सीएसआईआर–केन्द्रीय भवन अनुसंधान संस्थान
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No. 76(2)4/2024-Rectt. Dated: 12.06.2025

Notification to Advt. No. CSIR-CBRI-5/2025

In continuation to this office notification to advt. no. CSIR-CBRI-5/2025, all the candidates applied for the post of Technician in following post codes and areas are hereby informed that the syllabus for all the post codes are attached herewith from Annexure-I to XI for trade test as well as Paper III of written examination.

S. No.	Post Code	Area	Annexure
1	T01-25	Draftsman (Civil / Architect)	I
2	T02-25	Instrumentation	II
3	T03-25	Electrician	III
4	T04-25	Mechanic (Machine tool/Maintenance/refrigeration)	IV
5	T05-25	Mason	V
6	T06-25	Fitter	VI
7	T07-25	Welder	VII
8	T08-25	Plumber	VIII
9	T09-25	Medical Lab Technician	IX
10	T10-25	Computer / IT	X
11	T11-25	Digital Photography	XI

Controller of Administration

Annexure I

DRAFTSMAN (T01-25)

TRADE TEST

Draw freehand sketches of hand tools used in civil work following safety precautions.

Draw plane figures applying drawing instruments with proper layout and the method of folding drawing sheets.

Draw orthographic projections of different objects with proper lines, lettering and dimensioning

Draw Isometric/Oblique/Perspective views of different solid/hollow/cut sections with proper lines, lettering and dimensioning.

Draw component parts of a single storied residential building with suitable symbols and scales.

Draw different types of stone and brick masonry.

Draw different types of shallow and deep foundation.

Draw different types of shoring, scaffolding, underpinning, framework and timbering.

Draw different types of Damp proofing in different position.

Draw different types of doors and windows according to manner of construction, Arrangement of component, and working operation.

Perform site survey with chain / tape and prepare site plan.

Prepare the detailed drawing of electrical wiring system.

Draw types of ground and upper floors.

Draw different types of vertical movement according to shape, location, materials in stair, lift, ramp and escalator.

Draw different types of roofs, truss according to shape, construction, purpose and span.

Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style.

Draw a sanction plan of double storied flat roof residential building by using CAD.

Create objects on 3D modeling concept in CAD.

Prepare a drawing of public building detailing with roof and columns by frame structures using CAD.

Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule.

Draw the details of a framed structure and portal frame of a residential building using CAD.

Draw the different types of steel sections, rivets and bolts using CAD.

Draw the details of girders, roof trusses and steel stanchions using CAD

DRAFTSMAN (WRITTEN TEST)

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, Soft Skills: its importance and Job area after completion of training. Introduction of First aid. Introduction of PPEs. Introduction to 55 concept& its application. Response to emergencies e.g.; power failure, fire alarm, etc.

Importance of B.1.5, Introduction of Code for practice of Architectural and Building Drawings, Layout of drawing. Lines, Lettering, Dimensioning.

Knowledge of different types of scale. Principle of R.F 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.

Different types of projection views: Orthographic, Isometric, Oblique and Perspective, Building: Principle of planning, Objectives & importance, Function& responsibility, Orientation, Local building Bye-Laws as per ISI code, lay out plan & key plan, submitted in composition of drawing, Provisions for safety, Requirement of green belt and land.

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.

Building Planning: Economy & orientation, Provision for lighting and ventilation, Provision for drainage and sanitation, Types of building, Planning & designing of residential, public and commercial building.

Prefabricated Structure: Preparation, Method of construction, assembling, Advantages & disadvantages.

3D modeling concept in CAD: 3D coordinate systems to aid in the construction of 3D objects, Knowledge of shortcut keyboard commands.

Concepts of design of earthquake resisting buildings- requirements resistance, safety, flexible building elements, special requirements, base isolation techniques.

Reinforced cement concrete structure: Introduction to RCC uses, Materials proportions, Form work, Bar bending details as per IS Code, Reinforced brick work.

Materials used for RCC: Construction, Selection of materials - coarse aggregate, fine aggregate, cement water and reinforcement., Method of mixing concrete machine mixing and hand mixing, Slump test.

Structure columns, beams, slabs one-way slab & two-way slab, Innovative construction, Safety against earthquake, Grade of cement, steel-behavior and test, Bar-bending schedule, Retaining wall, R.C.C. Framed structure

Steel structures: - Conmen forms of steel sections, Structural fasteners, Joints, Tension & compression member, Classification, fabrication, Construction details.

House drainage of building: Introduction, Terms used in PHE, Systems of sanitation, System of house drainage, plumbing, sanitary fittings, etc.,

Types of sewer appurtenance, Systems of plumbing, Manholes & Septic tank, Water treatment plant, Sewerage treatment plant

Roads: History of highway development, General principles of alignment, Classification and construction of different types of roads, Component parts, Road curves, gradient, Curves-types, designation of curves, Setting out simple curve by successive bisection from long chords, simple curve by offsets from long chords, Road drainage system.

Estimating and Costing: Purpose and common techniques, drawing of construction,

Measurement techniques, Estimate-necessity, importance, types-approximate and detailed estimate-main and sub estimates, revised, supplementary, maintenance /repair estimate-taking off quantities-method, Rate analysis of typical items and their specifications, Labour and materials., Govt. Schedule of rate, estimating of irregular boundaries by trapezoidal and Simpsons formula.

Total Station: 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.

GPS (Global Positioning System): - Introduction of GPS system, Co-ordinate and time system, Satellite and conversional geodetic system, GPS. Signal, code, and biases, Role of TRANSIT in GPS development, GPS survey methods. Basic geodetic co-ordinate, Ground support equipment, signals, Tracking devises& system, Time measurement and GPS timing.

Annexure II

INTRUMENTATION (T02-25)

TRADE TEST

Identify, Test various analog and power electronics components. Construct, test and 2 analyze the circuit functioning.

Identify, place, solder and de-solder and test different SMD, discrete components with due care and following safety norms using proper tools/setup.

Test various electrical passive and active components using proper measuring instruments and compare the data using standard parameter. Detect the faults and troubleshoot SMPS, UPS, inverter, converter and Thyristor family.

Identify, test the cable and measure the electrical parameters, use of various types of switches, E.M. relays, Circuit breaker and construct electrical circuits. 5. Plan, execute commissioning, testing and evaluate performance of AC & DC motors and
generators.

Select, perform electrical/electronic measurement, earthing installation service and calibrate MI instruments, electro dynamometer instruments, Induction type and Special instruments -voltage tester, continuity tester, rotation tester, phase sequence indicator, synchronising, synchroscope, frequency meter, thermocouple type ammeter.

Identify, test and verify all digital ICs. Assemble, test and troubleshoot various digital circuits and digital instruments.

Measure the various parameters by CRO and execute the result with standard one.

INTRUMENTATION (WRITTEN TEST)

Use of Electrical components - conductor, semiconductor & insulators. Standard wire gauge (SWG). Introduction of electricity- static electricity.

Current, voltage, P.D, E.M.F, resistance. Electrical circuit - D.C & A.C circuit differences. Importance of grounding.

Uses of multimeter. Resistor, Resistivity and colour code, Types of resistors used in instrumentation. Definition and purpose of soldering and desoldering. Soft soldering, Types of soldering irons. Solder & flux. Care & precaution of soldering. De-soldering tools and method of use. Ohm's law & Kirchhoff s laws. Series & parallel circuits. Primary & secondary cells and batteries. {Liquid & dry). Maintenance free batteries construction-charging, efficiency-use, advantage

Switches and types. Magnet and magnetism, magnetic properties. Magnetic campus and its uses. Explanation of Electro-magnetism, Advantages, disadvantages, application-types E.M. relays. Principles of alternating current, A.C & DC electricity, types of wave forms, time period and frequency, peak to peak values, RMS values, Average values.

Inductor and Inductance, types of inductors, Factors affecting the value of inductance, selfinductance (L), Capacitance, types of capacitor, unit of capacitance, factors affecting the value of capacitors, charge, energy stored in capacitors. Capacitors in series and parallel. Capacitors in DC circuit. A.C.-impedance, Inductive reactance, capacitive reactance. AC

current through R, L, C circuits, Resonance in RLC circuit. Importance of series and parallel resonance.

Introduction of AC and DC generators working principles, construction. Operation, field magnets, armature windings, commutator and brushes, EMF equation. Faraday's Law, Lenz's Law: Fleming's left Hand and right-hand rules. DC motors working principles, construction, operation, types. Different speed controlling techniques of DC motors. AC motors, induction motors, three phase motors, stepper motors.

Transformer, types, transformation ratio. Open circuit test and short circuit test, regulation Auto transformer. Current measurement. Instrument transformer. Potential transformer and current transformer.

Basics of electrical measuring instruments, Types Types of secondary instruments, DC instruments working principle, method of working, moving coil absolute and secondary instruments. 'D1 Arsonval meter, PMMC meter-operation. (FSD) full scale deflection reading, measurement

value, meter sensitivity, accuracy. Meter resistance, maximum power, capability etc. Meter range extension, Converting galvanometer into ammeter. voltmeter. Range extension of voltmeter, ammeter. Shunt resistance and series resistance value calculation. Meter resistance, meter FSD identification techniques. Ohm meters-measuring electrical resistance. Basic construction of Ohm meter, working method of ohmmeter. Types of Ohm meter series and shunt type of ohm meters. Megger/insulation tester, earth tester construction working advantages and disadvantages of various types of ohm meter. AC instruments types of AC measuring instruments -MI, electro dynamometer type, Working principle, construction, advantages and disadvantages of MI instruments and electro dynamometer instruments. Various applications. Induction type meters working principle construction and operation of induction type instruments. Construction and Applications single phase and three phase energy meter, watt meter. Walt hour meter, Ampere Hour meter, power factor meter etc. Special instruments: voltage tester, continuity tester, rotation test, phase sequence indicator, synchronizing, the synchroscope, frequency meter. Thermocouple type ammeters.

Semiconductor, Covalent bond, Doping, Intrinsic and extrinsic semiconductor. PN junction diode, Forward and Reverse characteristics. Specification of diodes (data sheets). Applications of diode. Special semiconductor diode-Zener diode, tunnel diode, Photo diode Transistors. Defining transistors, NPN& PNP transistor, Symbol, operation, Biasing of Transistor & mode of Application. Transistor CB, CC, CE Amplification, current gain, voltage gain, and power gain. Introduction to FET, MOSFET. Rectifiers: half wave rectifier, full wave (bridge & center tapped) rectifier. Voltage multipliers. Filters: Introduction, purpose and use of ripple filter. Types of filters. Capacitance filter, inductance filters, RC filters, LC filters, voltage dividers and bypass filters. Voltage regulators. Introduction & purpose Zener regulators, shunt regulators, series regulators, IC regulators, variable regulators.

Power Supply units. Introduction, purpose & use. UPS and SMPS, inverters and converters and their applications

General characteristics of an amplifier, Concept of amplification. PCB basic construction, applications. Lay outing circuit on PCB

Oscillator's oscillations, oscillation frequency, basic working principle and working of Talk circuit, Crystal controlled oscillators, Phase shift oscillators, RC phase shift oscillators, Colpitt, Clapp, Hartley.

