printing merged documents using mail merge, Practice of shortcut keys.
6. Worksheet (MS EXCEL): Elements of worksheets, application of electronic worksheet and entering data in Worksheet, Saving and Quitting, Opening and Moving around worksheet, Formatting cells and Data copying., Working with charts and graphs etc., Printing, editing and entering formula, Functions in Excel.
7. MS-Power point: Planning and Preparation of different slides in a Presentation, Editing and animating the presentation.
8. Data Base (MS-Access): Data Base Management System, Microsoft Access Interface, Title Bar, Menu Bar, Tables, Query, Forms, Report, Printing and Closing etc.

9. Internet Operational Skills: Networking concept, LAN WAN, Services on Internet - Websites (www) E-Mails, Voice Mails, Browser and search engines, Searching &downloading, Printing, saving portion of web page, E-Mail addressing, Inbox, outbox, viewing, sending and saving mails Sending same mails to various Users (multi- address) &sending attachment and enclosures. Web Page Transaction.
10. Preparation of: Arrival list, Departure list, Room availability chart, Reserved chart.
11. Practice on Preparing guest folio for: Walk in guest, VIP Guest, Group or Crew, Corporate Guest, registration process for: Walk-in guest, Guest with confirmed booking, Group or crew, corporate guest, Filling of guest reservation form and registration card, Property management system.
12. Interpersonal communication and customer service skills, Handling of: Currency Exchange, Room change, Guest complaints - Room Change (noise)/ AC not effective/ delay in check in process/ laundry complaint/ Delay in Room Service.
13. Procedure of performing the duties of bell boy during: Check-in, Check-out, Monitoring of CCTV.
14. The techniques and guidelines for up-selling and suggestive selling, Practice on handling messages, mail and Parcels for the Guest and in the office.
15. Situation Handling - Scanty Baggage/Minor guest check in/Wrong Billing, Guest without prior reservation/ late check in/ Early Check in/ Lost and Found/Left Luggage/Skipper/Drunk Guest/Hoax Call, Handle accidents and emergency situations.
16. Compute occupancy percentages and average room rate figures, Studying and analyzing the movement list Studying and analyzing the Arrival/Departure Listetc., Briefing and debriefing.
17. Paging System, Preparing Room Packages and Guest Feed backs, Rules and regulations guiding Hotel to allow check in and other operations related to Front Office.

17. Syllabus for WELDER (FABRICATION & FITTING) Trade-for the post of Instructor.

Theory:

1. Elementary First Aid, Importance of Welding in Industry, Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting.
2. Introduction and definition of welding, Arc and Gas Welding Equipment, tools and accessories.
3. Various Welding Processes and its applications, Arc and Gas Welding terms and definitions.
4. Different process of metal joining methods- Bolting, riveting, soldering, brazing, seaming etc., Types of welding joints and its applications, Edge preparation and fit up for different thickness, Surface Cleaning.
5. Basic electricity applicable to arc welding and related electrical terms & definitions, Heat and temperature and its terms related to welding, Principle of arc welding and characteristics of arc.
6. Common gases used for welding & cutting, flame temperatures and uses, Chemistry of oxy-acetylene flame, Types of oxy-acetylene flames and uses, Oxy-Acetylene, Cutting Equipment principle, parameters and application.
7. Arc welding power sources-Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance, Advantages and disadvantages of A.C. and D.C. welding machines.
8. Welding positions as per EN & ASME-flat, horizontal, vertical and overhead position, Weld slope and rotation, Welding symbols as per BIS &AWS.
9. Arc length-types-effects of arc length, Polarity-Types and applications.
10. Calcium carbide properties and uses, Acetylene gas properties and generating methods, Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor.
11. Oxygen gas and its properties, Production of oxygen by Air liquefaction, charging process of oxygen and acetylene gases, Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders, Gas regulators, types and uses.
12. Oxy acetylene gas welding Systems (Low pressure and High pressure), Difference between gas welding blow pipe (LP & HP) and gas cutting blow pipe, Gas welding techniques, Rightward and Leftward techniques.
13. Arc blow-causes and methods of controlling, Distortion in arc & gas welding and methods employed to minimize distortion, Arc Welding defects, causes and Remedies.
14. Specification of pipes, various types of pipe joints, pipe welding positions, and procedure, Difference between pipe welding and plate welding.
15. Pipe development for Elbow joint, T joint, Y joint and branch joint, Manifold system, 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.
16. Electrode-types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, Effects of moisture pick up, Storage and baking of electrodes, Special purpose electrodes and their applications.
17. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.

