GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

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(I) JOURNEYMAN (STRUCTURAL FITTER)

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.
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.
Power Saw, band saw, Circular saw machines used for metal cutting.
Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.
Safety precautions to be observed in a workshop
Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses. Sheet and wire gauge.
Stakes-bench types, parts, their uses. Various types of metal joints, their selection and

application, tolerance for various joints, their selection& application. Wired edges.
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- Introduction, types and method of brazing.
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, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
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.
Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.
Gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge).
Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and uses Wrought iron:- properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.
Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate.
Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.
General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper.

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

Engineering Drawing:

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 (definition and difference)

Workshop Calculation & Science:

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

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

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Mass, Weight, Volume and Density Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** Work, power, energy, HP, IHP, BHP and efficiency **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 Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure **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 Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels **Levers and Simple machines** Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
Marking and laying out toolsand accessories Measuring Tools : steel Rule, calipers, try square, L square,Micrometer, Vernier caliper, Vernier height gauge, Combination set, screw pitchgauge, radius gauge, SWG, Bevel Protractor etc. MarkingTools: Scratch AWL, divider, Trammel point, punches etc. Cutting tools: Snips, shears, hacksaw, chisel, cutting plier,files, drills, tap & die sets etc.
Hand tools: mallets, hammer, sheet metal hammers, groovers, rivetingtools, screw drivers, wrenchand spanners etc. Holding tools & accessories: vices, Cclamps, stakes, stakes holder, hollow mandrel, wooden former, Jigs & fixtures, soldering bits etc.
Sheet Metal Folded Joints: Description of Sheet Metal Seam, Grooved seam, Locked Grooved seam, Paned down seam, Knocked up seam inside and outside, capstrip seam, pitsburg seam etc.
Folding and joining allowances, edge stiffing, wiring allowances and falsewiring, types of notches in sheet metal.
Definitions of pattern, Development, stretched outpattern, Master pattern (gross pattern) and templates Development of by parallel line method, radial line method.
Development of surfaces:Triangulation method andgeometrical construction methods.

Solid and Hollow Punches. Description of hand punchesas per BIS. Sizes of solid and hollow Punches and their uses.
Fastening of Sheet Metal: Self taping screws, Clips andConnectors; Their uses, Types and Allowance of 'S' Clips, Government Clips, Drive Clips, Mailing Clips etc.
Development of surfaces:Triangulation method andgeometrical construction methods.
Solid and Hollow Punches. Description of hand punchesas per BIS. Sizes of solid and hollow Punches and their uses.
Rivets and its parts, Selectionof Rivet heads. Types of Rivet and their uses.Standard sizes of Rivets and Riveting Tools. Calculation for Riveting allowances (pitch and Lap)
Solder, Different types of solder and their composition.Types and uses of fluxes, their effect on different metal.
Process of soft soldering, hard soldering (brazing). Heating appliances (Hand Forge, Blow Lamp, L.P.G.)
Development & laying out pattern of elbow pipe, T pipeand offset pipe in equal diameter.
Development of T pipe, round equal and unequal.Introduction to tubes and pipes.
Laying out pattern of 600 off-set 'T' pipe. Pattern Development of 'Y' pipe. Preparation of pickling solution. Protection-Coating,Cleaning and preparing of Sheet Metals Corrosion and anti-corrosion treatment of sheet metal.
Method of galvanizing,tinning, anodising, sheradising and Electroplating.
Development and laying outof pattern of segmental quarter bend pipe.
Need for ducting. Places where ducting is employed and the working principle of a dust cyclone, Gutter and itsuse. False ceiling.
Safety precaution in gas & arc welding Description of Oxyacetylene plant and the equipments, accessories & tools.
Types of oxy-acetylene flames & its uses. Types anddescription of flux. Types ofwelding blow pipes & its functions.
Various types of pipe joints. Method of metal preparation& cleaning them base metal before welding. Gas welding defects causes & remedies. Arc welding defects causes & remedies.
Introduction to Aluminum fabrication, and its applications. Ferrous and Non-Ferrous metals. Use of Copper and Alloys. Laying out pattern of conical elbows. Pattern development of lobster back bend. Chemical and Physical properties of Aluminium. Useof Aluminium and its Alloys.

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

Brief Description of hand punch machine. Hand and Power operated drilling Machines. Drill Bits, parts and effects of cutting angles.Angles for Drilling Sheet Metals, effect of speed, FeedCutting Fluids, etc., on metals. Difference between drilled and punched holes.
Description of swaging andbeading machine, its parts,operating principles etc. Description of Fly Ball press.Operating Principles of Power Press and press brakes. Method to calculate thepressure adjustment. Clearance between Die andPunch. Introduction to "C" and "H"frame presses.
Properties of stainless steeland its uses. Properties and uses of tin,lead, zinc and silver. Description and Physical properties of Muntz Metal, Gun Metal, White Metal etc.
Introduction to pipe/tube bending. Brief description ofHydraulic pipe bending machine. Operating Principles etc. Description ofroll forming machine types and operating principles, description of slip roll forming machine and its function.
Use of Die and Die Holder, Description of taps and tapwrench.
Method to operate folding/brake folder fortypical folding. Description and use of jigsand fixtures.
Different process of metal joining types of weld joint &weld positions. Oxy- acetylene welding equipments & application, Types of flame & their uses.

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EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(II) JOURNEYMAN (FITTER)

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.
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.
Power Saw, band saw, Circular saw machines used for metal cutting.
Micrometer- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer.
Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.
Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.

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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.
Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses. Sheet and wire gauge.
Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection& application. Wired edges.
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- Introduction, types and method of brazing.
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, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
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.
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- Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses. Setting up parameters for ARC welding machines- Selection of Welding electrodes.
Oxygen acetylene cutting- machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
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.
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).
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.
Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill.
Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.
Gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge).
Interchange ability: Necessity in Engg, 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.
Method of expressing tolerance as per BIS Fits: Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.
Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and uses Wrought iron:- properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.
Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate.
Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use.
Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators- measurement of quality in the cylinder bores.
Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centres, works with catch

plate, dog, simple description of a facing and roughing tool and their applications.

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.

Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes.

General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest,

Knurling: tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation.

Taper – definition, use and method of expressing tapers.

Standard tapers-taper, calculations Morse taper.

Screw thread definition – uses and application. Square, worm, buttress, acme (non-standard-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.

Engineering Drawing:

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 (definition and difference)

Workshop Calculation & Science:

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

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

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity

Related problems for mass, volume, density, weight and specific gravity

Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP,

BHP and efficiency **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

Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure

Basic Electricity

Introduction and uses of electricity, electric current AC,DC their comparison, voltage, resistance and their units

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

Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels

Levers and Simple machines

Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage

Trigonometry

Measurement of angles Trigonometrical ratios Trigonometrical tables

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(III) JOURNEYMAN (ELECTRICIAN)

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.
Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011.
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.
Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison.
Joints in electrical conductors. Techniques of soldering. Types of solders and flux.
Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables.
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.
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.
Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs. Electrostatics: Capacitor- Different types, functions, grouping and uses.
Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits.