Operational Amplifier. Differential amplifier, ideal opamp. Op-amp with feedback. advantages of feedback. Inverting and Non inverting and inverting amplifier, Opamp as summer, differential amplifier. V to I converter and I to V converter, Instrumentation amplifier Basics of op amp applications integrator, differentiator, Introduction of timers (555) and its applications.

Number systems, binary, octal, decimal and hexadecimal number system. Conversion of number systems. Boolean algebra, binary addition, subtraction, multiplication and division. 1's and 2's compliment, BCD code, ASCII code, gray code. Logic Circuits. Basic gates-AND, OR and NOT gates. De-Morgan Is Theorem. Universal gates NAND and NOR gates. Special gates Ex-OR, Ex-NOR gates and Buffer and its applications. Basic digital ICs, function, digital application, logic symbols. Adders Half adder, full adder Subtractor -Half subtractor, full subtractor. Flip flops RS flip flop, clocked RS flip flop, JK flip flop, Basics of Counters and registers. Multiplexer and de- multiplexer Digital meters: displays. LED, 7 segment display, LCD, CRT, electro-luminescent displays, electro-phoretic image display, liquid vapor display, dot matrix display.

A/D and D/A converters, Introduction, weighted register D/A converter, binary(R-2R), ladder D/A converter, specification for D/A converter, Ramp or counter type A/D converter, GPIB (general purpose interface bus) IEEE-488, RS 232

Digital meters: frequency meter, phase measuring meter, and time measuring instruments. Digital capacitance meter

CRO: introduction and applications of CRO, functional block diagram of CRO, CRT power supply. Various types of probes. Applications of various

types of CROs like dual beam CRO, Dual trace CRO, storage oscilloscope.

Computer Hardware, Computer systems, computer hardware, CPU, CPU operations, ROMs and RAMS, I/P and O/P and peripheral equipment, terminals, printers, MODEMS, Data interface, ADC and DAC.

Introduction to microprocessor microcomputers, Memories Intel 8085. Architecture Instruction set of 8085, Microprocessor. 1. Data transfer group. 2. Arithmetic group. 3. Logic group. Basic Programming of 8085 such as adding, subtraction of two 8-bit numbers, etc. Block diagram and pin' diagram 8255 and its operation. Microprocessor applications

Instrument characteristics Static characteristics- accuracy, precision, sensitivity, resolution dead zone, repeatability, reproducibility, drift, Dead band, backlash, hysteresis. Dynamic characteristics speed response, fidelity, lag. Error, deviation, true value, data. Types of errors- systematic, random& illegitimate error. Certainty/uncertainty, validity of result. Measuring system Response. Introduction, amplitude responses, Phase response, Delay, rise time &slew rate. Damping & its importance. Statistical analysis arithmetic mean, deviation from the mean average deviation, standard deviation. Stress & Strain Measurement. Introduction to Strain gauges, types of strain gauges and differences. Applications of strain gauges, load cells. LVDT, RVDT, advantages and limitations

Electrical pressure transducers. Method of conversion, primary and secondary pressure transducers. Potentiometric pr. Transducers, Capacitive pr. transducers, reluctance-servo pressure transducers, strain gauge pressure transducers, piezo electric pressure transducer. Differentials pressure transducers

Low Pressure Measurement. Vacuum, gauges, thermal conductivity gauges, pirani gauges, thermocouple gauges, slack diaphragm. ionization gauge, McLeod gauge, capacitance manometers. Method of pressure instrument calibration. Dead weight tester and

comparators/manifolds. Elements of pressure transmitters; Installation components, pressure laps, Isolation valve, instrument piping, connections and fittings blow down valve, instrument valve, pulsation damper, diaphragm seal, pressure transmitter, Installation, procedure, locating and mounting, piping, electrical wiring placing into service, guidelines for periodic maintenance, troubles shooting and repair, instrument shop safety.

Principles of level measurement. Types of level measurements-solid and liquid, volume and mass, mechanical and electrical type. Surface sensing gauges, storage tank gauges, sight glasses, magnetic gauges, buoyancy, displacement gauges. Factors need to consider for open and closed channel level measurements level switches, mercury level switches in high pressure tank, level detectors, magnetic reed switches. Pressure head instruments. Hydrostatic pressure, specific gravity, pressurized fluids, pressure head instrumentation, air bellows. U- tube manometers, air purge systems, liquid purge systems, force balance diaphragm system Electrical method conductivity and capacitance method for measuring the liquid level capacitance probes, zero and span adjustments, sonic level detectors, point level detection. Solid level measurement Using weight to determine level, sonic solid level measurement with microwaves, using capacitance probes to measure solid level. diaphragm switches, nuclear gauges, microwave solid level detectors

Temperature measurement. Temperature, heat, specific heat, changing physical state Fahrenheit and Celsius temperature scales Rankin and Kelvin scales, calibration of temperature scales primary and secondary standards. Industrial application of temperature measuring instruments with compensating link & precautions to be taken. Bimetallic and fluid filled temperature instruments. Bimetallic thermometers, liquid-in-glass thermometers, filled system thermometers, thermometer bulbs, capillary

& bourdon tube, temperature transmitters for filled system, advantages & disadvantages of filled systems. Resistance thermometer, how it works, RTD bridge circuits, lead wire error, RTD elements, advantages and disadvantages of RTDs, thermistors, thermocouples, Ex-tension wires, compensating for changes in reference junction temperature, construction of thermocouple junction, types of thermocouple, advantages and disadvantages of thermocouples.

Control valves. Control valves functions and components, types of control valves, based on valve flow characteristics liner, equal percentage, quick opening valves, globe valves, cage valves, butterfly valves, ball valves, sliding gate valves, diaphragm valves, split body valves, capacitive, inductive type valve, proximity switch, IR switch, micro switch, limit switch, other control valves, control valve mechanical considerations, selecting control valves, valve positioner.

Pneumatic and Hydraulic Actuators. Pneumatic principles, effects of changing pressure. pressure/volume/ temperature relationship, effects of changing temp. Pneumatic actuators, diaphragm actuator, spring and spring less actuators, direct and reverse acting actuator, piston actuator, positioner, Electrical actuators and their advantages.

Introduction to controllers. Basic block diagram of control systems. Advantages Process variable and set point, analog controllers, digital controllers, control angles and limits, control loop measuring Pv, amplifying signals final control elements, current proportioning. Hunting & its effect on the product. Types of controller and their operation. Types of controller, range limit of controllers. ON/OFF controllers, direct and reverse acting controllers proportional controllers, automatic/manual split control, pneumatic control. Adaptive, limiting and batch control, ratio control system, feed forward, feedback control systems and cascade control system. Comparison between pneumatic and electronic control systems. Basic knowledge on communication protocol, Introduction to programmable controllers. History of programmable controllers, general characteristics of programmable controllers, some limitation of PLCs, method of developing PLC programming.

Input/output devices. Definition of input/output devices, I/O interface, input modules, output modules, input devices encoders, output devices, the opto-isolators, safety.

Digital control systems: need of smart devices, HART transmitters futures, advantages, applications. Working method of HART devices, HART protocol. HART communicators and PC based HART device configuration. Steps in calibration of HART devices. Communication.

Fundamentals of SCADA and DCS. History of DCS development. Basic architecture, description advantages and disadvantages, applications. Terminology- RTU (remote transmitting unit, central monitoring station, types of communications, field instruments and types.

ELECTRICIAN (T03-25)

Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Prepare profile with an appropriate accuracy as per drawing following safety precautions.	1. Visit various sections of the institutes and location of electrical installations. 2. Identify safety symbols and hazards. 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. 4. Practice safe methods of fire fighting in case of electrical fire. 5. Use of fire extinguishers.	Scope ofthe electrician trade. Safety rules and safety signs. Types and working of fire extinguishers.
	6. Practice elementary first aid. 7. Rescue a person and practice artificial respiration. 8. Disposal procedure of waste materials. 9. Use of personal protective equipment. 10. Practice on cleanliness and procedure to maintain it.	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.
	11. Identify trade tools and machineries. 12. Practice safe methods of lifting and handling of tools & equipment. 13. Select proper tools for operation and precautions in operation. 14. Care & maintenance of trade tools.	Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011.
	15. Operations of allied trade tools. 16. Workshop practice on filing and hacksawing.	Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Types of drills, description & drilling

		machines.
Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable.	17. Prepare terminations of cable ends 18. Practice on skinning, twisting and crimping. 19. Identify various types of cables and measure conductor size using SWG and micrometer. .	Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison.
	20. Make simple twist, married, Tee and western union joints. 21. Make Britannia straight, Britannia Tee and rat tail joints. 22. Practice in Soldering of joints / lugs.	Joints in electrical conductors. Techniques of soldering. Types of solders and flux.
	23. Identify various parts, skinning and dressing of underground cable. 24. Make straight joint of difference types of underground cable. 25. Test insulation resistance of underground cable using megger. 26. Test underground cables for faults and remove the fault.	Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades. Precautions in using various types of cables.
Verify characteristics of electrical and magnetic circuits.	27. 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. 28. Measure current and voltage in electrical circuits to verify Kirchhoff's Law 29. Verify laws of series and parallel circuits with voltage source in different	Ohm's Law; Simple electrical circuits and problems. Kirchhoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks.

	combinations.	
	30. Measure voltage and current against individual resistance in electrical circuit. 31. Measure current and voltage and analyse the effects of shorts and opens in series circuit. 32. Measure current and voltage and analyse the effects of shorts and opens in parallel circuit.	
	33. Measure resistance using voltage drop method. 34. Measure resistance using Wheatstone bridge. 35. Determine the thermal effect of electric current. 36. Determine the change in resistance due to temperature. 37. Verify the characteristics of series parallel combination of resistors.	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.
	38. Determine the poles and plot the field of a magnet bar. 39. Wind a solenoid and determine the magnetic effect of electric current. 40. Determine direction of induced emf and current.	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.
	41. Practice on generation of mutually induced emf. 42. Measure the resistance, impedance and determine inductance of choke coils in different combinations. 43. Identify various types of capacitors, charging / discharging and testing. 44. Group the given capacitors to get the required capacity and voltage rating.	