18. Classification of steel, Welding of low, medium and high carbon steel and alloy steels, Effects of alloying elements on steel, Stainless steel types-weld decay and weldability.
19. Brass- types-properties and welding methods, Copper-types-properties and welding methods, Aluminium and its alloys, properties and weldability, Welding methods, Arc cutting & gouging, cast iron and its properties types, Welding methods of cast iron.
20. Role of fabrication in industry, BasicTrigonometric calculations, Marking of Angles, Triangles, Square, Rectangle, Parallelogram, Hexagon, Octagon and Circles.
21. Calculation of volume and surface area of rectangular prism, cubes and cylinders, Development of right solids, prisms, cylinders, pyramids, cones, frustum of pyramid, cone etc.
22. Workshop practice-Hack sawing, Filing, Chipping, Hand grinding, Marking, Punching, Drilling, Tapping, Die-passing, etc.
23. Drilling machine-construction and operation feature.
24. Machine shop practice-Milling machine construction and operation- Milling cutter-Types of Milling etc.
25. Lathe-construction and Operation, Turning-Facing-Taper Turning-Threading etc.
26. Principles of Shielded metal Arc welding (SMAW).
27. Basic Electricity of welding power source, AC/DC power source advantages and disadvantages.
28. Polarity types & Arc length.
29. Electrode -Types, description & Specification-BIS, AWS, etc., Functions of flux & Characteristics of flux & arc, Selection of electrodes and coating factors, Tack welding procedure on plate, channels & pipe- Length & pitch.
30. Metals used in fabrication, Types of fabrication joints, Types and classification of steel and application, Framed structures- hell structure - Rolled sections, I section, channel section, angle section, T-section.
31. Welding symbols- Structural/ Pressure vessel design drawing reading and understanding the concepts.
32. Description and operation of croppers, shearing machine, Guillotine shears, punching machines, Edge planning machine and nibbling machine etc., Description and operation of straightening machines.
33. Methods of bending plates, angle iron etc., Cold bending and hot bending etc., Bending of angles and channels, Press work, Flame straightening methods.
34. Pipes and pipe fitting-Pipe schedule- types-methods of bending -use of bending fixture - pipe bending machine - use of pipe cutter, pipe wrenches - pipe vices - pipe threads - pipe dies and taps etc.
35. Edge preparation for pressure line pipes, fit up procedure, hand riveting, cold and hot-methods of riveting - use of pneumatic riveting, hydraulic riveting - checking rivets -removing of bad rivets.
36. Types of bolts - black bolt, turned bolt, high strength bolt etc. and their application, Development of pipe templates for T,Y,K joints.
37. Kind of structures - Column base, plate girders, Gantry girders, Root trusses-description, types and use - Beam connection, beam to column connection - framed connection and seated connection.
38. Type of pressure vessels - Boilers, Heat exchangers, High pressure pipe lines etc. - Marking for cutting to size, marking for bevelling and chamfering and marking for pipes and intersection.

39. Jigs and Template making - Design and description of templates for cutting - templates of gussets-templates for marking angle.
40. Template for marking joint section, Design and development of jigs for drilling and angles, Design of simple fixture and clamping devices.
41. Assembly-Procedure and technique for assembly, assembling of riveted plates, girders and trusses, Assembly of welded section, Assembly of cylindrical tanks including fitting and lining of vessels.
42. Distortion & methods of control, Preventing and allowing for weld distortion, Common welding defects, Inspection and testing, Non-destructive method of flaw detection -PT, MPT, Ultrasonic & Radiographic, Inspection Chipping & Grinding- Chisels & pneumatic chisels used for chipping- Method of chipping and cutting - Types of grinding machines -Grinding wheels - Method of removing welds and rivets by chipping and grinding, Finishing & Painting:- Common types of painting, Stencilling, marking and colour marking.

Practical:

1. Importance of trade Training Machinery used in the trade, Introduction to safety equipment and their use etc., Hack sawing, filing square to dimensions, Marking out on MS plate and punching.
2. Setting up of Arc welding machine & accessories and striking an arc Setting of oxy-acetylene welding equipment, Lighting and setting of flame.
3. Fusion run without and with filler rod on M.S. sheet 2 mm thick in flat position, Edge joint on MS sheet 2 mm thick in flat position without filler rod, Marking and straight line cutting of MS plate. 10 mm thick by gas.
4. Straight line beads on M.S. plate 10 mm thick in flat position, Weaved bead on M. S plate, 10mm thick in flat position, square butt joint on M.S. sheet 2 mm thick in flat Position, Fillet "T" joint on M.S. Plate 10 mm thick in flat position.
5. Bevelling of MS plates 10 mm thick. By gas cutting, Open corner joint on MS sheet 2 mm thick in flat Position, Fillet lap joint on M.S. plate 10 mm thick in flat position.
6. Circular gas cutting on MS plate 10 mm thick by profile cutting machine, Fillet "T" joint on M S she et 2 mm thick in flat position, Open Corner joint on MS plate 10 mm thick in flat position.
7. Fillet Lap joint on MS sheet 2 mm thick in flat position, Single "V" Butt joint on M S plate 12 mm thick in flat position, Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position, Straight line beads and multi-layer practice on M.S. Plate 10 mm thick in Horizontal position, Fillet Lap joint on M.S. sheet 2 mm thick in horizontal l position, Fillet Lap joint on M.S. plate 10 mm thick in horizontal position.
8. Fusion run with filler rod in vertical position on 2mm thick, M.S. sheet, Square Butt joint on M.S. sheet. 2 mm thick in vertical position, Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position, Weaved bead on M.S Plate 10mm in vertical position, Fillet "T" joint on M.S sheet 2 mm thick in vertical position, Structural pipe welding butt joint on MS pipe 0 50 and 3mm WT in 1G position, Fillet Lap joint on M.S. Plate 10 mm in vertical position, Open Corner joint on MS plate 10mmthickinvertical position, Pipe welding - Elbow joint on MS pipe 0 -50 and 3mm WT. Pip e we l ding "T" joint on MS pipe 0 5 0 and 3mm WT, Single "V" Butt joint on M S p late 12 mm

thick in vertical position, Pipe welding 45 ° angle joint on MS pipe 0 50 and 3mm WT.

9. Pipe welding butt joint on MS pipe 0 50- and 5-mm WT. in 1G position, Fillet Lap joint on M.S. plate 10 mm thick in overhead position, Single "V" Butt joint on MS plate 10mm thick in overhead position, Pipe butt joint on M. S. pipe 0 50mm WT 6mm (1G Rolled).
10. Square Butt joint on S.S. sheet. 2 mm thick in flat position, Square Butt joint on S.S. Sheet 2 mm thick in flat position, Square Butt joint on Brass sheet2mmthickin flat position, Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing, Single "V" butt joint C.I. plate 6mm thick in flat position. Arc gouging on MS plate 10 mm thick. Bronze welding of cast iron (Single "V" butt joint) 6mm thick plate.

18. Syllabus for HUMAN RESOURCE EXECUTIVE Trade-for the post of Instructor.

Theory:

1. Functional Grammar, developing grammatically correct statements- written and verbal, Reading–purpose, skimming take the best part, scanning reading with attention, cognates relative words, text structures, Writing–how to put thoughts in written texts, minimizing errors, crosschecking for errors, filing reports.
2. Computer overview- Office Application- MS word Office Applications – MS Excel Office Applications–MS PowerPoint, Basic Internet application.
3. Speaking–how to express yourself verbally, importance of good spoken communication in any field of advancement Business Communication–verbal.
4. Accident prevention techniques, Occupational Safety and Health legislations in India.
5. Advanced internet application, Business Applications and IT, Business Communication-Written.
6. Women and Occupational Safety, Managing work and family, online social media.
7. Social/Formal etiquettes, Introduction to quality consciousness.
8. Basics of Economics–an overview of micro and macroeconomics, theory of demand and supply, production, markets, GDP, inflation, wage market, basic concept of employment, Introduction to Indian economy, Concepts of National Economic Planning, Quality concepts and Quality Tools.
9. Concepts of Happy Capitalism, trickle up Theory, Increasing Marginal Utility, Survival of the Weakest. Advanced Executive Communication, Concepts in TQM and ISO, Detailed quality specifications of an entrepreneur–business leader, analytical mind Market Feedbacks and business decisions; market intelligence, Business environment and entrepreneurship.
10. Time Management, Introduction to Entrepreneurship, who can become an entrepreneur, how can entrepreneur start his venture, National Economic Planning and how India may grow faster? Critical detailing of the economic

development vis a vis the most optimal development strategy, Introduction to Quality parameters.

11. Course expectations, Content introduction and class resources.
12. Pedagogy of the curriculum-Introduction to various forms of teaching mechanism which will include role-plays, case studies specific to subject, how to read a case and draft out the solutions.
13. What is Human Resource management, HR jobs in India at the entry level, Hierarchy of an HR department in an organisation.
14. Need and demand of the market for trained/skilled personnel and how to meet the demand through recruitment and selection.
15. Wage, Salary and Compensation, Appraisal system and Evaluating manpower, Training and Development job enrichment and growth, Managing Personnel Issues, negotiations and bargaining, Maintenance and Integration of HR Functions.
16. Worker's participation and Corporate Governance.