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.
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.
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.
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.
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.
Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.
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.
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.
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.
Working principles and circuits of common domestic equipment and appliances.
Concept of Neutral and Earth.
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).
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.
General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self- excited generators. Series, shunt and compound generators.
Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators. Load characteristics of DC generators. Application, losses & efficiency of DC Generators.
Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors.
Methods of speed control of DC motors. Lap and wave winding and related terms.
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 c

and their functions.
Single phasing prevention. No load test and blocked rotor test of induction motor. Losses & efficiency. Various methods of speed control. Braking system of motor.
Concentric/ distributed, single/ double layer winding and related terms.
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.
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.
Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement.
Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory.
P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, ty characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier.
Basic concept of power electronics devices. IC voltage regulators Digital Electronics - Binary numbers, logic gates and combinational circuits.
Working principle and uses of oscilloscope.
Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive.
Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS.
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

WORKSHOP CALCULATION & SCIENCE

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division

Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

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

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 thermometer,

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 ratios, Trigonometrical tables

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(IV) JOURNEYMAN (CRANE OPERATOR)

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.
Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011.
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.
Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison.
Joints in electrical conductors. Techniques of soldering. Types of solders and flux.
Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables.
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.
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.
Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs. Electrostatics: Capacitor- Different types, functions, grouping and uses.
Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits.

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.
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.
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.
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.
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.
Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.
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.
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.
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.
Working principles and circuits of common domestic equipment and appliances.
Concept of Neutral and Earth.
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).
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.
General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self- excited generators. Series, shunt and compound generators.
Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators. Load characteristics of DC generators. Application, losses & efficiency of DC Generators.
Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors.
Methods of speed control of DC motors. Lap and wave winding and related terms.
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 c

and their functions.
Single phasing prevention. No load test and blocked rotor test of induction motor. Losses & efficiency. Various methods of speed control. Braking system of motor.
Concentric/ distributed, single/ double layer winding and related terms.
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.
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.
Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement.
Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory.
P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, ty characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier.
Basic concept of power electronics devices. IC voltage regulators Digital Electronics - Binary numbers, logic gates and combinational circuits.
Working principle and uses of oscilloscope.
Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive.
Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS.
General description and construction of simple E.O.T. crane Main parts of an E.O.T. crane and functions of each part **Lifting devices:** Simple hook, C-hook, Ramshorn Hook, Spreader Beam, Claw, Magnet Brab Bucket etc. and criteria for selecting a particular device Ropes and slings, choice of a sling for a particular load.
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

WORKSHOP CALCULATION & SCIENCE

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division

Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

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

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 thermometer, pyrometer and transmission of heat - Conduction, convection and radiation.

Mensuration

Area and perimeter of square, rectangle and parallelogram

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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

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Measurement of angles, Trigonometrical ratios, Trigonometrical tables

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
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EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(V) JOURNEYMAN (MACHINE OPERATOR)

Linear measurements- its units, steel rule dividers, calipers – types and uses, Punch – types and uses. Uses of different types of hammers.Description, use and care of marking off table.
Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, methodof using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Typesof files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements
Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care & maintenance.Try square, ordinary depth gauge, protractor- description,uses and cares. Calipers- types, material, constructional details, uses,care & maintenance of coldchisels- materials, types, cutting angles.
Marking media, Prussian blue,red lead, chalk and their special application, description. Surface plate and auxiliary marking equipment, 'V' block,angle plates, parallel block, description, types, uses, accuracy, care and maintenance.
Drill, Tap, Die-types & application. Determination oftap drill size. Reamer- material, types (Handand machine reamer), parts and their uses, determining hole size for reaming, Reaming procedure.
Micrometer- outside and inside – principle, constructional features, partsgraduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction,graduations, reading, use and care, dial Vernier Calliper, Digital Vernier calliper.
Pedestal grinder – Introduction, care & use. Procedure of wheel mounting& wheel dressing. Related hazards, risk and precautions.
Drilling machines-types &theirapplication, construction of Pillar & Radial drilling machine. Countersunk, counter bore and spot facing- tools and nomenclature. Cutting Speed, feed, depth ofcut and Drilling time calculations
Interchangeability: Necessity in Engg, field, Limit- Definition,types, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone, allowances. Different standardsystems of fits and limits. (British standard system & BIS

system)
Shaper: Introduction to Shaper machine parts & constructional details, its function and operations. Quick return mechanism ofshaper. Calculation of cutting Speed,feed & depth of cut.
Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinderparts and use. Radius/fillet gauge, feeler gauge, hole gauge, and theiruses, care and maintenance.
Milling: Introduction to milling machine, parts & constructional details, types.Safety precaution followed during milling operation. Milling machine attachments.Different types of milling cutters and its materials. Nomenclature of millingcutters. Milling cutter holding devices,work holding devices, Milling machine operations, Up milling and Down milling. Calculation of cutting speed, feed, machining time for milling machine. Indexing methods and its calculations.
Heat Treatment: Iron Carbon Equilibrium Diagram, Time-Temperature-Transformation Curve. Annealing, Case Hardening, Tempering, Normalizing and Quenching
Classification, construction, materials and functional detailof Chisels & Hammers. Chipping technique. Related hazards, risk and precautions while working. **Scrapers**: Introduction, Its types, material and use. Types of nuts, bolts, studs, locking devices for nut, wrenchand spanner, pliers, screw drivers, Circlip, split pin, washers, spring washer. Concept of torque & torque wrench. Different types of rivets andtheir applications. Identification of different fasteners & operating them byusing proper hand tool
Surface finish - importance,symbol, measuring techniques. Lapping & honing process. **Gauges:** Classification and uses of Sine bar, Slip gauge,Limit gauge, Feeler gauge, thread gauge, screw pitch gauge, taper gauge.
Tolerances & interchangeability -Definitionand its necessity, basic size, actual size, limits, deviation,Tolerance, allowance, clearance, interference, Fits- definition, types, description with sketches. Method of expressing Tolerance as per BIS, Hole and Shaft basis (BIS standard). Related calculation on Limit, Fit and Tolerance.

Fasteners:

Introduction to fasteners,screw threads, related terminology and specification.
Keys- types & use, (parallel,sunk, tangential, gib head, woodruff, key ways.) Related hazards, risk and precautions, while working.

Maintenance Practice and Mechanical Assembly Introduction to various maintenance practices suchas preventive maintenance,predictive maintenance, breakdown maintenance & reconditioning.
Organization Structure for maintenance, Roles and responsibility, advantage and disadvantage of TPM.

Transmission of Power Elements of mechanical power transmission, type of spindles and shafts (Universalspindle, Plain shaft, Hollow shaft, crank shaft, cam shaft).Positive and Non-positive drive, Friction drive, Gear drive, Belt drive, Chain drive and Rope drive.

Clutches

Function of Clutches, its typesand use in power transmission system. Functionof mechanical & electromagnetic system in clutch mechanism.

Couplings:

Concept of coupling and its type viz. Rigid coupling- Muff coupling, Flange coupling, Flexible coupling, Pin-bush coupling, Chain coupling, Gear coupling, Spider coupling, Tyre coupling, Gridcoupling, Oldham-coupling, Fluid coupling, Universal coupling and their specific applications.