	45. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. 46. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. 47. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. 48. Measure the resonance frequency in AC parallel circuit and determine its effects on the circuit. 49. Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically. 50. Measure Current, voltage, power, energy and power factor in three phase circuits 51. Practice improvement of PF by use of capacitor in three phase circuit.	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.
	52. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. 53. Determine effect of broken neutral wire in three phase four wire system. 54. Determine the relationship between Line and Phase values for star and delta connections. 55. Measure the Power of three phase circuit for balanced and unbalanced loads. 56. Measure current and voltage of two phases in case of one phase is short-circuited in three phase four wire system and compare	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.

	with healthy system.	
Install, test and maintenance of batteries and solar cell.	**57.** Use of various types of cells. **58.** Practice on grouping of cells for specified voltage and current under different conditions and care. **59.** Prepare and practice on battery charging and details of charging circuit. **60.** Practice on routine, care/ maintenance and testing of batteries. **61.** Determine the number of solar cells in series / parallel for given power requirement.	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.
Estimate, Assemble, install and test wiring system.	**62.** 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.	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.
	65. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to a greater number of points of minimum 15 mtr 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. **66.** Wire up PVC conduit wiring and practice control of	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.

	sockets and lamps in different combinations using switching concepts.	
	69. Wire up the consumers main board with MCB & DB's switch and distribution fuse box. **70.** Prepare and mount the energy meter board.	Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g., godown, tunnel and workshop etc.
	71. Estimate the cost/bill of material for wiring of hostel/ residential building and workshop. **72.** Practice wiring of hostel and residential building as per IE rules. **73.** Practice wiring of institute and workshop as per IE rules. **74.** Practice testing / fault detection of domestic and industrial wiring installation and repair. .	
Plan and prepare Earthing installation.	**75.** Prepare pipe earthing and measure earth resistance by earth tester / megger. **76.** Prepare plate earthing and measure earth resistance by earth tester / megger. **77.** Test earth leakage by ELCB and relay.	Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.
Plan and execute electrical illumination system and test.	**78.** Install light fitting with reflectors for direct and indirect lighting. **79.** Group different wattage of lamps in series for specified voltage. **80.** Practice installation of various lamps e.g., fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide etc. **81.** Prepare decorative lamp circuit to produce rotating light effect/running light effect. **82.** Install light fitting for show case lighting.	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

Select and perform measurements using analog / digital instruments and install/ diagnose smart meters.	**83.** Practice on various analog and digital measuring Instruments. **84.** Practice on measuring instruments in single and three phase circuits e.g., multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter etc. **85.** Measure power in three phase circuit using two wattmeter methods. **86.** Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings. **87.** Measure electrical parameters using tong tester in three phase circuits. **88.** Demonstrate Smart Meter, its physical components and Communication components. **89.** Perform meter readings, install and diagnose smart meters.	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. Automatic meter reading infrastructures and Smart meter. Concept of Prosumer and distributed generation. Electrical supply requirements of smart meter, Detecting/clearing the tamper notifications of meter.
Perform testing, verify errors and calibrate instruments.	**90.** Practice for range extension and calibration of various measuring instruments. **91.** Determine errors in resistance measurement by voltage drop method. **92.** Test single phase energy meter for its errors.	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.
Plan and carry out installation, fault detection and repairing of domestic appliances.	**93.** Dismantle and assemble electrical parts of various electrical appliances e.g., cooking range, geyser, washing machine and pump set.	Working principles and circuits of common domestic equipment and appliances.
	94. Service and repair of electric iron, electric kettle, cooking range and geyser. **95.** Service and repair of induction heater and	Concept of Neutral and Earth.

	oven. **96.** Service and repair of mixer and grinder. **97.** Service and repair of washing machine.	
Execute testing, evaluate performance and maintenance of transformer.	**98.** Verify terminals, identify components and calculate transformation ratio of single-phase transformers. **99.** Perform OC and SC test to determine and efficiency of single-phase transformer. **100.** Determine voltage regulation of single-phase transformer at different loads and power factors. **101.** Perform series and parallel operation of two single phase transformers. **102.** Verify the terminals and accessories of three phase transformer HT and LT side.	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).
	103. Perform 3 phase operation (i) delta-delta, (ii) delta-star, (iii) star-star, (iv) star-delta by use of three single phase transformers. **104.** Perform testing of transformer oil. **105.** Practice on winding of small transformer. **106.** Practice of general maintenance of transformer.	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.

Read and apply engineering drawing for different application in the field of work	**ENGINEERING DRAWING** • Introduction to Engineering Drawing and Drawing Instruments. • Conventions. • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke Dimensioning Practice • Types of arrowhead Symbolic representation • Different electrical symbols used in the related trades Reading of Electrical Circuit Diagram. • Reading of Electrical Layout drawing	
WORKSHOP CALCULATION & SCIENCE		
Demonstrate basic mathematical concept and principles to perform practical operations.	**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 operation (i) delta-delta, (ii) delta-star, (iii) star-star, (iv) star-delta by use of three single phase transformers.	
WORKSHOP CALCULATION & SCIENCE		
Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.		**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 & division. Decimal fractions-Addition, subtraction, multiplication & division. Solving problems by using calculator.

		Square root, Ratio and Proportions. Percentage Square and square root. Simple problems using calculator. Applications of Pythagoras theorem and related problems. Ratio and proportion. Ratio and proportion - Direct and indirect proportions. Percentage Percentage - Changing percentage to decimal and fraction.
		Material Science Types metals, types of ferrous and non-ferrous metals. Introduction of iron and cast iron
		Mass, Weight, Volume and Density Mass, volume, density, weight Related problems for mass, volume, density, weight. Work, power, energy, HP, IHP, BHP and efficiency. Potential energy, kinetic energy and related problems with assignment.
		Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals. Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature. Heat &Temperature - Temperature measuring instruments, types of thermometers, pyrometer and transmission of heat. Conduction, convection and radiation.

		Mensuration Area and perimeter of square, rectangle and parallelogram. Area and perimeter of Triangles. Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse. Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder. **Trigonometry** Measurement of angles Trigonometrical ratio Trigonometrical tables
Plan, execute commissioning and evaluate performance of DC machines.	**107.** Identify terminals, parts and connections of different types of DC machines. **108.** Measure field and armature resistance of DC machines. **109.** Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. **110.** Test for continuity and insulation resistance of DC machine. **111.** Start, run and reverse direction of rotation of DC series, shunt and compound motors.	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.
Execute testing, and maintenance of DC machines and motor starters.	**112.** Perform no load and load test and determine characteristics of series and shunt generators. **113.** Perform no load and load test and determine characteristics of compound generators (cumulative and differential). **114.** Practice dismantling and assembling in DC shunt motor. **115.** Practice dismantling and assembling in DC compound generator.	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.
	116. Conduct performance analysis of DC series, shunt and compound motors. **117.** Dismantle and identify parts of three point and four-point DC motor starters. **118.** Assemble, Service and repair three point and four-point DC	Principle and types of DC motor. Relation between applied voltage and back e.m.f.. Armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and

	motor starters. **119.** Practice maintenance of carbon brushes, brush holders, Commutator and slip rings.	armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance.
Distinguish, organise and perform motor winding.	**120.** Perform speed control of DC motors - field and armature control method. **121.** Carry out overhauling of DC machines. **122.** Perform DC machine winding by developing connection diagram, test on growler and assemble	Methods of speed control of DC motors. Lap and wave winding and related terms.
Plan, Execute the commissioning and evaluate performance of AC motors. Execute the testing, and maintenance of AC motors and starters.	**123.** Identify parts and terminals of three phase AC motors. **124.** Make an internal connection of automatic star-delta starter with three contactors. **125.** Connect, start and run three phase induction motors by using DOL, star- delta and auto-transformer starters. **126.** Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic.	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.
	127. Determine the efficiency of squirrel cage induction motor by brake test. **128.** Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test.	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.
	129. Measure slip and power factor to draw speed- torque (slip/torque) characteristics. **130.** Test for continuity and insulation resistance of three phase induction motors. **131.** Perform speed control of three phase induction motors by	

	various methods like rheostatic control, autotransformer etc.	
Distinguish, organise and perform motor winding	**132.** Perform winding of three phase AC motor by developing connection diagram, test and assemble. **133.** Maintain, service and troubleshoot the AC motor starter.	Concentric/ distributed, single/ double layer winding and related terms.
Plan, execute commissioning and evaluate performance of AC motors. Execute testing, and maintenance of AC motors and starters.	**134.** Identify parts and terminals of different types of single-phase AC motors. **135.** Install, connect and determine performance of single-phase AC motors. **136.** Start, run and reverse the direction of rotation of single-phase AC motors. **137.** Practice on speed control of single-phase AC motors. **138.** Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed.	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.
Distinguish, organise and perform motor winding.	**139.** Carry out maintenance, service and repair of single-phase AC motors. **140.** Practice on single/double layer and concentric winding for AC motors, testing and assembling. **141.** Connect, start, run and reverse the direction of rotation of universal motor. **142.** Carry out maintenance and servicing of universal motor.	Concentric/ distributed, single/ double layer winding and related terms. Troubleshooting of single-phase AC induction motors and universal motor.
Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. Execute parallel operation of alternators.	**143.** Install an alternator, identify parts and terminals of alternator. **144.** Test for continuity and insulation resistance of alternator. **145.** Connect, start and run an alternator and build up the voltage. **146.** Determine the load performance and voltage regulation of three phase alternator.	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.

	147. Parallel operation and synchronization of three phase alternators.	
	148. Install a synchronous motor, identify its parts and terminals. **149.** Connect, start and plot V- curves for synchronous motor under different excitation and load conditions.	Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement.
	150. Identify parts and terminals of MG set. **151.** Start and load MG set with 3 phase induction motor coupled to DC shunt generator.	Rotary Converter, MG Set description and Maintenance.
Assemble accessories and carry out wiring of control cabinets and equipment.	**152.** Design layout of control cabinet, assemble control elements and wiring accessories for: (i) Local and remote control of induction motor. (ii) Forward and reverse operation of induction motor. (iii) Automatic star-delta starter with change of direction of rotation. (iv) Sequential control of three motors.	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.
	153. Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. **154.** Mount various control elements e.g., circuit breakers, relays, contactors and timers etc. **155.** Identify and install required measuring instruments and sensors in control panel. **156.** Test the control panel for its	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.

	performance.	
Perform speed control of AC and DC motors by using solid state devices.	**157.** Perform speed control of DC motor using thyristors / DC drive. **158.** Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive.	Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive.
	159. Construct and test a universal motor speed controller using SCR.	
Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc.	**160.** Assemble circuits of voltage stabilizer and UPS. **161.** Prepare an emergency light. **162.** Assemble circuits of battery charger and inverter. **163.** Test, analyze defects and repair voltage stabilizer, emergency light and UPS. **164.** Maintain, service and troubleshoot battery charger and inverter. **165.** Install an Inverter with battery and connect it in domestic wiring for operation. .	Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS. Preventive and breakdown maintenance.
Erect overhead domestic service line, outline various power plant layout and explain smart distribution grid and its components.	**166.** Draw layout of thermal power plant and identify function of different layout elements. **167.** Draw layout of hydel power plant and identify functions of different layout elements. **168.** Visit to transmission / distribution substation. **169.** Draw actual circuit diagram of substation visited and indicate various components.	Conventional and non-conventional sources of energy and their comparison. Power generation by thermal and hydel power plants.
Plan, assemble and install solar panel.	**170.** Prepare layout plan and identify different elements of solar power system. **171.** Prepare layout plan and identify different elements of wind power system. **172.** Assemble and connect solar panel for illumination.	Various ways of electrical power generation by non-conventional methods. Power generation by solar and wind energy. Principle and operation of solar panel.
Erect overhead domestic service line, outline various power	**173.** Practice installation of insulators used in HT/LT line for a given voltage range.	Transmission and distribution networks. Line insulators, overhead poles

plant layout and explain smart distribution grid and its components.	**174.** Draw single line diagram of transmission and distribution system. **175.** Measure current carrying capacity of conductor for given power supply. **176.** Fasten jumper in pin, shackle and suspension type insulators.	and method of joining aluminum conductors.
	177. Erect an overhead service line pole for single phase 230V distribution system in open space. **178.** Practice on laying of domestic service line. **179.** Install bus bar and bus coupler on LT line.	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.
Examine the faults and carry out repairing of circuit breakers.	**180.** Identify various parts of relay and ascertain the operation. **181.** Practice setting of pick up current and time setting multiplier for relay operation. **182.** Identify the parts of circuit breaker, check its operation. **183.** Test tripping characteristic of circuit breaker for over current and short circuit current. **184.** Practice on repair and maintenance of circuit breaker.	Types of relays and its operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching.)
Install and troubleshoot Electric Vehicle charging stations.	**185.** Demonstrate different charger specifications. **186.** Perform installation of EV charging Station for Public places. **187.** Perform installation of home EV charging stations.	EV scenario in India and EV Charging basic theory. EV Charging safety requirements.
Read and apply engineering drawing for different application in the field of work.	**ENGINEERING DRAWING:** Reading of Electrical Sign and Symbols. Sketches of Electrical components. Reading of Electrical wiring diagram and Layout diagram. Reading of Electrical earthing diagram. Drawing the schematic diagram of plate and pipe earthing. Drawing of Electrical circuit diagram. Drawing of Block diagram of Instruments & equipment of trades.	

Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**WORKSHOP CALCULATION & SCIENCE** **Friction** Lubrication **Algebra** Addition, subtraction, multiplication & division Algebra Theory of indices, algebraic formula, related problems **Elasticity** Elastic, plastic materials, stress, strain and their units and young's modulus **Profit and loss** Simple problems on profit & loss Simple and compound interest Estimation and Costing **Estimation and costing** Simple estimation of the requirement of material etc., as applicable to the trade. Estimation and costing Problems on estimation and costing
Project work Battery charger/Emergency light b) Control of motor pump with tank level c) DC voltage converter using SCRs d) Logic control circuits using relays e) Alarm/indicator circuits using sensors	

Annexure IV

MECHANIC (MACHINE TOOLS/MAINTANANCE/REFRIGERATION) (T04-25)

TRADE TEST AND WRITTEN TEST

1. Electrical Aspects of refrigeration -
2. Electrical AC and DC supply, Voltage, Current, Resistance, Power, Energy, Frequency etc.. Materials used as conductors and Insulators. Series and parallel circuit, open circuit, short circuit, ete., measuring instruments such as voltmeter, ammeter, ohm meter, watt meter, energy meter and frequency meter, Earthing and its importance, Insulation and continuity test, principle of Diodes. Rectification, Zener diode as voltage regulator, transistors parameters, ICs, Star and Delta connection, Safety precautions and first aids, firefighting equipment and electrical safety.
3. Welding processes-
4. Welding processes, oxy fuel gas welding/cutting, brazing & soldering, nozzles, base metal and filler metal, Use of flux, difference between soldering and Brazing in terms of temperatures, filler materials, joint strengths and application, Use of Oxy Acetylene, two stage regulators for brazing/soldering, back fire arrester, Solder - its composition and paste.
5. Basics of refrigeration and Air conditioning -
6. History of Refrigeration and Air conditioning, Basic principle of refrigeration, refrigeration tools. instruments and equipment. Fundamentals Thermodynamics law, Science related to refrigeration, work, power, energy, force, Heat and Temperature, Different temperature scales, Thermometers. Units of heat, super heating and sub-cooling, saturation temperature, pressure, types and units. Types of Refrigeration systems, working of vapor compression cycle, Coefficient of Performance (COP), Ton of Refrigeration, fundamental operations, sub cooling and super heating.
7. Types of Refrigerators and their working -
8. Working of single door direct cool refrigerator, frost free refrigerator, specifications, trouble shooting, Heat Insulation materials, Care and maintenance of refrigerators, Electrical components of refrigerator, Working of Frost Free (2 or 3 door) Refrigerator, temperature control in Freezer & cabinet, automatic defrost system, Function of Electrical accessories like Timer. Heater, Bimetal, Relay, OLP, T/S etc., Refrigerator cabinet volume calculation. Working of two and three door frost free

refrigerator with inverter technology, advantages of variable speed technology over fixed speed, Working principle of control system for inverter Air Conditioners (ACS).

9. Components of Refrigeration system –
10. Working and application of hermetic compressor, Fixed speed and variable speed compressor like Reciprocating, rotary, scroll, centrifugal Geren, compressor and inverter type. Replications of compressors used in commercial refrigeration, Volumetric efficiency, Compressor abricant oil, types and properties, types of lubrication methods such as splash, forced feed. AC motors and their types. Advantages of AC motor over DC motor. Split phase induction motors, Common faults, causes and remedies in motors, Function of Starting relay, Capacitors, OLP's in motor. Working principle of three phase induction motor, torque, slip, rotor, frequency and their relation, Squirrel cage induction motor, Importance of phase sequence, 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.
11. Function of condenser, types, effect of chocked condenser, descaling of air-cooled condenser. Function of drier, its types and application. Types of desiccants, Expansion valve used in domestic refrigeration and ACs, Function of accumulator and types, Methods of defrosting, leak testing, gas charging method in refrigerator, Function of Evaporator, types of evaporators. Super heating in evaporators, Plate & Tube forced air DX evaporators. Types of Defrost system, Types of brine used as secondary refrigerant, Water/ Brine chillers Accumulator and its function, Oil separator. Expansion Valve, Types and function, their advantage & disadvantages. Thermostatic Expansion Valves (TXV), Automatic Expansion Valves (AXV). Humidifiers & Dehumidifier's. Humidity control. Use of hygrometer. Water-cooled Condenser, types and capacity, de-scaling. Evaporative condenser and its function. Liquid receiver and its function,
12. Function, construction, working and Specification of different types of hand tools used in Refrigeration and Air conditioning work. Machineries and equipment used in fittings like drilling machine and grinding machine.
13. Types of refrigerants and their properties
14. Classification of refrigerants, nomenclature of refrigerants including chemical name and formulas, hydro-chlorofluorocarbons (HCFCs), hydro fluorocarbons (HFCs) and hydro fluoro olefins (HFOs), blends of HFCs and blends of

HFCs/HFOs, Properties of refrigerants, environment related properties. Ozone Depleting Potential (ODP) and Global warming Potential (GWP) of various refrigerants, Thermo-chemical properties flammability and toxicity, lower flammability limit (LFL) and upper flammability limit of refrigerants. Thermo-physical properties - pressure and temperature of different refrigerants, Handling of flammable refrigerants, Refrigerant leak detection methods, evacuation and charging of refrigerant, procedure of charging of refrigerant blends like zeotropic blends, hydrocarbon blends, HFC blends (R-404A, R-407C, R-410A), Change of components & practices while retrofitting CFC appliances with HC Refrigerants.

15. Types of Air Conditioners and their working -

16. Window Air Conditioner. Split AC (wall/floor/Cassette), Construction and working principle. types, trouble shooting. Electrical components used in split AC, wiring circuit, testing components, fault detection. 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

17. labelling on inverter AC, Package AC (with Air Cooled Condenser), Package AC with Water Cooled Condenser, construction and working principle, Duct system, AHU, Care and maintenance

18. Engineering Drawing -

19. Introduction to Engineering Drawing and Drawing Instruments Conventions, Sizes and layout of drawing sheets. Title Block, Drawing of Geometrical figures: Angle, Triangle, Circle, Rectangle, Square, Parallelogram, Lettering & Numbering. Dimensioning. Types of arrowhead. Leader line with text, Position of dimensioning (Unidirectional, Aligned) Symbolic representation, Concept of axes plane and quadrant, Concept of Orthographic and Isometric projections, Method of first angle and third angle projections, Mensuration Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles, Centre of gravity and its practical application, calculating area of cut out regular surfaces and irregular surfaces. Estimation and Costing. Estimation of the requirement of material etc. Reading of Electrical, Electronic & Mechanical Sign and Symbols used in RAC. Sketches of Electrical, Electronic & Mechanical components used in RAC. Reading of Electrical wiring diagram and Layout diagram Drawing of Electrical circuit diagram used in RAC

20. Insulating materials -

21. Properties of insulating materials. Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature, Temperature measuring instruments, types of thermometers, pyrometer. Transmission of heat Conduction, convection and radiation. Co-efficient of linear expansion. Thermal conductivity and insulators, Units of pressure. Atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure. Thermal Insulation Function, types, thermodynamic properties of heat insulation materials used in refrigeration and Air Conditioning systems

22. Water cooler, Deep freezers and Cold storage systems-

23. Water Cooler, Water Dispenser, refrigeration cycle of storage type water cooler and dispenser Capacity & applications. Electrical and mechanical components of storage type water cooler. Visible Cooler and Bottle Cooler, Deep Freezer/Display Cabinet working, specifications, faults and remedies, Cold Storage plant, Construction, applications, controls & electrical diagram used in cold storage plant.

24. HVAC plant and components -

25. HVAC (Plant), Fundamentals of Central Air Conditioning/HVAC plant, psychometric terms. DBT, WBT, RH, enthalpy, dew point, and specific humidity. Types of Central air conditioning (Direct and indirect system), Description of blowers & fans, static and velocity pressure measurements. DUCT Function, types, materials, duet designing, duct insulation, properties of insulating material. Air filters and its types, effect of chocked Air filter. Working principle, types and maintenance of Industrial Air-conditioning plant. Humidification and dehumidification methods, Description of AHU and FCU, Temperature and pressure controls used in AC plant. piping lines. Indirect/Chiller System, central station AHU and FCU, specification of Sheet metal tools, instruments and equipment. Rivet & riveting- their types and use, Planning for preventive maintenance and scheduling of maintenance activities in large AC and Refrigeration plant.