Practical:

1. Stress and accents, accentuation mode of pronunciation marks, Intonation using a particular tone, Diction use of word and speech using audio-visual aids.
2. Transformation of sentences. Adjectives of comparison, Voice change, narration, change of tense, spellings and vocabulary development, reading simple English with preparations, news reports, elementary office reports/ memos/notices, reading current news and giving opinions or engaging into group discussions, Construction of simple sentences. Preparation of news reports, paragraphs; form filling, addressing envelopes, layout of letters, writing requests, answering to queries – written and over email, letters of application, letters of appointments, office notifications, job-orders, simple comprehension.
3. Computer – its use and application. How to put together the keyboard, the mouse, the monitor and the printer ports to the CPU tower, Use Computer as an input and output device, Identify Types of memory viz. hard disk, CD, pen drive, external hard disk.
4. MS Word –Getting started; How to type, format, edit content, how to mail merge, how to convert into a pdf, how to print; compilation of project/business reports, Password protection of documents, MS Excel –Getting started, Excel as database manager. Excel as a calculating application. Some basic calculation and formulation techniques. How to edit and format. Password protection of excel sheets, MS PowerPoint- Getting started. Power Point as a presentation manager. How one can present business ideas using a slide system, creating presentations, Editing and formatting a presentation; Real life presentations on corporate / business briefs. Presentation styles and types. Book presentations, movie, presentations, corporate presentations, what is the internet, what are browsers and how to browse? How to search on search engines. How to create a document with data copied from the internet.
5. Speaking with preparation – on self, family, career aspirations, on any given topics. Radio jockeying, introducing seniors, initiating business conversations, sales pitching, ending business meetings, body language to impress others, reading other's body language. Speaking on the spot extempore, just a minute, flip-back; role plays, dialogues, group discussions, interjection, raising a query, answering a query.

6. General guidelines of how to prevent an accident from happening – depending on job types. Humanity and helping colleagues, how to prevent oneself in emergency. Learning how and when to evacuate in case of an emergency – earthquake fire, terror attack, etc.; how should office spaces be designed – workplace ergonomics; need for first aid, fire extinguisher and emergency numbers, Practical aspects of Factories Act, Workmen's Compensation Act & ESI Act to be explained with examples &case studies.
7. How to open a mail account or use Outlook Express MS Outlook, sending mails, answering mails. Security issues and passwords, Online marketing basics; ecommerce and m- commerce, Introduction to financial tools, Online marketing reports, Software's to convert data in different forms freeware; concepts of spyware, malware and internet security. Resume building, introductory notes, e-mail communication, request for meetings and written acknowledgements. What is the concept of quarantine?
8. What are the government and corporate guidelines for women at work? What is meant by social or physical abuse of a woman? What is the legal defense sought by a woman in her working environment? How to manage work life balance – the need for it, what is the concept of social media; uses of social media – networking, making friends, business prospects.
9. How to greet, wish, bid goodbye; how to exchange business cards, how to speak with seniors and juniors, how to maintain corporate decorum? How to eat/drink in social/corporate get- togethers, how to thank people.
10. History of Indian civilization, How the Indian economic state in its current form came into being; barter system and the silk route, spice trade. Colonization different wars during the Islamic period and later the British East India Company; Indian independence and the economic changes.
11. How our present stage is related to our past and how our future is related to the present economic situation, Why the Indian growth was called Hindu Growth rate? How did the growth rate change to near double digit; basic understanding of liberalization and opening of Indian economy.
12. Linking with the concept of more choice and expanding market, why do we need a quality process? How does quality help an organization? How is an organization's vision linked to its quality consciousness?
13. Why do we need economics? Economics and its impact on our life., Economics and choice – with case studies and examples of everyday life, Economic concepts used in business – understanding demand, supply, production, Economic decisions to enter a market based on type of market – monopoly, oligopoly, duopoly, perfect competition, Basic concept of why prices rise – inflation, how price rise affects our life – money supply and theory of wage, How does one contribute to the country's growth – concepts of GDP and GNP?
14. Why do people remain unemployed and the role of government in reducing unemployment? What is meant by a planned economy? Where did the concept of planning evolve from? What is the difference in the economic development of the western world Capitalist and the Soviet Bloc Communist-Socialist? How the growths of Chinese and Indian economy differ?
15. How the knowledge of economic growth helps you as an entrepreneur? Quality in customer- supplier relations, designing organizations for quality 8 Tools and techniques used to achieve quality, explain how quality adherence builds long term credibility and organizational growth.