Brakes& Braking Mechanism:Types & Functions. Inspectionof brakes for safe & effective working.

Belts-

Belt types (Flat and V) andspecifications.
Pulleys used for belt drive.Installation, Alignment of belts.
Problems related to belts (Creep and slip), Belt maintenance.
Sheave alignment, Chain drive- Roller chain, Silent chain, alignment of sprockets,and maintenance of chain drive.

Bearing:

Description and function of bearing, its types - Solid Bush,Split Bush, Collar, Pivot and Plummer Block Bearing.

Mounting of bearings, measurement and adjustment of clearances inbearings.

Types of bearing fitting onshaft and hubs.

Type of Roller contact

bearings- Ball bearings- singlerow & double row, Deep groove ball bearing, Angular contact, Self aligning and Thrust bearing.

Roller bearing- Cylindrical, Needle roller, Taper roller, Spherical roller, self aligning and Spherical roller thrust bearing.

Use of ISO bearing designation code to generatemarket survey and purchase.Checking and adjustment of bearing clearance.

Methods of Mounting and dismounting of roller contactbearing, taper roller bearing and angular contact ball bearing. (Back-to-back, Face-to-face, tandem). Mounting-dismounting andadjustment of Taper bore bearings withadopter and withdrawal sleeve.

Handling and storage of bearings.

Related hazards, risk and precautions. Rigging Knowledge of different tools &tackles used in rigging.

Construction and capacity ofwire rope/steel rope/belts. Application of knots and hitches.

Care and maintenance of all types of ropes.

Gear:

Type, description andfunction of gears-

Spur, Helical, Spiral, Bevel, Straight and Spiral bevel, Worm gears, Rack and pinion.Gear Terminology.

Gear train- simple, compound, reverted andepicyclic.

Types of Gear box

Gear meshing: Checking of backlash and root clearanceswith Feeler Gauge, Dial Test Indicator and lead wire.

Impression testing of gearmesh with Prussian blue. Running maintenance Related hazards, risk and precautions.

Lubrication and its importance, lubricatingsystems
Concept of lubrication Types and properties of Oiland Grease.
Methods of oil lubrication- Once through and centralizedlubrication system. (05 hrs)
Methods of grease lubricationsystem- grease guns, centralized lubrication system.
Warning & protective devicesused in centralized lubricationsystem (Pressure switch, temperature gauge, level indicator and relief valve.) Lubrication fittings. Storage and handling, Contamination control,
Leakage prevention- Shaft seals, sealing devices and "O"rings.

Cutting Fluids and Coolants.Essential parts of a basic coolant system used in the cutting of metals.
Various types of coolants, its properties and uses, coolant system type-soluble oils-soaps, suds paraffin, sodawater etc.
Effect of cutting fluids inmetal cutting. Difference between coolant and lubricants.

MACHINE FOUNDATION
Purpose & methods employed for installation & erection of precision & heavyduty machines.
Location & excavation for foundation. Different types of foundations – structural, reinforced, wooden, isolated foundations.

Foundation bolt: types (rag, Lewis cotter bolt) descriptionof each erection tools, pulley block, crow bar, spirit level, Plumb bob, wire rope, manilarope, 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.
Energy usage in relevance for Mechanical assembly.

Maintenance
-Total productive maintenance
-Autonomous maintenance
-Routine maintenance
-Maintenance schedule
-Retrieval of data from machine manuals Geometrical tests and inspection method withinstruments.
Preventive maintenance- objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use ofhandbooks and reference table. Possible causes for assembly failures and remedies.
Hazardous wastemanagement.
Basic Electrical:
Study of basic Electricals-Voltage –Current etc.

Working Of Solenoids, Inductors, Motors, GeneratorBased On Electromagnetic Induction Principle. (08hrs)
Safety precautions to be observed while working on alathe, Lathe specifications, and constructional features.
Lathe main parts
descriptions- bed, head stock,carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.

Hydraulics & Pneumatics

Basic principles of Hydraulics –
Advantages & limitation of hydraulic system, hydrostatictransmission, Pascal's law, Brahma's press, pressure Temperature & flow, speed of an actuator.
Control valves: Different typeof control valves used in hydraulic System.
Function of pressure controlvalve, directional control valve, check valve, flow control valve.

Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applicationsof pneumatics, Hazards & safety precautions in pneumatic systems.
Pneumatic actuators:- Types, Basic operation, Force, Strokelength, Single-acting and double-acting cylinders.
Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control Valve

Pneumatic valves: Roller valve, Shuttle valve, Two-pressure valve
Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way singlesolenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls

- Symbols of hydraulic components, Hydraulic oils –function, properties, andtypes, Contamination in oils and its control
- Hydraulic Filters – types,constructional features, and their typical installation locations, cavitations, Hazards & safety precautions in hydraulic systems
- Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/piston types, Pressure relief valves – Direct actingand pilot-operated types
- Pipes, tubing, Hoses andfittings – Constructionaldetails, Minimum bend radius, routing tips for hoses
- Hydraulic cylinders –Types
- Hydraulic motors –Types

- Hydraulic valves: Classification, DirectionalControl valves – 2/2- and3/2-way valves
- Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves
- Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function
- Flow control valves: Types,Speed control methods – meter-in and meter-out
- Preventive maintenance &troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitations, and proper sampling of hydraulic oils

Electro hydraulic circuit,Electrical components

- Switches
- Solenoid
- Relay

Introduction to Pneumaticactuators

Pneumatic SymbolsPneumatic circuit

Electrical control components

- Switches
- Solenoid
- Relay

Study & working of a hydraulic press along with its components. Breakdown & preventive maintenance of ahydraulic press. Safety in useof and maintenance of hydraulic presses.

Proximity Sensors Classification And Operation-Proximity Sensor-Types Of Proximity Sensor And Their Working-Industrial Application

Sensors For Distance and Displacement -LVDT-Linear

Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use ofbending fixture, pipe threads-Std. Pipe threads Die and Tap, pipe vices.

Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes andhouse hold taps and pipe work.

Grinding:

Grinding machine – introduction, parts & constructional details, types – surface grinding and cylindrical grinding machines. Safety precaution followed while working on grinding machines. Grinding wheels – abrasives, bond andbonding process, grit, grade, and structure of grinding wheels and its marking system.

Procedure for mounting of grinding wheels, balancing ofgrinding wheels, dressing and truing of grinding wheels, glazing and loading in grinding wheel.

Different type of jacks, chainblock and pull lift.
Knowledge of different typesof scaffolding.
Material movement by usingdifferent rigging tools and techniques.
Safety appliances & precautions in rigging. Maintenance of tools andtackles.