26. Various types of Machine tools and their maintenance.

Annexure V

MASON (T05-25)

TRADE TEST

1. Plan and organize the work to make masonry brick wall as per drawing and specification applying different types of tools, materials and check for dimensional accuracy.
2. Construct wall leaving space for door & window opening.
3. Perform R.C.C casting, rod cutting in different sizes, bending, binding & placing. Mixing & compaction of Concrete with different proportions.
4. Perform Laying out of building plan, diagonal check-up, fixing up of excavation lines.
5. Perform Wall & ceiling plastering with application of mortar, smoothening the surface by using of screeds & floats.
6. Make different types of floor with determination and formation of Slope.
7. Lay drain pipe, jointing, fittings & fixing of W.C. pan, urinals, gully trap. Construction of manhole etc.
8. Construct septic tank.
9. Perform fixing & fittings of wash basin, flushing cistern, sink, vent pipe, etc.
10. Lay marble on floor & stair with marking, cutting & complete setting.
11. Construct circular brick wall & hollow block walls.
12. Prepare & mix concrete, formwork, cutting & bending of bar, casting of roof slab, beams, lintels, stair, column etc.
13. Cut & set glazed tiles to walls.
14. Perform Construction of R.C.C. & Brick stairs.
15. Demonstrate basic mathematical concept and principles to perform practical

MASON (WRITTEN TEST)

1. Technical terms used in brick masonry. Necessity of bonding bricks. Types of bond Types of mortars, different grades of sand for brick work & plastering. Grades of cement. Brickwork-racking back & toothing. Differences between English & Flemish bonds. Details of English & Flemish bond for 1 and 11 2 brick walls. Precautions at quoins. Cross wall-method of construction. Grouting of mortar, jointing and finishing of brickwork. Types of pointing & tools used. Details of bonding & special precautions at 'T', 'L' and cross junctions. Types of copings, weathering & throating
2. Pillars: Necessity, types, relation between cross section & height. Details of reinforcement for square &rectangular pillars. Types of cement, sand & lime. English & Flemish garden wall bonds. PWD specification on brickwork. Foundation: Definition, purpose, types, important terms, causes of failure of foundations
3. Purpose of arch cantering & form work. Different types of bricks & their sizes. Characteristics of good bricks Sizes of mortar joints for different works.
4. RCC lintels: Materials required, method of construction, precast lintels, method of construction of formwork, details of reinforcement. Arches: Purpose, technical terms & types. Setting out an arch.
5. Cavity wall: Technical terms, advantages, constructional details, precautions to be taken at the bottom of cavity
6. Steps in setting out & marking centre line, excavation line & other lines-use of dead man checking accuracy & precautions. Windows & ventilators: Including steel windows & ventilators, fixtures & fastenings used.
7. Plastering: Tools used, necessity of screeds& their fixing, Steps in plastering. Concrete: Ingredients, selection of materials, various ratios of mix, their uses, measuring of materials for mixing.
8. Floors: Types, constructional details such as consolidation of bed, sand filling, concrete base & finishing. Granolithic flooring. Local Municipal byelaws
9. Purpose of drainage, different systems, their advantages & disadvantages, method of collection, carriage & final disposal of wastage, various types of constructions required.

10. Roofs: Classification, parts, trussed roof, covering materials. House drainage system normal layout of drainage. Traps-gully, nahani, etc. their description. Purpose & method of fixing sanitary fittings such as WC, urinal, washbasin, kitchen sink, etc. Construction of surface drains and laying its surface with bricks. Drainage pipes: Types, materials, sizes, gradient for different diameters, method of laying & jointing, importance of water tightness, concrete base and covering 10. Septic tank: Purpose, parts and method of construction.
11. Marble floor, types, constructional details.
12. Circular walls: Details of construction. Purpose made bricks. Setting out and construction of circular gate pillars with brick/stone/tile/concrete. Hollow block masonry: Laying of hollow blocks for walls & columns. Use of structural clay tile for partition. Precast concrete partition, metal lathe partition and concrete block partition.
13. Introduction to RCC: Uses, materials, properties and formwork, bending of bars & construction. Reference to ISI code. Reinforced brickwork. Brief description of slabs. beams, lintels, stairs, columns, etc. RCC work: Mixing of concrete. Laying, compacting &Curing of concrete. Thumb rule for percentage of reinforcement for lintels, slabs, beams & columns. Necessity hook & cranking. Shear reinforcement
14. Method of finishing factors to be kept in mind, PWD specification on the above. Use of glazed tiles for wall facing, steps in fixing, precautions. Construction & expansion joints-method of filling repair of cracks
15. Stairs. Technical terms, relation between tread & rise, Types of stairs, construction details. of brick, stone & RCC stairs. Spiral stairs with precast concrete steps. shuttering their removal-precautions, PWD specifications Formwork & shuttering their removal precautions PWD specifications.

Annexure VI

FITTER (T06-25)

TRADE TEST

1. Plan and organize the work to make job as per specification by applying different types of bang fitting operation and Check for dimensional ber specific allowing safety precautions. [Basic fising operation-marking, Hacksawing, Chiselling, Filing, Drilling, Taping and Grinding etc

2. Produce components by different operations and Dreck accuracy using appropriate measuring

3. Instruments. Different Operations Drilling. Reaming, Taping, Dieing: Appropriate Measuring Instrument-Vernier, Screw Gauge, Micrometer) 3. Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality.

4. Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. [Different Mating Surfaces Dovetail fitting. Radius fitting, Combined fitting. Different surface finishing operations - Scraping, Lapping and Honing: Different fastening components - Dowel pins.

screws, bolts, keys and cotters. Different fastening tools-hand operated & power tools]

5. Read and apply engineering drawing for different application in the field of work

WRITTEN TEST

1. Linear measurements - its units, dividers, calipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V Blocks, marking off table. Measuring standards (English, Metric Units), angular measurements. Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files-specifications, description, materials, grades, cuts,

file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements.

2. Marking off and layout tools, dividers, scribing block, description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor - description, uses and cares. Uses, care & maintenance of cold chisels materials, types, cutting angles. Marking media, marking blue. Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.

3. Micrometer- outside and inside principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer.

4. Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper. Digital Vernier caliper. 26 FITTER Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.

5. Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.

6. Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine-description, parts and uses.

7. Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection& application. Wired edges.

8. Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method

of soldering, selection and application-joints. Hard solder, types and method of brazing.

9. Various rivets shape and form of heads, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.

10. Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators.

11. Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-28 FITTER Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses.

12. Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses.

13. Counter sink, counter bore and spot facing-tools and nomenclature, Reamer material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (coarse and fine) material, parts (shank body, flute, cutting edge)

14. Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.

15. Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.

16. Interchange ability: Necessity in Eng0067, field definition, BIS. Definition, types of limit, terminology of limits and fits, basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system.

17. Lathe cutting tools, Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants.

18. Screw thread definition uses and application, Square, worm, buttress, acme (nonstandard-screw threads), Principle of cutting screw thread in centre lathe principle of chasing the screw thread use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.

19. Introduction to Engineering Drawing and Drawing Instruments Conventions Sizes and layout of drawing sheets Title Block, its position and content Drawing Instrument Lines- Types and applications in drawing Free hand drawing of Geometrical figures and blocks with dimension Transferring measurement from the given object to the freehand sketches. Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering - Single Stroke. Dimensioning. Types

of arrowhead Leader line with text Position of dimensioning (Unidirectional, Aligned) Symbolic representation Different symbols used in the related trades, Concept and reading of Drawing in. Concept of axes plane and quadrant Concept of Orthographic and Isometric projections Method of first angle and third angle projections.

20. Screws: material, designation, specifications, Property classes (eg. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts. Torque wrench, screw joint calculation uses, Power tools: its constructional features, uses & maintenance.

21. Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.

22. Metallurgical and metal working processes such as Heat treatment, various heat treatment methods chartmalizing, annealing, hardening and tempering purpose of each method, tempering colour

23. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing

24. Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row

25. Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing properties of bronze and brass

26. Foundation bolt: types (Lewis cotter bolt) description of each erection tools, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.

Annexure VII

WELDER (T07-25)

1. Perform joining of MS sheet by Gas welding in different positions following safety precautions.

2. Join MS plate by SMAW in different positions.

3. Perform straight, bevel & circular cutting on MS plate by Oxy-acetylene cutting process.

4. Perform different types of MS pipe joints by Gas welding (OAW).

5. Weld different types of MS pipe joints by SMAW 6. Join Aluminium & Stainless Steel sheets by GTAW in different position.

6. Join MS sheets/plates by GMAW in various positions using different modes of metal transfer.

7. Perform visual inspection/testing of welded joint.

WRITTEN TEST:

1. Introduction and definition of welding. Arc and Gas Welding Equipment, tools and accessories Various Welding Processes and its applications. Arc and Gas Welding terms and definitions

2. Different process of metal joining methods: Bolting, riveting, soldering, brazing etc. Types of welding joints and its applications. Edge preparation and fit up for different thickness. Surface Cleaning

3. 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 4. Common gases used for welding & cutting, flame

temperatures and uses. Types of oxy-acetylene flames and uses. Oxy-Acetylene Cutting Equipment principle, parameters and application 5. Arc welding power sources: Transformer, Rectifier and Inverter type welding machines and its care & maintenance. Advantages and disadvantages of A.C. and D.C. welding machines.

6. Welding positions as per EN & ASME: flat, horizontal, vertical and overhead position. Weld slope and rotation. Welding symbols as per BIS & AWS

7. Arc length-types effects of arc length. Polarity: Types and applications

8. Calcium carbide uses and hazards. Acetylene gas properties Acetylene gas and Flash back arrestor

9. Oxygen gas and its properties, Charging process of oxygen and acetylene gases.

10. Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. Single stage & double stage Gas regulators and uses

11. Arc blow causes and methods of controlling. Distortion in arc & gas welding and methods employed to minimize distortion. Arc Welding defects, causes and Remedies

12. Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. Difference between pipe welding and plate welding

13. 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

14. Electrode: types, functions of flux, coating factor, sizes of electrode.

15. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.

16. Stainless steel: types- weld decay and weldability, Aluminium properties and weldability, welding methods. Arc cutting & gouging, Cast iron and its properties types. Welding methods of cast iron

17. Types of welding process Advantages & limitations. Various types of welding power sources Welding parameters Different types of weld joints Gas welding principle and application Safety in welding and cutting.

18. Basic welding metallurgy (pre heating, post heating etc.) Welding symbol and its nomenclatures Effects of heat

19. Principle of Shielded metal Arc welding (SMAW) Function of flux and baking requirements Selection Of electrodes and coating factors Different type of edge preparation, Welding procedure - Edge preparation and fit up, use of backing strips and bars, root run welding and cover pass welding.

20. Introduction to GTAW welding, TIG welding equipment, Advantages of TIG welding process Tungsten electrode, Types, sizes, and uses. Type of shielding gases Purging Methods Parameter setting.

21. GMAW welding process Power source & accessories Wire Feed unit MIG welding

22. Types of Welding defects (Cracks, Inclusions, Incomplete penetration, Lack of fusion, Under cut, Burn through, Overlap etc.)

23. Non destructive Testing of Metals. Visual inspection Dye penetrant test - Principles - Advantages -Limitations - Types of Penetrants - Cleaners -Dwelling time.

24. Safety guidelines in welding.

Annexure VIII

PLUMBER (T08-25)

TRADE TEST

1. Identify and comply with the safe working practices, environmental regulation and housekeeping.
2. Test various electronic components using proper measuring instruments and prepare electrical wire joints, carry out soldering, crimping.
3. Identify different tools, equipment's, and fittings for plumbing.
4. Test and measure equipment's in plumbing.
5. Interpret plumbing system and plumbing terminology
6. Read the plumbing drawings.
7. Interpret water distribution system & demonstration of water meter.
8. Install and maintain pressure in boosting pumps.
9. Reduce water wastage and increase water efficiency.
10. Identify, select and perform cutting of Pipes.
11. Carry out joining, fitting and laying of different types of PVC Pipes.
12. Install, fix and maintain different taps, valves, etc..
13. Perform installation of different types of faucets, water closet and its repair.
14. Carry out testing of water pressure in plumbing system. Install, fix and maintain sanitary ware systems and their components.
15. Install, fix and maintain kitchen sink, wash basin, bathtub, etc.
16. Perform rainwater, gray water harvesting and conservation.
17. Carry out repairing and maintenance of plumbing system,
18. Prepare and maintain the records of plumbing system.
19. Construct various brick bond for inspection chamber with multi inlet gradients adopted for conveyance of Black Water and grey water without any obstruction various vent pipes for ventilation provided to arrest foul gas with various traps.
20. Read and apply engineering drawing for different application in the field of work.