16. Individual's contributions to enhancing organizational quality, what are the contributions of an entrepreneur that will make the society better, people around happier and economic system stronger?
17. How can capitalism the concept of rich getting richer and poor getting poorer make a society happier?
18. In an era of cut throat competition, where it is the law of the jungle and the fittest only survive.
19. How can modern economic thought involving National Economic Planning ensure the survival of the weakest?
20. Group Discussion- Initiate a discussion, participate in a discussion, drawing conclusion.
21. Interviewing techniques.
22. Value of time for a business, how to respect other's time, how is time management, punctuality and regularity leads to positive attitude towards work., How to schedule your day and prioritize your work, how to plan your goals, brief about project planning processes.
23. What is entrepreneurship–basic concepts, Difference between entrepreneurship and self- employment, how an entrepreneur contributes to economic growth and prosperity of a country, Entrepreneurial qualities, what makes an entrepreneur different from a business manager, entrepreneurs, Ethics, attitudes, values and motives.
24. Competencies required to be successful entrepreneur, Case studies on successful entrepreneurs, Creativity and entrepreneurship; how to think creatively and innovatively.
25. How does a successful entrepreneur see same thing differently with a business acumen, Entrepreneurship and calculated risk.
26. Current economic situation, Concepts of the economic crisis in 2008-10, What are the factors that stabilize a country from economic crisis, what can be your role in bringing about a change in consciousness towards current economic development process.
27. Basic HR and Personnel Concepts in the real life – what is so important about human resources, understanding whether there is shift of labour intensive or technology intensive industrialization, how to read a case study, how to analyze, what kind of answers to look for, do cases have any right or wrong answers.
28. Concepts on recruitment and Selection, Differentiation of the two terms, who recruits, who to recruit, when to recruit, how to recruit, Understanding the process of job analysis, Job description, Job specification, Segregation of CVs as per functional area, Filing and coding the CVs.
29. Administration of welfare, amenities & fringe benefits, safety & accident prevention work (reorientation of Occupational Safety and Health), Environment fatigue, safety, accident prevention; Employee grievances and their redressal.
30. Suggestion schemes, administration of discipline; Attire in work environment (in case of production facility) – helmet, gloves, boots, eye guard, ear plugs.

19. Syllabus for MECHANIC MOTOR VEHICLE Trade-for the post of Instructor.

Theory:

1. Occupational Safety & Health- Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs-for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire, Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving &road-testing vehicles, Energy Conservation-Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips. Introduction to road safety and Automotive emissions.
2. Hand & Power Tools- Marking scheme, marking material- chalk, Prussian blue, cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut, Hammer- ball pein, lump, mallet, Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver, Allen key, bench vice & C- clamps, Spanners-ring spanner, open end spanner & the combination spanner, universal adjustable open-end spanner, Sockets& accessories, Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlips pliers, external circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing.
3. Systems of measurement, Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
4. Drilling machine-Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.
5. Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps, Different type of Die and Die stock, Screw extractors, Hand Reamers – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
6. Basic electricity, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.
7. Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

8. Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs).
9. Introduction to Hydraulics & Pneumatics: - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear Pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3-way valve, Pressure relief valve, non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator &Lubricator).
10. Auto Industry-History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association.
11. Definition- Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.
12. Introduction to Engine-Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4- stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine (SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light.
13. Different type of starting and stopping method of Diesel Engine, Procedure for dismantling of diesel engine from a vehicle.
14. Petrol Engine Basics- 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components- Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems -Electronic fuel injection systems, Exhaust systems, Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating.
15. Gasoline Fuel Systems-Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure & vacuum.
16. Engine Components- Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Petrol and Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence Valves & Valve Trains- Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, and Valve seats inserts in cylinder heads, importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valve timing. Description of Camshafts & drives, Description of Overhead camshaft, importance of Cam lobes, Timing belts & chains, Timing belts & tensioners.

17. Description & functions of different types of pistons, piston rings and piston pins and materials, used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy, Compression ratio.
18. Description & function of connecting rod, importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins.
19. Description and function of Crank shaft, camshaft, Engine bearings- classification and location – materials used & composition of bearing materials- Shell bearing and their advantages- special bearings material for diesel engine application bearing failure & its causes-care & maintenance. Crank-shaft balancing, Firing order of the engine.
20. Description and function of the fly wheel and vibration damper, Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc., Function of clutch & coupling units attached to flywheel.
21. Description of Cylinder block, Cylinder block construction, and Different type of Cylinder sleeves (liner).
22. Need for Cooling systems, Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, Basic cooling system components- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.
23. Need for lubrication system, Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system.
24. Lubrication system components - Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters, Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.
25. Intake system components- Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material, Exhaust system components- Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination., Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, Electronic mufflers.
26. Diesel Fuel Systems- Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology, Diesel fuel system components – Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection. Electronic Diesel control- Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.
27. Engine assembly procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engines, Different between gas turbine and Diesel Engine.
28. Emission Control-Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion, Combustion chamber design. Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in

exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels, Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, , Controlling air-fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR VS SCR.