Engineering Drawing

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 thefreehand sketches.
- Freehand drawing of hand tools and measuring tools.Drawing of Geometrical figures:
- Angle, Triangle, Circle, Rectangle, Square, Parallelogram.
- Lettering & Numbering–Single Stroke.Dimensioning
- Types of arrow head
- 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(definition and difference)

Workshop Calculation & Science

Unit, Fractions

Classification of unit system
Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units
Measurement units and conversion
Factors, HCF, LCM and problems
Fractions - Addition, substraction, multiplication & division
Decimal fractions - Addition, subtraction, multilipication & division

Square root, Ratio and Proportions, Percentage

Square and square root,
Applications of pythagoras theorem and related problems
Ratio and proportion, Percentage, Changing percentage to decimal and fraction

Material Science

Types metals, types of ferrous and non-ferrous metals
Physical and mechanical properties of metals
Introduction of iron and cast iron
Difference between iron & steel, alloy steel
Properties and uses of insulating materials

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity

Speed and Velocity, Work, Power and Energy

Work, power, energy, HP, IHP, BHP and efficiency

Heat & Temperature and Pressure

Concept of heat and temperature, effects of heat, difference
between heat and temperature, boiling point & melting point ofdifferent metals and non-metals
Concept of pressure - Units of pressure

Basic Electricity

Introduction and uses of electricity
Electrical power, HP, energy and units of electrical energy

Mensuration

Area and perimeter of square, rectangle and parallelogramArea and perimeter of Triangles
Area and perimeter of circle, semi-circle, circular ring, sector ofcircle, hexagon and ellipse
Surface area and volume of solids - cube, cuboid, cylinder,sphere and hollow cylinder
Finding the lateral surface area, total surface area and capacityin litres of hexagonal, conical and cylindrical shaped vessels

Levers and Simple machines - Lever and its types

Trigonometry Measurement of angles
Trigonometrical ratios, Trigonometrical tables

Friction

Friction - Advantages and disadvantages, Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction, Lubrication, Co- efficient of friction

Centre of Gravity

Centre of gravity - Centre of gravity and its practical application

Elasticity

Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus

Heat Treatment

Heat treatment and advantages

Different heat treatment process – Hardening,tempering, annealing, normalising and case hardening

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(VI) JOURNEYMAN (MACHINIST)

Linear measurements- its units, steel rule dividers, callipers – types and uses, Punch – types anduses. Uses of different types of hammers. Description, use andcare of marking off table.
Bench vice construction, types,uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description,types and their uses, method ofusing hacksaws. Files- elements, types, specification and their uses. Methods of filing. Care and maintenance of files. Measuring standards - English, Metric Units
Pedestal grinding machine: Use, care and safety aspect. Marking off and layout tools, scribing block, care & maintenance. Try square, ordinary depth gauge, Care & maintenance of coldchisels- materials, types, cutting angles. Combination set- its components, uses and cares.
Marking media, Prussian blue, redlead, chalk and their specialapplication, description. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.
Drill, Tap, Die-types & application. Determination of tap drill size. Basic terminology related to screw thread. Reamer- material, types (Hand and machine reamer), parts and their uses, determining hole sizefor reaming, Reaming procedure. Vernier height gauge:construction, graduations, verniersetting & reading. Care and maintenance of Vernier heightGauge. Drilling machines-types &their application, construction of Pillar & Radial drilling machine. Countersunk, counter bore and spot facing-tools andnomenclature. Cutting Speed, feed, depth of cut and Drilling time calculations.
Interchangeability: Necessity in Engg., field, Limit- Definition, types, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero-line, tolerance zone, allowances. Different standard systems of fits and limits. (British standard system & BIS system) Vernier calliper-its parts, principle,reading, uses & care. Outside micrometre- its parts, principle, reading, uses, Reading of Vernier Micrometre), care & maintenance. Dial test indicator- its parts, types, construction and uses.

Getting to know the lathe with its main components, lever positions and various lubrication points as well. Definition of machine & machine tool and its classification. History and gradual development of lathe.Introduction to lathe- its types. Centre lathe construction, detail function of parts, specification. Safety points to be observed whileworking on a lathe.
Lathe cutting tool-different types, material, shapes and different angles (clearance, rake etc.) andtheir effects, specification of lathe tools, grinding process of tools.Types of chips, chip breaker. Tool life, factors affecting tool life.
Driving mechanism, speed and feed mechanism of Lathe.
Concept of Orthogonal and Oblique Cutting. Chucks & different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks. Vernier Bevel Protractor – parts, reading and uses.
Lathe operations-facing, turning, parting-off, grooving, chamfering, boring etc. Knurling- types, grade & its necessity.
Taper – different methods of expressing tapers, differentstandard tapers. Method of taper turning, important dimensions of taper. Taper turning by swiveling compound slide, its calculation.
Calculations of taper turning byoff-setting tail stock. Sine Bar – description & uses. Slip gauge –description and uses.
Different thread forms, their relateddimensions andcalculations of screw cutting in a lathe (Metric thread on English lathe and English thread on Metriclathe). Measurement of threads by three wire methods. Use of Screw Pitch Gauge.
Slotter– Classification, principle,construction, Safety precaution. Introduction and their indexing process on a Slotter by its Rotary table graduations. Driving mechanisms, quick return motion and speed ratio. Safety points to be observed whileworking on a Slotter.
Job holding devices-vice, clamps,V-block, parallel block etc. Slotting tools- types, tool angles.
Spline – types and uses. **Coolant & lubricant –** Introduction, types, properties, application & applying methods.
Milling Machine: Introduction, types, parts,construction andspecification. Driving and feed mechanism ofMilling Machine.
Different types of milling cutters& their use. Cutter nomenclature.
Different milling operations - plain, face, angular, form, slot, gang and straddle milling etc. Up and down milling.

Different types of milling attachments and their uses.
Jigs and Fixtures– Introduction, principle, types, use, advantages & disadvantages.
Properties of metals general idea of physical, mechanical propertiesof metals, colour, weight, hardness toughness, malleability,ductility their effect on machinability. Heat Treatment – Introduction, necessity, types, Purposes,different methods of Heat Treatment. Heat Treatment of Plain Carbon Steel.
Indexing-introduction & types. Indexing head- types&constructional details, function of indexing plates and the sector arms. Calculation for direct and simple indexing.
Turning of taper by taper turning attachment - advantages and dis- advantages, taper calculations. Mandrel, Lathe centres, Lathe dog, catch plate/Driving plate, Face plate, Rests, their types & uses.
Terms relating screw thread major/ minor diameter, pitch and lead of the screw, depth of thread. Simple gear train and compound gear train change gears for fractional pitches. Square thread and its form and calculation of depth, core dia, pitch dia. Difference between single and multi-start threads- their uses, merits and demerits.
Grinding – Introduction, grinding wheel- abrasive, types, bond, grade, grid,structure, standard marking system of grinding wheel, selection of the grinding wheel.
Dressing, types of dresser. Glazing and Loading of wheels –its causes and remedies. Roughness values and their symbols. Explain the importance andnecessity of quality.
Surface Grinder – Types, Parts, construction, use, methods of surface grinding, specification & safety.
Cylindrical grinder- Introduction, parts, construction,types, specification, safety, different methods of cylindrical grinding.
Cutting speed, feed, depth of cut, machining time calculation.
Wet grinding and dry grinding, various types of grinding wheelsand their application, grinding defects and remedies.
Engineering Drawing: 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 offhand tools and measuring tools.