21. Demonstrate basic mathematical concept and principles to perform practical
22. operations. Understand and explain basic science in the field of study.

WRITTEN TEST

1. Importance of safety and general precautions observed in the industry/shop floor. 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.
2. Introduction to 55 concept & its application, Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable, basic understanding on work permit methodology, confined space work.

3. Introduction to different tools like Vice and chain wrench, various hand tools like files, hammer, hacksaw, chisel, vice jaws, steel rule, V block Pipe Vice, water pump pliers, Pipe cutter, threading dies, sink auger, internal pipe cutter etc., different Types of Pipe Fittings: Socket, Elbow, Tee, Union, Bend, Cap, Plug, etc., Concept of laser pen, Concept of laser distance meter, Use of drilling machine and importance of drill bit selection.

4. Introduction to Plumbing, and plumbing Terminologies Air gap, Backflow, Back-Siphonage, Backwater valve, Cesspool, cross connection, dry/wet area, Fixture unit, Float Valve, Flush Cock, Flush Tank, Gully Trap, Interceptor, Inspection Chamber, Potable water, Push tap, Sensor operated faucet, septic tank, Single lever Mixer, Slope, static head, Strainer, Thermostatic Valve, Trap, Vent pipe, Water Hammer, Water Pressure.

5. Basic planning for plumbing - Location of daily water requirements, Water sources, quality of water & treatment, Water storage, Water Distribution, Hot water generation & distribution, Types of pipes (SWR, UPVC, CPVC, etc.) and their selection criteria, Concept of composite

PVC/uPVC pipe., Installation of Pipes and fittings Vs old process of laying or jointing, Estimation of Water requirements, Water sources, quality of water & treatment, Water storage, Water Distribution.

6. Soil & Waste drainage, Concept of wastewater treatment plants, Sizing of pipes, Calculation of water utilization, Installation of Taps, Vents, Inspection chambers & Manholes, gravity drains, sewage treatment systems.

7. Introduction to type of pipe bends & pipe bending concept for water flow, Introduction to portable jig saw machine, Internal pipe cutter, Telescopic pipe cutter, Hexa pipe cutter, Rachet type PVC Pipe cutter, Concept of handheld sandler/Polisher, Method of PVC pipes Cutting or Jointing, etc., Types of cutting and joining tools for piping. Such as Pipe cutter, pipe bending machine, threading dies, chain wrench, etc., Plumbing Symbols and Code for Tools & Materials on water line. All type of pipes, pipe fittings and joints, Impurities of Water, test of water, hard and soft water and it's removal, Pumps (different types). Introduction to different types of fitting and its applications, introduction to different solvent for joining process, Different types of Joints, Fittings and Materials in joining pipes: - PVC/CPVC, UPVC etc. Methods of fixing and joining and their uses. Precautions to be taken while fixing.

8. Introduction to Retrofitting of plumbing systems, Sanitary fixtures and appliances, Reading of sanitary plumbing drawing, General guidelines for Installing of sanitary fittings, Cistern-Open and concealed (fixing of flush tank), 23-inch Orissa pan (Indian Pan), Types of urinals and its installation process, sanitary symbols and its plumbing codes for all tools and materials, Advanced plumbing trends and different materials used in piping systems. (e.g., Noise reducing drainage water system - silencecio). Foam core drainage pipelines, Scrapping and painting of pipelines. Study and identify the advanced plumbing trends and different materials used in piping systems.

9. Introduction to water conservation. Water conservation measures, Drainage system and its types. Layout reading of drainage system,

Collection and storage, Recharge and disposal system. Method of testing drainage lines, Testing method of drainage pipeline system. Rain water harvesting.

10. Concept and accessible of Washroom accessories and its selection. Design criteria for washroom accessories, water closet, Fitting consideration of Wash basins, Fitting consideration for kitchen sink Showers, Bathtubs, Grab bars, Different types of washbasins and sinks, Bottle trap (Ptype). Basic troubleshooting and maintenance. guideline for kitchen sink, bathtub, etc. (e.g., Drainage chock up) Types of floors mounting EWC (European water closet), Types of walls mounting EWC (European water closet), Bathroom fittings Towel rod, towel ring, towel bracket, soap dish, toilet paper holder.

11. Periodic inspection, testing and maintenance. Cleaning of storage tank testing of water quality Inspect leakages of pump, valve and its rectifying techniques. Inspect the water pressure system, Inspect water level indicator and sensors, Inspect pipe supporting clamps and supporting system. Check operation and effectiveness of non-return valve, inspect thermoset. Cleaning Sanitary fixtures. Inspect trap, chamber Inspect drainage pipes and outlets, Sensor system for urinals and wash basin, etc. Corrosion-causes and remedies, prevention. Effect of water and frost on materials.

12. Importance of preparing and maintain the record of installation and repair maintenance of plumbing. Creation and maintain documents like: Project report Installation report, Job works estimation and actual work cost. Test and calibration certificate, Warranty certificate Valve identification chart, Routine and preventive maintenance schedule List of manufacturer and supplier Standard operating procedure (SOP) for repair and maintenance as per Indian standard code of practice for water supply.

Annexure IX

Medical Laboratory Technician (T09-25)

TRADE TEST

ANATOMY & PHYSIOLOGY

Demonstration of different parts of body, Demonstration of basic tissues of the body. various parts of bones, major joints of the body, structural differences between: -Skeletal muscle - Smooth muscle and Cardiac muscle, Excretory System, Parts of Excretory System, various parts of respiratory system, Structure of Skin Demonstration of structure of brain, structure spinal cord, structure of eye, structure of ear, structure of nose, structure tongue, structure of heart, Blood Pressure, female reproductive system, male reproductive system Principle and performance of ECG.

CLINICAL MICROBIOLOGY

Preparation of cleaning agents and techniques for cleaning glassware. Sterilization by autoclave, Sterilization by hot air oven, Sterilization by filtration, Handling, care and use of a compound microscope, Preparation and sterilization of various culture media-- Nutrient agar and Nutrient broth, MacConkey Agar and MacConkey Broth, Blood Agar, Chocolate agar, LJ media, Inoculation of culture media by following techniques-Streak plate, Pour plate, Agar slant, liquid media.

Staining techniques: Principle, Requirements, Procedure, Observation and Precaution. Gram staining, ZiehlNeelson staining, Albert Staining. Biochemical testing- Principle, Requirements, Procedure, Observation and Precaution.

Collection, transportation, and processing of following clinical samples for lab diagnosis and identification of pathogens. Urine, Sputum, Throat swabs, Blood Collection and preservation of stool sample. Preparation of thin and thick blood smears. Staining of blood smears by Leishman stain for the identification of Malarial parasite (MP test). Staining of blood smears by Field stain for the identification of Malarial parasite. Demonstration of PAN malaria card test in the laboratory Demonstration of various stages from Malarial parasite slides/charts.

HEMATOLOGY

Demonstration of various parts of microscope: Its function and care. Demonstration of various parts of centrifuge: Its function and care. Cleaning and drying of glassware and plastic ware. Preparation of various anticoagulants Collection of blood: Venous and Capillary, Separation of serum and plasma. Preparation of Romanowsky stains. Preparation of thick and thin smear. Staining of blood film by Romanowsky stains.

Hemoglobin Estimation by Cyanmethaemoglobin method and Sahli's method, Counting of RBC, Counting of WBC, Platelet count, Absolute eosinophil count. Performance of DLC, Study of morphology of normal RBC and WBC with the help of stained slide, study abnormal morphology of RBC with the help of stained slide, study abnormal morphology of WBC with the help of stained slide, abnormal morphology of platelet with the help of stained slide. ESR Estimation in blood (Wintrobe and Westergren method). PCV Estimation in blood (Wintrobe and capillary method), Calcülation of various red cell indices, Counting of Reticulocytes in blood, Identification of abnormalities in red blood cells associated with anemia (Macrocytic, Microcytic, hypochromic and sickle cell anemia), To perform red cell fragility test, Calculation of Mean and SD value.

CLINICAL BIOCHEMISTRY

To prepare cleaning agents (Chromic acid, HCl, Nitric acid and other agents). To clean and preserve laboratory Glasswares (Glass Pipette, Burette, Test Tube, Conical Flask and Beaker). Standardization and Calibration of volumetric Glasswares (Glass Pipette, volumetric Flask and measuring Cylinder). Handling and maintenance of Weighing Balance, Water Bath, Centrifuge and distillation plant/deionizer. Handling and maintenance of Colorimeter and Spectrophotometer. Calibration of pH meter using various standard solutions. To prepare EDTA vials/containers. To collect sample in different vacutainers. To separate plasma and serum from blood. To prepare various disinfectants used in laboratory (70% ethanol, 6% sodium hypochlorite, 3% phenol).

Preparation of Reagents. Estimation of Sugar, Proteins, Ketone Bodies, Bile salts in urine sample.

HISTOPATHOLOGY AND CYTOLOGY

Reception of specimen, labelling and preserving and mounting of the histological specimen, Preparation of various smears by unfixed methods Imprint smears, Teased smears, Squashed smears.

Preparation of different fixatives with special emphasis on preparation of formalin based fixatives, Preparation of paraffin blocks from various tissue pieces, Performing H&E on given smear/section.

Demonstration of cell, malignant cell, Processing of urine samples for malignant cells. sputum sample for malignant cytology Preparation of dry smear and wet smear. Preparation and staining of buccal smear, To perform Pap stain, MGG.

TRANSFUSION MEDICINE

Demonstration of glassware used in transfusion medicine, Washing and sterilization of glassware, Perform ABO blood grouping by following method: Direct, Tube Test. Indirect (reverse), Subgroup. Perform Rh grouping using slide and tube method.

WRITTEN TEST

GENERAL ANATOMY

Introduction to Anatomy & Physiology, Structure of human cell, Basic tissues of the body (Definition, Gross structure and functions), Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue.

Skeletal System: Gross structure, function and classification. Bones of appendicular and axial skeleton, Bones of Pectoral girdle and upper limbs. Bones of Pelvic girdle and lower limbs. Joints & Articulations: Types of joints (Structural and functional classification). Bones forming major synovial joints (Shoulder, Elbow, wrist, hip, knee, ankle and intervertebral joints).

Digestive system: Diagrammatic representation of Digestive System, Function of Various parts of Digestive System, Structure and function of Liver, Definition Digestion Absorption Assimilation.