29. Description of charging circuit operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system.
30. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.
31. Troubleshooting-Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.
32. Introduction-Study of different major components & assemblies of heavy vehicle, and different make (indigenous). Name plate-constructional differences and their merits. leading manufacturers in Heavy vehicle Industry.
33. Clutches & Manual Transmissions- Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms Clutch components- Pressure plate, Driven/ center plate, Throw-out bearing, Manual transmissions- Gear ratios, Compound gear trains, Gear selection, Bearings, Oil seals & gaskets, Brief about Automated Manual Transmission (AMT) Gearbox layout & operation-Gearbox layouts, Transaxle designs, Gearbox operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit. Gear shift mechanism.
34. Final Drive & Drive Shafts - Basic layouts Front-wheel drive layout, Rear-wheel drive layout, Four-wheel drive layout, All-wheel drive layout, 4WD v/s AWD Front-wheel drive, Front-wheel drive shafts, Front-wheel final drives, Front- wheel differentials, Rear-wheel drive- Propeller shaft, Type of Universal joints, Type of Constant velocity Joints, Rear-wheel final drives, Salisbury axles, Rear-wheel drive differentials, Limited slip differentials. Four-wheel drive- Four-wheel drive shafts, Four-wheel final drive, Four- wheel drive transfer case, Freewheeling hubs, Four-wheel drive differentials, All-wheel drive- four-wheel final drives, All-wheel drive transfer case, Transfer case differential action.
35. Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches. Planetary gearing- Planetary gears, Simple planetary gear sets, Compound planetary gear sets, Automatic transmission brake bands, multi-disc clutches, electronic control transmission-Electronic control Unit, fully hydraulically controlled transmission, electronic shift programs, Manual selection.
36. Layout & operation for P, R, N & D (1st & 2nd), Selector positions, Planetary gear set, High range power flow, Low range power flow Servos & clutches-Rear servo, Front servo, One-way clutch, Multi-plate front clutch, Clutch pack, Rear clutch.
37. Hydraulic system & controls-Hydraulic system components, Spool valves, Regulating or flow control valves, Control valves, Orifice, Valve types & functions- Basic valve action, Regulator & control valves, Shift & governor valves, Pressure regulation- The primary regulating valve, Line pressure variation, Modulator valve pressure, the governor, Governor pressure, Kick

down pressure. Flow control- Gear position 1, 1-2 shift valve, 2-3 shift valve assembly, The servo orifice control valve, 3-2 kick down Continuously variable transmission (C.V.T.) - Continuously variable transmission, Drive or reverse, The steel belt, Secondary pulley shaft.

38. Steering Systems-Description and function of Steering systems, Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system, Steering boxes & columns - Description and function of Steering columns, Rack- and-pinion gearbox, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operation Steering arms & components-Forward control vehicle steering, Steering linkages, Joints, Bushes/bushings, Wheel alignment fundamentals:- Basic principles of wheel alignment, wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, Turning radius, Thrust angle & centrelines.
39. Suspension Systems- Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening. Types of suspension-Suspension systems, Solid axle, Dead axle, Description, function and advantages of non-independent suspension independent suspension, Rear independent suspension, Rear- wheel drive independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types- Description and function of Hydraulic shock absorbers, Gas- pressurized shock absorbers, Load- adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers, Front suspension types & components- Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types & components- Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension, Rigid non-drive suspension.
40. Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels, Tyre types & characteristics- Tyres, Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems, Run flat tyres, Space-saver tyres, Tyre distortion, Center of gravity., Tyre construction-Tyre construction, Types of tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Descriptions Tire wear Patterns and causes Nitrogen vs atmospheric air in tyres.
41. Braking Systems - Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad, Regenerative braking, Braking system components-Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Brake light switch, Drum brakes & components -Drum brake system, Drum brake operation, Brake linings & shoes, Back plate, Wheel cylinders, Disc brakes & components -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake callipers, Proportioning valves, Proportioning valve operation, Brake friction materials, Antilock braking system & components-ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors,

ABS with EBD electronic control unit. The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system, Introduction to Electromagnetic retarder brake (EMR) and Engine exhaust brake.