Drawing of Geometrical figures:

- Angle, Triangle, Circle, Rectangle, square, Parallelogram.
- Lettering & Numbering- Single Stroke.Dimensioning
  - Types of arrow head
  - Leader line with text
  - Position of dimensioning (Unidirectional, Aligned)

Symbolic representation–

- Different symbol used in the related trades.Concept and reading of Drawing in
  - Concept of axes plane and quadrant
  - Concept of Orthographic and ISO metric projections
  - Method of first angle and third angle projections (definition anddifference)

WORKSHOP CALCULATION & SCIENCE:

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI unitsMeasurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication& division

Square root, Ratio and Proportions, Percentage

Square and square root

Applications of Pythagoras theorem and related problemsRatio and proportion

Ratio and proportion - Direct and indirect proportionsPercentage

Percentage - Changing percentage to decimal and fraction

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity

Related problems for mass, volume, density, weight and specific gravity

Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP, BHP and efficiency

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

Concept of pressure - Units of pressure, atmospheric pressure, absolutepressure, gauge

pressure and gauges used for measuring pressure

Mensuration

Area and perimeter of square, rectangle and parallelogramArea 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 andhollow cylinder

Finding the lateral surface area, total surface area and capacity in litresof hexagonal, conical and cylindrical shaped vessels

Levers and Simple machines

Simple machines - Effort and load, mechanical advantage, velocity ratio,efficiency of machine, relationship between efficiency, velocity ratio andmechanical advantage

Trigonometry

Measurement of angles,Trigonometrical ratios, Trigonometrical tables

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(VII) JOURNEYMAN (PIPE FITTER)

- Plumber's commonhand tools - names, description and material from which they aremade.
- Description, types and uses of holding device, hammers & cold chisels,cutting tools.
- Description of simple fitting operations hacksawing, punching and filing.
- Types of files usedcommonly.
- Marking instruments and their use of simpledrilling machine.
- Method of using drills.
- Description of simple bench drilling Machine.
- Description of Grindingand Chisel.
- Description of different types of locking and fastening devices.

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

Mason's works :-

- Names and descriptionof Mason's hand tools and their uses.
- Method of making holesin walls and floors.
- Types of tools used andvarious Processes.
- Concept of bricks, limeand cement.
- Preparation of mortarswith various materials of varying composition.
- Common brick joints.
- Description of bonds.
- Scaffolding &plastering.
- Define Plain cement concrete, RCC and itsproportion,
- Grades of coarse aggregate and fineaggregate,
- Knowledge of waterproofingcompound.
- Knowledge of BuildingPlan and Cross sectionof wall.
- Identify plumbing services required foreach type of buildingaccording to usage.

- Description of plumbertools and Equipment- Ratchet brace, Threading die, Pipe wrench, sliding wrench, Spanner set, Chain Wrench etc. and theirsafety.
- Care & use of tools.
- Pipes of different kinds
- Method of Pipe bendingin different dia.
- Plumbing Symbols and Code for Tools & Materials on water line.

Equipment and tools forhot gas welding and electric hot plate for PPR pipe joints.

- Types of fittings for different joints & different pipes.: - CI,HCI,AC,AC Pressure, DI, GI Pipes. Joints: - Flange joint, Socket jointwith lead, Detachable joint, Socket & Spigot joints etc.
- Description of pipefittings.
  Methods of joining and their uses.
- Precautions to be takenwhile fixing

Different kinds of Joints,Fittings and Materials injoining pipes: - PVC/CPVC, PPR and HDPE etc.

Composition of Water: -

- Sources of water
- Hard & Soft water, temporary hardness &permanent hardness.
- Impurities of water –organic and inorganicimpurities.
- Water purification stages and methods.
- Static water pressuresand measurement of pressures. Bursting pressure,
- Expansion of water onfreezing and heating.
- Bernoulli's principles
- Pascal's law.
- Pressure of water on thesides of cistern or tank.
- Water hammer in pipes.
  Description and working of water hammerarrester.

- Use of hummed pipesof different sizes.

Method of laying outpipes alignment and joining.

- Description of various pipe joints- straight, Branch, Taft and blow,Expansion joints. Solders and fluxes used in joints.

- Description of Plumber'smaterials Lead, tin, Zinc, solder, copper, red lead etc. and their uses.
- Water supply system ofa small town.

- Description and types of pumps viz. suction pump, Centrifugal pump etc. Contamination of water in a well.

- Description of pipe dies, their uses, careand precaution.
- Metric specification ofvarious pipes.
- Standard pipe threads.
- Method employed forbending, Joining and fixing PVC pipe.

- Joining material for water and gas pipes.

- Use of blow lamp.

- Inspection chamber, septic tank, descriptionof drains, cesspools, soak pits etc.

• Types of traps • layout of drainage system (07 hrs)
• Method of bending pipes by hot and coldprocess. - Method of testing drainage lines
• Method of dismantlingand renewal of the valves and pipes. Leaksin pipes and noises in plumbing. • Installation of water meters. Air lock in pipes and its removal.
• Description of cocks & valves-their types, materials & advantagesfor particular work. • Description of differenttype of diverts i.e. two way and three way - Sensor system for urinals and wash basinetc
- Erecting rain water and drainage pipe system, • Installation of sanitary fitting s, inspection andtesting of water supplysystem. • -Pipe alignment and slope. -Prevention ofwater hammer. • Storage tanks for general water supplypropose. • Test for water supplypipes. • Description of sanitaryfittings, • general points to beobserved when choosing sanitary. - Description of concealed flushingcistern
Method of bending galvanized and otherheavy pipes.
Domestic drainage system: General layout, one pipe system, specifications of Materials required.Method of testing leakage.Different types of traps, ventilation, anti-syphonage and sinks. About Fire hydrants andtheir fittings.
Concept of heat andTemperature. Method of transmission ofheat. Heating system by differentthermal units. Domestic hotand cold water. General layout, specification of materials required and Connection of pipes to mains. Tracing leakage. Repairs to service main.Domestic boilers and Geysers. Method of ventilating pipe.Precaution against air Poisoning. Fixing of solar watersystem.
Plumbing and sanitarysymbols and plumbingcodes for all tools andmaterials
Corrosion - causes andremedies, prevention.Corrosion due to electrolytic action. Effect of water and frost onmaterials. Layout of pipes as per drawing.
Engineering Drawing : Introduction to Engineering Drawing and Drawing Instruments–

- Conventions
- Sizes and layout of drawing sheets
- Title Block, its position and content
- Drawing InstrumentFree hand drawing of–
- Geometrical figures and blocks with dimension
- Transferring measurement from the given objectto the sketches.
- Free hand drawing of hand tools and measuring tools.Drawing of Geometrical figures:
  - Angle, Triangle, Circle, Rectangle, Square,Parallelogram.
  - Reading of dimension and Dimensioning Practice.Symbolic representation
  - Different symbols and Pipe joints used in the trade.