Excretory System: Organs of Excretory System (Structure and Function), Structure of nephron, Formation of Urine.

Respiratory System: Structure of Respiratory System Functions and mechanism of Respiratory system Gas exchange in lungs Control of respiration Basal Metabolic Rate (BMR).

Skin Structure and Function of Skin. Sense Organs (Eye, Ear, Tongue and Nose), Diagrammatic representation and functions.

Nervous System: Definition and parts of nervous system, Central nervous system (brain and spinal cord): Definitions, diagrammatic representation and functions, Peripheral nervous system (cranial and spinal nerves): Definitions, names and functions of different nerves.

Muscular System: Definition and types, Skeletal, smooth and cardiac muscles: diagrammatic representation and functions, Muscle fatigue.

Circulatory System: Definition and types of blood circulation: Coronary, Systemic. Pulmonary and Hepatic, Definition of heart, diagrammatic representation showing external and internal features, functions and working, Cardiac Cycle, Major arteries and veins functions, Conducting System of Heart, Lymphatic system: Definition, name of parts constituting it and functions, definition and functions of lymph.

ECG and BP Monitoring, Principle of E.C.G. and Types of Leads, Importance of E.C.G. Care and Maintenance of E.C.G. Machine, The blood pressure.

Reproductive System: Male and female reproductive system: Definition, diagrammatic representation and functions.

Endocrine System: Definition and classification, Names, structure and location of each glands. Hormones functions and associated diseases (GSH, TSH, thyroid parathyroid, Insulin, adrenaline, non-adrenaline, testosterone and oxytocin).

CLINICAL MICROBIOLOGY

Definition, Branches, Relationship of micro-organisms to man, Safety guidelines in a microbiology laboratory, universal precautions. Types of microorganisms- Prokaryotic and Eukaryotic.

Sterilization-Definition and Types, Physical methods of sterilization, Sterilization by dry heat Hot air oven principle, construction, operation,

sterilization control and sterilization indicators. Sterilization by moist heat-Autoclave- principle, construction, operation, sterilization control and sterilization indicators. Sterilization by radiation, Sterilization by filtration (SEITZ, HEPA), Sonic and ultrasonic vibrations, Chemical methods of Sterilization: Antiseptics and disinfectants Definition, characteristics of ideal antiseptics and disinfectants and uses of common disinfectants (formaldehyde, chlorine, iodine, ethylene oxide, phenol compounds).

Microscopy, Handling of a compound microscope- Principle, construction, working, care and maintenance of different parts of a compound microscope. Principle of a fluorescent microscope, Electron microscope and Dark field microscope.

Culture Media and Culture Techniques, Basic requirements and characteristics of ideal culture medium. Types of culture media: liquid, and solid media, routine laboratory media (Basal, Enriched, selective, enrichment, indicator, transport, and storaget with examples of each type. Inoculation of culture media, Types of bacterial culture: broth culture, slant culture. Culture techniques: streak plate, pour plate/spreading culture, Aerobic and anaerobic culture, Isolation of pure cultures.

General characteristics and classification of bacteria and fungi. Morphology of bacteria, Structure of bacteria cell, Bacterial growth curve, factors affecting growth, Characteristics of Bacteria-morphology, staining, culture, biochemical characteristics, pathogenicity and lab diagnosis of following organisms: Staphylococi (S.aureus), Streptococci (S.pyogenes). Pneumococci (P. pneumonia), Clostridium (Cl.tetani), Escherichia (E.coli), Vibrio (V.cholerae).

Lab processing of various samples, Staining methods, Method of smear preparation, Differential staining method, Gram staining, AFB staining, Albert Staining.

Biochemical Tests and their interpretation. Introduction to Medical Parasitology: Definition of parasite, host, and their types, Relationship of Host and Parasite- General characteristics of Protozoa and Helminths.

Morphology, pathogenicity, life cycle, lab-diagnosis and prevention of Entamoebahistolytica, Giardia lamblia, Ascarislumbricoides, Ancylostoma duodenale, Malarial Parasite (Plasmodium, falciparum).

Virology. Definition and Morphology of virus, Effect of physical and chemical agents on viruses. Collection and transportation of samples for viral diagnosis. Morphology. Pathogenicity, Lab diagnosis and prevention of Hepatitis, HIV virus.

Introduction to fungi, Definition, morphological forms, pathogenicity (mycosis and its types) and lab diagnosis. Staining of Fungi, KOH (Potassium hydroxide) preparation, LCB (Lactophenol Cotton Blue) preparation, Culture media for culture of fungi.

HAEMATOLOGY

Apparatus and Instruments: Principle, Care & Safe Operating Procedure and Application of following: Compound Microscope, Centrifuge. Water Bath Hot Air Oven, Incubator, Hand tally counter, Blood mixer.

Introduction to blood. Composition & functions of blood, Cells-WBC, RBC & Platelets, Plasma & its contents. Formation of blood (Erythropoiesis, Leukopoiesis & Thrombopoiesis). Collection of blood: Venous blood collection (Venipuncture), Venipuncture site, Materials and equipment required for venepuncture, Preparation of patients for venepuncture, Selection and preparing the venipuncture site, Performing venepuncture. Care of venipuncture site, Disposal of blood, syringes, needle and lancets.

The Microscope-different types, parts of microscope, cleaning & care. Examination of Urine-Formation of urine, Physical examination-Colour, transparency, phi and Sp gravity. Chemical examination Protein. Sugar, Ketone bodies. Bile pigment/salt, Chyle, Blood. Microscopical examination Cells (RBC, WBC, Epith), casts, crystals, Detection of micro albumin & 2 hours' urine protein estimation.

Introduction to haematology and laboratory organization Lab safety and Instrumentation. Formation of blood, Composition and functions of blood. Various anticoagulants, their uses, mode of action and their merits and demerits. Methods of determination of PCV, Calculation of different red cell indices (Haemogram). Physiological variations in HB, PCV, TLC and platelets, drawing of peripheral blood smear, staining & stain preparation (Leishman, Giemsa), Quality assurance in hematology.

Romanowsky Stains (Leishman, Giemsa, Wright, Jenner, Field & JSB): Preparation and theory. Choice of slide and spreader, Preparation of blood film, Characteristics of good blood smear, Staining procedure, Examination of blood smear, Identification of blood cells, Haemoglobinometery, Formation of haemoglobin, function and its degradation, Types of haemoglobin, Various methods of estimation with sp cyanmethaemoglobin method.

Haemocytometery, Neubauer counting chamber, Methods of counting of RBC, WBC and platelets, their calculations and reference values. Errors involved in haemocytometery and means to minimize them, Differential leucocyte counting (DLC). Preparation and staining of blood film, Performance of DLC, Normal values and significance of DLC, Blood cell morphology in health and disease (Peripheral blood film), Automation in haematology, Vanous types of Blood cell counter, Principle and operation of the automated blood cell counters.

Erythrocyte sedimentation rate (ESR) and packed cell volume (PCV), Various methods of estimation of ESR and PCV Reference range, Interpretation of results.

CLINICAL BIOCHEMISTRY

Definition and Importance of Biochemistry, Volumetric apparatus and their calibration. Cleaning and care of laboratory Glass and Plastic ware, Different cleaning agents (soaps, detergents, chromic acid). Important Instruments Principle, Working. Handling, Care and Maintenance of Balances, Centrifuges pH Meter, Ion Selective Electrodes, Hot Plate and Magnetic stirrer, Water Bath, Hot Air Oven, Incubator.

Distillation unit, Colorimeter, Flame Photometer, Photometer. Fluorimeter. Spectrophotometer. Urinometer, Glucometer (Rapid Diagnostic Technique). Cholesterol Strip (Rapid Diagnostic Technique), Different types of syringes and vacutainers used for blood collection, Biochemistry Analyzers.

Anticoagulants Types. Uses, Merits and Demerits, Blood Glucose and Glucose Tolerance Test (GTT), Principle and different methods of estimation. Reference Values, True and Apparent sugar, Renal Threshold, Glucose Tolerance Test (GTT), Glycated Hemoglobin (HbA1c), Clinical Significance.

Principle and different methods of estimation, Reference values, Clinical Significance of Blood Urea, Serum Creatinine, Serum Proteins, Electrolytes, Principle and different methods of estimation (Na+, K+, Cl- P,Ca2+, Mg2+ and Fe2+), Uric Acid.

Patient identification, Collection, Preservation, Transport and Disposal of clinical specimen. Blood, Unne, Stool, Other body Fluid.

Blood Fractions: Preparation of Serum, Preparation of Plasma. Serum Bilirubin, Formation and excretion of bilirubin, Formation of bilepigments, Conjugated and unconjugated bilirubin, Principle and procedures of serum bilirubin estimation (Direct & Indirect). Reference values, Clinical Significance.

Principle and procedures of estimation, Reference values, Clinical Significance of Alkaline Phosphatase (ALP) and Acid Phosphatase (ACP), Serum Calcium and Phosphorus, Serum Glutamic Oxaloacetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT), Serum Amylase and Lipase, Renal Function Tests, Renal Clearance Test-Principle and Procedures, Lipid Profile, Cholesterol, High delisity and low density cholesterol, Triglycerides, Principles and procedures of estimation, Estimation and importance of various ratios of HDL, LDL and VLDL.

Urine Examination, Normal composition of urine, Physical examination (Volume, Colour, Odour, pH and Specific Gravity etc.) Chemical examination of Blood, Protein, Sugar, Creatinine, Bile salts.

HISTOPATHOLOGY AND CYTOLOGY

Introduction and definition of Histology. Histopathology, Biopsy. Autopsy, Autolysis, Putrefaction, Fixation, Deparaffinization, Blueing. Preparation of Tissue. Unfixed Tissue preparations: Imprint methods Impression Smears, Teased preparation, Squashed preparation, Frozen section. Fixed Tissue Preparations: Paraffin embedding, Celloidin embedding, Gelatin embedding.

Reception of Specimen, recording, labelling and preservation of histological specimen. Fixation (Histological Specimens), Classification & Composition of various fixatives, Advantages/Disadvantages of various fixatives. Decalcification, Introduction, Principle & Procedure of Acid Method of

Decalcification. Processing (by Paraffin Technique). Dehydration, Clearing, Infiltration and Impregnation, Paraffin embedding.

Microtomy, Microtome & Microtome Knives, Types of Microtome, Principle and Working of Rotary Microtome & Freezing Microtome, Types of Microtome knives. Sharpening of knives (Honing & Stropping technique), Care and Maintenance of Microtome & its Knives, Section Cutting, Process of section cutting, Errors /cutting faults in sections and their remedies.

Routine & Special Stains. Principle, Procedure & Interpretation of Routine Stain Haematoxylin and Eosin, Principle, Procedure & Interpretation of Special Stains, PAS. Silver impreganation, Oil Red, Masson trichome, Pearl's Prussian Blue, Zighi Neelson: AFB.

Automation, Histokinete (Automatic tissue processor): Use, Care, & Maintenance. Automatic Knife Sharpener. Use, Care, & Maintenance.