42. Licensing of drivers & conductors, Registration of vehicle, Traffic rules, Signals & controls, Accidents, Causes & analysis, Responsibility of driver, Offences, penalties & procedures, Different types of forms, Government administration structure, Personnel, Authorities & duties, Rules regarding construction of motor vehicles, Tax exemption & tax renewal, Insurance types & significance -Comprehensive, Third-party insurance, Duty of driver in case of accident.
43. Introduction to EFI Engine Management- EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp.
44. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.
45. EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor.
46. Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, Induction, Inductive system operation, Induction wiring, Hall effect sensors, Hall effect operation, Optical type sensors Distributor less ignition systems, Insulated coils, Distributor less ignition system timing.
47. Charging system- The purpose of Charging system, charging system components, charging system circuit, Alternator principles, Alternating current, Alternator components, Rectification, Phase winding connections, Rotor circuit, Voltage regulation, System operating voltage, High voltage charging systems, Rotor, Stator, Alternator end frames, Slip ring & brush assembly, Rectifier assembly, Alternator cooling fan.
48. Starting system- purpose of starting system, Staring system components, Starter motor principles, study of starter control circuits, Starter motor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction. Lighting system, Lamps/light bulbs, Lamp/light bulb information, LED lighting, Headlights-description of standard sealed beam, halogen sealed beam, composite and High intensity discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light circuits, Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit, interior lights- courtesy, reading and instrument panel lights, Smart lighting, Reverse lights.
49. Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Basic air- conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air- conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX valve

construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements, Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems.

50. Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos, Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Reflective displays, Global positioning satellites, Triangulation/ trilateration, Telematics. Networking & multiplexing.
51. Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle, Electrical & Electronic architecture.
52. Locating vehicle information, Obtaining & interpreting scan tool data, using a repair manual, using a shop manual, using an owner's manual, using a labour guide, using a parts program, Using a service information program.

Practical:

1. Familiarization Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor, Importance of maintenance and cleanliness of Workshop, First aid and Fire safety, Use of fire extinguishers, Practice operation of different workshop equipment, Demonstrate Energy saving tips and electricity usage, knowledge using all marking aids, like steel rule with spring callipers, dividers, scriber, punches, Chisel etc.
2. Layout a work piece- for line, circle, arcs and circles, Practice to measure a wheel base of a vehicle with measuring tape, Practice to measure valve spring tension using spring tension tester, Practice to remove wheel lug nuts with use of an air impact wrench, Practice on General workshop tools & power tools.
3. Carryout Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers, Carryout Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer, Carryout Measuring practice on valve spring free length, Carryout Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges, Carryout Measuring practice on cylinder bore for taper and out- of-round with Dial bore gauges.
4. Perform Measuring practice to measure wear on crankshaft endplay, crankshaft run out, and valve guide with dial indicator, Perform Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge, Perform Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge.
5. Practice to check engine manifold vacuum with vacuum gauge, Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting, Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a

drilling machine, Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor, Practice Cutting Threads on a Bolt/ Stud. Adjustment of two-piece Die, reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.

6. Practice in joining wires using soldering Iron, Construction of simple electrical circuits, measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, and circuit breakers, Diagnose series, parallel, series- parallel circuits using Ohm's law, check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting.
7. Carryout Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, connect battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit, Test diode for functionality.
8. Practice checking Transistors, Identify Hydraulic and pneumatic components used in vehicle, trace hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit, Identify components in Air brake systems.
9. Carry out Identification of different type of Vehicle, Perform Demonstration of vehicle specification data, Perform Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipment. - Vehicle hoists – Two post and four post hoists, Engine hoists, Jacks, Stands.
10. Identify parts in a Diesel engine of LMV/ HMV, identify parts in a Petrol engine of LMV/ HMV, Practice on starting and stopping of engines.
11. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition, Practice identification of difference in components of Petrol and Diesel Engines, Practice on dismantling engine of LMV/HMV as per procedure.
12. Practice on removing the valves and its parts from the cylinder head, cleaning. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness, Perform Checking valve seats & valve guide – Replacing the valve, if necessary, check valve overlap. Testing leaks of valve seats for leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble.
13. Practice Overhauling piston and connecting rod Assembly. Use of service manual for clearance and other parameters, Practice on removing oil sump and oil pump – clean the sump. Practice on removing the big end bearing, connecting rod with the piston, Dismantle the piston and connecting rod, Check the side clearance of piston rings in the piston groove & lands for wear, Check piston skirt and crown for damage and scuffing, clean oil hole, Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.
14. Practice on Checking &Top up coolant, Drain& refill coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat, Inspect the radiator pressure cap, testing of thermostat, Practice on Checking engine oil, draining engine oil, Replacing oil filter, Refilling engine oil.
15. Reassemble all parts of engine in correct Sequence and torque all bolts and nuts as per workshop manual of the engine.