WORKSHOP CALCULATION &SCIENCE:

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI unitsMeasurement units and conversion

Factors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication & divisionDecimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

Applications of Pythagoras theorem and related problemsRatio and proportion

Ratio and proportion - Direct and indirect proportionsPercentage

Percentage - Changing percentage to decimal and fraction

Material Science

Types metals, types of ferrous and non-ferrous metalsPhysical and mechanical properties of metals Properties and uses of insulating materials

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity.

Related problems for mass, volume, density, weight and specificgravity

Heat & Temperature and Pressure

Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point ofdifferent metals and non-metals

Scales of temperature, Celsius, Fahrenheit, kelvin andconversion between scales of temperature

Mensuration

Area and perimeter of square, rectangle and parallelogramArea and perimeter of Triangles

Area and perimeter of circle, semi-circle, circular ring, sector ofcircle, hexagon and ellipse

Surface area and volume of solids - cube, cuboid, cylinder,sphere and hollow cylinder

Finding the lateral surface area, total surface area and capacityin litres of hexagonal, conical and cylindrical shaped vessels

Trigonometry

Measurement of angles,Trigonometrical ratios

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(VIII) JOURNEYMAN (RIGGER)

Awareness of safety norms. Fire prevention and personal safety. Ergonomic safety and health principles. Use various PPE whileworking. Safety during material handling
Operating procedures of materialhandling equipments, including manual handling. Knowledge of different tools and tackles used in rigging
Application knots and hitches
Types of sling, Construction of manila and steel rope
SWL of slings base on apical angle
Selection /Rejection criteria of steel sling
Application of sling (choker, basket)
Care and maintenance of rope
Capacity of steel rope
a) Construction and application of chainblock. b) Different type of jacks, chain block, and pull lift
Knowledge of different types of scaffolding
Safety during working on scaffolding
Application of sling on irregular shape load. Material movement by using different rigging tools and technique.
Maintenance of tools and tackles.
Types of derrick, use of derrick
Types of winch, application winch.
Calculation and estimation of weight of load.
Application of sling at different angle
Crane hand signal for EOT crane and mobile crane.
Workshop Calculation & Science **Unit**: Systems of unit- FPS, CGS, MKS/SIunit, unit of length, Mass and time, Conversion of units **Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and viceversa. **Properties of Material** : properties - Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrousand Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non- Ferrous Alloys. **Average:** Problems of Average. **Ratio & Proportion**: Simple calculation on related problems.

Mass, Weight and Density:
Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.
Percentage: Introduction, Simple calculation. Changing percentage todecimal and fraction and vice-versa.
- Forces definition.
- Definition and example of compressive,tensile, shear forces, axial and tangential forces.
Stress, strain, ultimate strength, factor ofsafety for MS.
Speed and Velocity: Rest and motion, speed, velocity, difference between speedand velocity, acceleration, retardation.
Mensuration: Area and perimeter of square, rectangle, parallelogram, triangle,circle, semi circle.
Volume of solids – cube, cuboids, cylinderand Sphere.
Surface area of solids – cube, cuboids,cylinder and Sphere.
Area of cut-out regular surfaces: circleand segment and sector of circle.
- Volume of cut-out solids: hollow cylinders, frustum of cone, block section.
Volume of simple solid blocks.
Work, Power and Energy: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.
Geometry:
Properties of angles, triangles and circles. Area of trapezoid, parallelograms, length of diagonals of square and rectangle.
Pythagoras theorem. Area and
Circumference of circle.
Heat & Temperature:
Heat and temperature, their units, differencebetween heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.
Friction and its application in Workshop practice.
Concept of pressure – units of pressure,atmospheric pressure, gauge pressure – gauges used for measuring pressure.

• Common Indian timbers. • Defects in timber, diseasesof timber, knots, shakes, grains etc. • Introduction of carpentry hand tools, classification and uses of marking, workholding devices. • Measuring & testing tools.
• Type of bench vice and theiruses. • Introduction of differentsaw and their uses. • Introduction of power circular saw and its use. • Type of special saw and itsuses i.e. -compass saw, coping saw, bow saw, fret saw. • Saw sharpening and sharpening tools. • Description of boring tools -Types, Parts, functions, sizeand application. • Description of portableelectrical drill machine. • Drill bits, types, sizes etc. • Hand augers description, sizes of augers, application ofhand augers.
• Type of different planes andtheir proper uses in woodwork - Description, function and its size, setting,knowledge of sharpening and uses etc. • Knowledge of using markinggauges. • Important instruments necessary for checking flatness and twistness ofsurface. • Sharpening and grindingangle of cutter. • Portable power planer - useful in modern woodworkand new technology design. • Different type chisels - Definition, identification,their uses. • Necessity of grinding andsharpening. • Striking tools- Definition,types, application. • Files - Types, uses • Care & maintenance of files • Function of work bench, bench vice, bench hook, etc.
• Seasoning of timber - Definition, advantage and disadvantage of seasoning. • Moisture content in timberand its effect on timber. • Characteristics of wood,physical and mechanicalproperties of wood. • Quality of good timber. • Define the classification ofwooden joint. • Description of different typesjoint. • Uses of joint: Framing jointangle joint and lengtheningjoint etc.

• Preservation of timber. • Application of different typesof preservation & Process of each treatment. • Definition of housing joint. Different type of housingjoint. Uses of housing joint. • Description of differentdovetail joint and theirfunction. Uses of dovetail joint. • Glues - Types of glue andtheir uses.
• Broadening joint description. • Types of broadening joint. • Application of broadening joint. • Setting of end side accordingto annual Rings as well as matching the grain stranding. • Advantage of adhesives useand their types. • Method of Dowel application.

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(IX) JOURNEYMAN (DRIVER MATERIAL HANDLING)

Hand & Power Tools: -

- Marking scheme, marking **material** chalk, Prussian blue.
- Cleaning tools- Scraper, wire brush, Emery paper**,**
- Description, care and use of Surface plates, steel rule,measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber,
- Punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch.
- Chisel- flat, cross-cut.
- Hammer- ball pein, lump, mallet. Screw drivers-blade
- Screw driver, Phillips screwdriver, Ratchet screw driver. Allen key, bench vice & C-clamps
- Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories,
- Pliers - Combination pliers, multi grip, long nose, flat- nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers ,external circlips pliers.
- Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers- Gear and bearing.

Systems of measurement,

- Description, Least Count calculation, care & use of Micrometers- Outside, and depth micrometer,
- Micrometer adjustments,
- Description, Least Count calculation, care & use of Vernier Calliper.

Telescope gauges, Dial bore gauges, Dial indicators, straight edge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

- Different types of metal joint (Permanent, Temporary),methods of, Soldering, etc.

Fasteners

- Study of different types of screws, nuts, studs & bolts, locking devices, Such as locknuts, cotter, split pins, keys, circlips, lockrings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, **oil seals. Types of Gaskets**-– paper, multilayered metallic, liquid, rubber, copper and printed.
- Thread Sealants- Various types like, locking,sealing, temperature resistance, antilocking, lubricating etc.