Cytology, Definition of cell, Structure and function of cell, Exfoliative Cytology, Preparation of vaginal & cervical smears, Collection and Processing of specimen for cytology Urine, Sputum, CSF (Cerebro Spinal Fluid), Other fluids. Fixation (Cytological Specimen), Various types of Cytological fixatives, Advantages and Disadvantages. Cytological Staining. Technique and interpretation of results of Papanicalaou staining, May Grunwald & Giemsa staining. Haematoxylin and Eosin staining, Aspiration Cytology. Principle of FNAC (Fine Needle Aspiration Cytology) Indications of FNAC, Uses of FNAC, Staining Techniques MGG (May-Grunwald Giemsa), PAP (Papanicolaou Stain), H&E (Haematoxylin & Eosin Stain), PAS (Periodic Acid Schiffs reagent Stain).

Malignant Cells, Characteristics Differences from normal cell, Sex Chromatin (Barr bodies), Collection of sample, Staining and Interpretation.

TRANSFUSION MEDICINE

Anticoagulants, Different types and composition of various anticoagulants, Advantages and disadvantages of various anticoagulants, Color codes of vials used for different anticoagulants. ABO Blood Group System, Antigens and antibodies involved, Principle and procedure of ABO blood grouping. The Rh Blood Group System, Antigen and antibody involved, Principle and procedure of Rh grouping Variant of D antigen (Du).

Coombs Test, Direct coombs test (principle, procedure, importance and application). Indirect coombs test (principle, procedure, importance and application).

Cross Matching. Types of cross matching, Various methods and their procedures. Donor Selection and Blood Collection, HIV, HbsAg, HCV, Characteristics of ideal blood donor. Blood collection procedure. Transportation and storage.

Preparation and Preservation of Various Blood Components. Packed cells, Fresh frozen plasma, Cryoprecipitate, PRP (Platelet rich plasma) Blood Transfusion Reactions, Classification of transfusion reactions.

Annexure X

Computer/IT (T10-25)

TRADE SKILL TEST AND WRITTEN TEST

Introduction to Computers and Windows Operating System

History, Generations, Types, Applications of Computers, Concepts of Hardware and Software Introduction to various processors. Introduction to the functions of an Operating System. Popular Operating Systems in Use. Main features of Windows OS. Various input/Output devices in use and their features. Using Scanner. Printer and Webcam

Computer Hardware basics and Software Installation

Introduction to the booting process, BIOS settings and their modification. Introduction to various types of memories and their features. Basic Hardware and software issues and their solutions. Formatting and Loading O.S and Application software and Antivirus.

Introduction to DOS Command Line Interface & Linux Operating System.

Introduction to basic DOS Internal and External Commands. Introduction to Open Source Software. Introduction to Linux Operating System features, structure, files and processes, Introduction to various Linux Shells, Basic Linux commands.

Word Processing

Introduction to the various applications in office. Introduction to Word features. Office button, toolbars. Creating, saving and formatting and printing documents using Word Working with inserting objects. macro, mail merge, templates. Page setup and Printing Documents using word.

Spread Sheet Application

Introduction to Excel fatiores and Data Types. Cellreferencing. Use of functions of various categories, 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. Introduction to Reporting.

Image editing, creating presentations & Using Open Office

Introduction to Open Office. Introduction to the properties and editing of images. Introduction to Power Point and its advantages. Creating Slide Shows. Fine tuning the presentation and good presentation techniques.

Database Management Systems

Concepts of Data, Information 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 behavior

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. 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. Logical and Physical Addresses, Classes of Networks. Network Security &firewall concepts. Concept of DHCP Server Program Flow r JAVA

Internet Concepts

Introduction to WWW, Concept of Internet, Web Browsers, intemet servers and search engines Concepts of Domain Naming Systems and E mail communication. Introduction to video chatting tools. VOIP and Social Networking concepts. Concept of Cloud storage and Open Web Server, Introduction to Internet Security, Threats and attacks. Malicious Software types, Internet security products and their advantages.

Web Design Concepts

Concepts of Static and Dynamic Web pages. Introduction to HTML and various tags in HTML Creating Forms with controls using HTML. Concepts of CSS and applying CSS to HTML. Introduction to open source CMS viz.. Joomla, Wordpress etc. and Web authoring tools viz. Kompozer, FrontPage etc.

Java Script

Algorithms and flowcharts. Introduction to Web Servers and their features, Introduction to Programming and Scripting Languages. Introduction to JavaScript and its application for the web. JavaScript Basics -Data types, Variables, Constants. Conversion between data types. The Arithmetic, Comparison, Logical and String Operators in JavaScript. Operator precedence. Arrays in JavaScript - concepts, types and usage. Program Control Statements and loops in JavaScript. Introduction to Functions in JavaScript. Built in JavaScript functions overview. The String data type in JavaScript. Introduction to String, Math and Date Functions. Concepts of Pop Up boxes in JavaScript. Introduction to the Document Object Model.

E Commerce

Definition of E commerce, Types, scope and benefits of E commerce. Difference between E commerce and traditional commerce. Capabilities requirements and Technology issues for E commerce. Types of E commerce web sites. Building business on the net. Concepts of on line Catalogues, Shopping carts, Checkout pages. Payment and Order Processing, Authorization, Chargeback and other payment methods. Security issues and payment gateways.

Cyber Security

Overview of Information Security, Security threats, information Security vulnerability and Risk management. Introduction to Directory Services, Access Control, Software Development Security, Privacy protection, Audit and Security. Introduction to I.T Act and penalties for cybercrimes.

Cloud Computing

Benefits of cloud services, different categories, Resources available in cloud, Explain the Application Development Life Cycle, Identify Phases of the

Application Development Life Cycle, Describe Roles in each of phases of the Application Development Life Cycle.

Programming in Python

Introduction to Python History, Features, Setting up path Basic Syntax, Comments, Variable, Different Data Types, Casting, string, Boolean, Python Operators, Conditional Statements, Looping, Control Statements, String Manipulation, Lists, Tuple, sets, Dictionaries, Arrays, Iterators, modules, dates, math, Modules, Input and Output

OR

Programming in Java

Object Oriented Programming with Core Java, Java Programming features, JVM, Byte codes and Class path, Java Program Development, Compilation and Execution of JAVA programs, Basic JAVA language elements-keywords, comments, data types and variables, JAVA Arithmetic, Assignment, Relational, Logical, Increment /Decrement operators and expressions. JAVA String Operators, JAVA Input and Output streams, System in, System out., Input using Scanner class and Console class methods, JAVA

Program Flow Control, JAVA Classes, Overloading and Inheritance, Abstract Classes and Interfaces in JAVA, Troubleshooting Java issues.

Annexure XI

DIGITAL PHOTOGRAPHY (T11-25)

1. Care & maintenance of equipments & material.
2. Introduction to photography and its applications.
3. Introduction to Cameras & it's History (From pin-hole camera to digital camera)
4. Types of Lenses Four basic types of lenses, they are:
5. Normal Wide angle Telephoto Zoom
6. Introduction to Focal length.
7. Depth-of-field in comparison with human eye.
8. Depth of focus Perspective aberrations of Lens.
9. Correct exposure, ('rules of photographic composition).
10. Conception of aperture, shutter speed, ISO
11. Knowledge of Pixels& their uses. Use of lens hood, tripod and mono pod stand.
12. Understanding visual communication and aesthetic in Photography.
13. Theory of light and sources. White balance, Kelvin temperature & colour balance.
14. Understand of special & professional shooting techniques.
15. Learning & usage of various filters like- (ND-Neutral Density, Gradient Filters)
16. Basics of Computers, OS, RAM, ROM and Graphic cards, Concept of operating software, functions and its uses.
17. Basics of Internet, different image editing software & its application.
18. Multimedia platform, accessories and configuration of multimedia PC.
19. Knowledge of different types of printers in respect of their resolution.
20. Workflow steps for editing photos in Photo editing software & Elements, learning the tools and techniques in a natural way.
21. Knowledge different types of scanners& capture cards, editing and capturing methods. Knowledge of photo editing through different types of updated photo editing software's
22. Knowledge for the selection criteria for a good quality camera and its accessories.
23. Etiquette of Photography Basic Rule for Photographer Corporate Etiquette Ethics of Photographer (NPPA) The combination of skilled

photographer and the empathic communicator is what makes a successful photographer.

24. Persistence of Vision, Understand the concept of handling the video cameras and their accessories.

25. Understand the techniques of shooting etc

26. Understanding theoretical knowledge of videography.

27. Camera, parts & its Setting Knowledge of visual composition and aesthetic approaches.

28. Knowledge of still digital camera, Video camera and drone camera.

29. Basic principle of light (i) Electromagnetic spectrum, visible spectrum. (ii) Behaviour of light falling on an object absorption, reflection refraction, transmission, diffraction, dispersion, scattering of light, refractive index. (iii) Inverse square law. (iv) Basic principles of color, CIE diagram, trichromatic theory of vision.

30. 2. (i) Quality of light: Specular, diffused and bounced. (ii) Types of light: Natural day light, Incandescent, (tungsten- halogen, [Tenner (10K), Senior (5K), Junior (2K), Baby (1K), Inkie Multi 10, Multi 20 etc], photoflood), fluorescent, (Kino Flo), Metal Halide enclosed AC arc (HMI) etc.

31. 3. Basic understanding of lighting ratio (key + fill: fill alone) use of back light

32. Use of reflectors, and soft boxes, mirrors, skimmers as fill light in an outdoor situation.

33. 4. Knowledge of symbols (icon) to identify the various lighting equipment.

34. Video & Video technology: Introduction to Video, How Video camera works? Working principle of an image sensor, Camera mounts and Camera support accessories.

35. Composition. Use of video as a communication tool, latest video technology, types of video cameras their Various formats and recording medium (tapes, disc and Hard disc). Applications of video recording.

36. Video and Audio productions. Knowledge of sound techniques. Use of different microphones, Mono, Stereo and Surround sound techniques. Recording methods, Video tape recording insert, sound mixing, editing, audio dubbing etc.

37. Lighting for still & video photography. Knowledge of different types of video lighting. Concept of power distribution depending upon the requirement

of the light output. Detailed light source including natural and studio lights instruments, Field lighting instruments. Usage of Light meter

38. (Lux meter), Inter valometer. Shooting with Zoom function, macro function, High speed shutter function & Automatic and manual focus function. Identification of Location and proper placement of different accessories.

39. Linear (Insert and assemble modes) Editing equipment: Edit VTR, Edit Control Unit, Vision Mixer, Computer Graphics (C.G.) etc., Non-linear Recording of audio (commentary, dubbing. music). Effects (visual and audio).

- Better understand techniques editors use to construct stories.
- Have a thorough working knowledge of a non-linear editing software.

40. Be able to do professional style color correction. Know how to create high quality motion graphics. - Understand video formats and principles. Video editing Practice on Different Audio & Video Software's with Effect, Titling, frame cutting/ trimming/ editing/ inserting audio & video/Pictures Rendering on Different format and resolutions.

41. Knowledge of planning for quality production, coordinating with director during production, objective to be coped with during preproduction.