16. Practice on troubleshooting in LMV/HMV for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.
17. Practice on adjusting clutch pedal play-removing gearbox and clutch assembly from Light & Heavy Vehicle, Perform Dismantling clutch assembly, cleaning inspecting parts.
18. Practice on removing wheels from light & Heavy vehicle, dismantling tyres and tubes, checking puncture, Practice Assembling & inflating tyres to correct pressure, Check & adjust tire pressure by use of air or by Nitrogen, Rotate the wheels in vehicle minor repairs to wheels and tyres, wheel balancing & alignment, Check for tyre wear patterns.
19. Practice on Adjusting brake pedal play, Overhauling and inspection of tandem master cylinder assembly, Perform Overhauling and inspection of front and rear brake assembly, overhauling and inspection of wheel cylinder assembly, Carryout Overhauling and inspection of vacuum assisted brake assembly, Perform Overhauling and inspection of disc brake, Practice Adjusting Air brakes- repair to tank unit, air compressor, wheel brake adjuster- locating air leaks in the brake lines and rectifying – general maintenance and care, Perform Brakes service procedures-Checking & adjusting brake fluid, Replacing brake fluid, Checking brake pads, Replacing brake pads, Removing & replacing a rotor, Replacing brake lining, Practice of maintaining of ABS system.
20. Trace the light circuit - test bulbs, align head lamps, aiming headlights. Changing a headlight bulb, checking of a head light switch and to replace if faulty, Perform Trouble shooting and remedy for Headlight - headlight do not light up, only one headlight does not light up, only one beam (“Hi” or “Lo”)does not light.
21. Driving Practice-Practice in straight driving on wide roads, driving through lanes and curves, Practice in reversing, Practice overtaking another vehicle, Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking.

SYLLABUS FOR PRACTICAL & DEMONSTRATION EXAMINATION FOR EMPLOYABILITY SKILL SUBJECT INSTRUCTOR

1. MEANING OF COMMUNICATION, KINDS OF COMMUNICATION, PRINCIPLES OF COMMUNICATION, FACTORS AFFECTING COMMUNICATION PROCESS, NATURE & BARRIERS OF COMMUNICATION, IMPORTANCE OF COMMUNICATION
2. COMMUNICATION SKILLS, PRESENTATION SKILLS AND SOFT SKILLS
3. DECISION MAKING AND PROBLEM SOLVING
4. LEADERSHIP SKILLS
5. TEAMWORK & SELF CONFIDENCE
6. PERSONALITY GROMING
7. DISCIPLINE & ETIQUETTES

SYLLABUS FOR PRACTICAL & DEMONSTRATION EXAMINATION FOR WORKSHOP CALCULATION & SCIENCE SUBJECT INSTRUCTOR

1. STANDARD UNIT
2. NUMERIC VALUE
3. FUNDAMENTAL QUANTITIES AND FUNDAMENTAL UNITS
4. DERIVED QUANTITIES AND DERIVED UNITS
5. SCALAR QUANTITY & VECTOR QUANTITY
6. DIFFERENT MEASUREMENT SYSTEM-CGS, FPS, MKS,SI
7. COVERSION UNITS-LENGTH, MASS & WEIGHT, CAPACITY, VOLUME, AREA, TIME, TEMPERATURE, ANGLE, PRESSURE, QUANTITY.

SYLLABUS FOR PRACTICAL & DEMONSTRATION EXAMINATION FOR ENGINEERING DRAWING SUBJECT INSTRUCTOR

1. DRAWING BOARD & BATTERN
2. CARD BOARD & DRAWING SHEET
3. T-SQUARE
4. USES OF T-SQUARE
5. MARGIN
6. ZONE
7. DRAFTING MACHINE & MINI DRAFTER
8. SIZES OF DRAWING SHEET
9. PENCIL-TYPES OF PENCIL
10. TITLE BLOCK
11. INFORMATION IN TITLE BLOCK
12. DRAWING INSTRUMENTS-LARGE SIZE COMPASS, LARGE SIZE DIVIDER, SMALL BOW COMPASS, RULING PEN & LINER, LENGTHENING BAR, LEAD CASE, SCREW DRIVER,
13. PRACTICAL DRAWING OF DIFFERENT POLYGONS BY USING DRAWING BOARD, DRAWING SHEET AND INSTRUMENT BOX
14. ASSIGNMENT OF MAKING BLUE PRINTS OF DRAWINGS IN THE BLUE PRINT MACHINE.

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