Cutting tools

Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF- hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
- Description and study of Bench type Drilling machine, Portable electrical Drilling machine,drill holding devices, WorkHolding devices, Drillbits. **Taps and Dies** - Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors **Hand Reamers** Different Type of hand reamers, Drill size for reaming,Lapping, Lapping abrasives, type of Laps.
Introduction to Hydraulics&Pneumatics - Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control, Pressure relief valve, Nonreturn valve, Flow control valve used in automobile.
- Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering trans mission, body and load. Uses of Vehicle hoists– Two post and four post hoist, Engine hoists, Jacks, Stands.
Introduction to Engine: - Description of internal & external combustion engines, Classification of IC engines, Principle &working of 2 & 4-strokediesel engine (Compression ignition Engine (C.I), - Principle of Spark Ignition Engine (SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, - Main Parts of IC Engine - Direct injection and indirect injection, Technical terms used inengine, Engine specification. - Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake- engagement warning light and an Engine-malfunction light. - Different type of startingand stopping method of Diesel Engine - Procedure for dismantling of diesel engine from a vehicle.
Diesel Engine Components: - Description and Constructional feature ofCylinder head, Importance of Cylinder - head design, - Type of Diesel combustion chambers, - Effect on size of Intake &exhaust passages, Head gaskets. - Importance of Turbulence. Valves &Valve Actuating Mechanism -

- Description and Functionof Engine Valves, different types, materials,
- Type of valve operating mechanism, Importanceof Valve seats, Valve seats inserts in cylinder heads,
- importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valvetiming.
- Description of Camshafts& drives ,
- Description of Overheadcam shaft (SOHC and DOHC), importance of Cam lobes, Timing belts & chains, Timing belts &tensioners.

- Description & functions ofdifferent types of pistons, piston rings and piston pins and materials.
- Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy.
- Compression ratio.
- Description & function ofconnecting rod,
- importance of big- endsplit obliquely
- Materials used for connecting rods big end& main bearings. Shells piston pins and locking methods of piston pins.

- Description and function of Crank shaft, camshaft,
  Engine bearings- classification and location – materials used& composition of bearing materials- Shell bearing and their advantages- special bearings materialfor diesel engine
- Application bearing failure & its causes-care& maintenance.
- Crank-shaft balancing,firing order of the engine.

- Description and functionof the fly wheel and vibration damper.
- Crank case & oil pump, gears timing mark, Chainsprockets, chain tensioner etc.
- Function of clutch & coupling units attached to flywheel.

- Description of Cylinder block,
- Cylinder blockconstruction,
- Different type of Cylinder sleeves (liner).

Need for Cooling systems

- -Heat transfermethod, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval,
- Different type of coolingsystems,

Basic cooling system components

- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans,
- Temperature indicators, Radiator pressure cap,Recovery system, Thermo- switch.

Need for lubrication system,

- Functions of oil, Viscosity and its grade as per SAE ,

- Oil additives, Syntheticoils, The lubrication system**,**

Splash system,

- Pressure system
- Corrosion/noise reduction in the lubrication system.
- Lubrication system components
- Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oilpump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Intake & exhaust systems–

- Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster,Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.

Intake system components-

- Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material**,**

Exhaust system components

- Description and functionof Exhaust manifold, Exhaust pipe, Extractors,Mufflers-Reactive, absorptive, Combinationof Catalytic converters, Flexible connections, Ceramic coatings, Back- pressure,
- Electronic mufflers.

Fuel Feed System in IC Engine (Petrol & Diesel)

- Gravity feed system, Forced feed system, main parts, Fuel Pumps-Mechanical & Electrical, Feed Pumps.
- Knowledge about function, working &types of Carburetor.

Diesel Fuel Systems

- Description and functionof Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology &Clean diesel technology.

Diesel fuel system components

- Description and functionof Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump,
- Inline injection pump, Distributor-type injectionpump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection.

Electronic Diesel control-

- Electronic Diesel controlsystems, Common Rail Diesel Injection (CRDI) system, hydraulicallyactuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit)used in Diesel Engines.

Marine & Stationary Engine:-Types,

- -double acting engines, opposed piston engines,starting systems, coolingsystems,

lubricating systems, supplying fuel oil, hydraulic coupling,

- Reduction gear drive,electromagnetic coupling, Electrical drive, generators and motors,supercharging.

Emission Control :-Vehicle emissions

- Standards- Euro andBharat II, III, IV, V
  Sources of emission,Combustion,
  Combustion chamber design.

Types of emissions:

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

Mechanical handling of machines/equipments:

Different types of appliances and tackle for shifting, loading and un-loading of machinesand equipments.

Screw jacks – their use and working principles.Chain pulley blocks – their use and working principles.

Crane and hoists for lifting purposes – workingprinciples and main constructional features.

Working principles and use of other tackles like crabs and winches, slings, rollers and bars,levers, lashings and packing

ENGINEERING DRAWING:

Introduction to Engineering Drawing and DrawingInstruments

- 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 thefree hand sketches.

Dimensioning

- Types of arrowhead
- Leader line with text

• Position of dimensioning (Unidirectional, Aligned)

Symbolic representation –

• Different symbols used in the related trades of MechanicAuto

Body Repair / Electrical and Electronics / Diesel / Tractor /Two and Three-wheeler.

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

WORKSHOP CALCULATION & SCIENCE

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SIunits

Measurement units and conversionFactors, HCF, LCM and problems

Fractions - Addition, subtraction, multiplication &division

Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

Applications of Pythagoras theorem and related problemsRatio and proportion

Ratio and proportion - Direct and indirect proportions

Percentage - Changing percentage to decimal and fraction

Material Science

Types metals, types of ferrous and non ferrous metalsPhysical and mechanical properties of metals Introduction of iron and cast iron

Difference between iron & steel, alloy steel and carbonsteel

Properties and uses of rubber, timber and insulatingmaterials

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity,

Related problems for mass, volume, density, weight and specific gravity

Speed and Velocity, Work, Power and Energy

Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration andretardation

Speed and velocity - Related problems on speed & velocity

Work, power, energy, HP, IHP, BHP and efficiency

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

Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure,

gauge pressure and gaugesused for measuring pressure

Mensuration

Area and perimeter of square, rectangle andparallelogram

Surface area and volume of solids - cube, cuboid, cylinder,sphere and hollow cylinder

Finding the lateral surface area, total surface area andcapacity in litres of hexagonal, conical and cylindrical shaped vessels

Levers and Simple machines

Simple machines - Effort and load, mechanical advantage,velocity ratio, efficiency of machine, relationship betweenefficiency, velocity ratio and mechanical advantage

Lever & Simple machines - Lever and its types

Trigonometry Measurement of angles,Trigonometrical ratios Trigonometrical tables

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GARDEN REACH SHIPBUILDERS & ENGINEERS LIMITED
KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(X) JOURNEYMAN (ELECTRONIC MECHANIC)

Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc.
Single range meters Introduction to electrical and electronic measuring instruments. Basic principle and parts of simple meters. Specifications, symbols used in dial and their meaning.
Cells & Batteries Construction, types of primary and secondary cells/battery. Materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections.
Introduction to electrical measuring instruments. Importance and classification of meters. MC and MI meters. Characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO/DSO, Function generator, LCR meter
Advantages and features of DSO. Block diagram of Digital storage oscilloscope (DSO)/ CRO and applications. Applications of digital CRO. Block diagram of function generator. Differentiate a CRO with DSO
Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications.

Different switches, their specification and usage.
Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications and energy storage concept. Self and Mutual induction.
Behaviour of inductor at low and high frequencies. Series and parallel combination, Q factor. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behaviour with AC and DC. Concept of Time constant of a RC circuit. Concept of Resonance and its application in series and parallel circuit. Properties of magnets and their materials, preparation of artificial magnets, significance of electromagnetism, types of cores. Relays, types, construction and specifications etc
Semiconductor materials, components, PN Junction, Forward and Reverse biasing of diodes. Forward current and Reverse voltage. Packing styles of diodes. Different diodes, Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode, varactor diode, their specifications and applications. Working principle of a Transformer, construction, Specifications and types of cores used. Step-up, Step down and isolation transformers with applications. Losses in Transformers.
Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator, (Transistorized & IC based). Voltage regulation, error correction and amplification etc.
Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Need for Biasing of Transistor. VBE, VCB, VCE, IC, IB, Junction Temperature, junction capacitance, frequency of operation. Transistor applications as switch and amplifier. Transistor input and output characteristics.

Transistor power ratings & packaging styles and use of different heat sinks.
Different types of biasing, various configurations of transistor (C-B, C-E & C-C), their characteristics and applications. Transistor biasing circuits and stabilization Techniques. Classification of amplifiers according to frequency, mode of operation and methods of coupling. Voltage amplifiers - voltage gain, loading effect. Single stage CE amplifier and CC amplifier. Emitter follower circuit and its advantages. RC coupled amplifier, Distinguish between voltage and power amplifier, Alpha, beta, voltage gain, Concept of dB dBm. Feedback and its types.
Introduction to positive feedback and requisites of an oscillator. Study of Colpitts, Hartley, Crystal and RC oscillators. Types of multi vibrators and study of circuit diagrams.
Diode shunt clipper circuits, Clamping / limiting circuits and Zener diode as peak clipper, uses their applications.
Construction of FET & JFET, difference with BJT. Purpose of Gate, Drain and source terminals and voltage / current relations between them and Impedances between various terminals. Heat Sink- Uses & purpose. Suitability of FET amplifiers in measuring device applications. Working of different power electronic components such as SCR, TRIAC, DIAC and UJT.
MOSFET, Power MOSFET and IGBT, their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET. Differentiate Transistor with IGBT
Working and application of LED, IR LEDs, Photo diode, photo transistor, their characteristics and applications.
Introduction to Digital Electronics. Difference between analog and digital signals. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables.
Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer / De- multiplexer.

Introduction to Flip-Flop.
S-R Latch, Gated S-R Latch, D- Latch.
Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop.
Master-Slave flip flops and Timing diagrams.
Basic flip flop applications like data storage, data transfer and frequency division.
Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications.
Schematic diagram of 741, symbol.
Non-inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps.
Block diagram of 555, functional description w.r.t. different configurations of 555 such as monostable, astable and VCO operations for various application.

ENGINEERING DRAWING

Introduction to Engineering Drawing and Drawing Instrument –

- 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

Symbolic representation–

- Different Electronic symbols used in the related trades

WORKSHOP CALCULATION & SCIENCE

Unit, Fractions

Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion. Factors, HCF, LCM and problems. Fractions - Addition, subtraction, multiplication & division. Decimal fractions - Addition, subtraction, multiplication & division.

Square root, Ratio and Proportions, Percentage

Square and square root.
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.

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.

Basic Electricity

Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC their comparison, voltage, resistance and their units Conductor, insulator, types of connections - series and parallel. Ohm's law, relation between
V.I.R & related problems. Electrical power, energy and their units, Magnetic induction, self and mutual inductance and EMF generation Electrical power, HP, energy and units of electrical energy

Trigonometry

Measurement of angles, Trigonometrical ratios, Trigonometrical tables

Introduction to Static charges, prevention, handling of static sensitive devices, various standards for ESD. Introduction to non-soldering interconnections.
Construction of Printed Circuit Boards (single, Double, multi- layer), Important tests for PCBs.
Introduction to rework and repair concepts.
Repair of damaged track. Repair of damaged pad and plated through hole.
Repair of solder mask.

Necessity of fuse, fuse ratings, types of fuses, fuse bases.
Single/ three phase MCBs, single phase ELCBs.
Types of contactors, relays and working voltages.
Contact currents, protection to contactors and high current applications.

1. LOW VOLTAGE DC MOTOR

(Low Potential motor) Introduction of DC motor. Types of DC motor .Types of DC motor controller.
DC Motor power.
Types of DC Motor power regulation.
Application area of DC motor controller.

2. What is a Stepper motor and its types.

Stepper Motor working Principal. How to select a stepper motor Types of wiring of stepper motor. Stepper motor control by varying clock pulses. Advantage of stepper motor.
Radio Wave Propagation – principle, fading. Need for Modulation, types of modulation and demodulation. Fundamentals of Antenna, various parameters, types of Antennas & application. Introduction to AM, FM & PM, SSB-SC & DSB-SC. Block diagram of AM and FM transmitter. FM Generation & Detection. Digital modulation and demodulation techniques, sampling, quantization & encoding. Concept of multiplexing and de multiplexing of AM/ FM/ PAM/ PPM /PWM signals. A simple block diagram approach to be adopted for explaining the above mod/demod techniques.
Introduction Microprocessor & 8051 Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Comparative study of 8051 with 8052. Introduction to PIC Architecture.
Basics of passive and active transducers. Role, selection and characteristics. Sensor voltage and current formats. Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors.
Introduction to optical fiber, optical connection and various types optical amplifier, its advantages, properties of optic fiber, testing, losses, types of fiber optic cables and

specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipment/ measuring tools. Precautions and safety aspects while handling optical cables.
Different types of seven segment displays, decoders and driver ICs. Concept of multiplexing and its advantages. Block diagrams of 7106 and 7107 and their configuration for different measurements. Use of DPM with seven segment display. Principles of working of LCD. Different sizes of LCDs. Decoder/ driver ICs used with LCDs and their pin diagrams. Use of DPM with LCD to display different voltage & current signals.
Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment. Voltage cut-off systems, relays used in stabilizer. Block Diagram of different types of Switch mode power supplies and their working principles. Inverter; principle of operation, block diagram, power rating, change over period. Installation of inverters, protection circuits used in inverters. Battery level, overload, over charging etc. Various faults and its rectification in inverter. Block diagram of DC-DC converters and their working principals.
Concept of Uninterrupted power supply. Difference between Inverters and UPS. Basic block diagram of UPS & operating principle. Types of UPS : Off line UPS, On line UPS, Line interactive UPS & their comparison UPS specifications. Load power factor & types of indications & protections
Semiconductor properties & types. P-type and N-type semiconductors, PN junction, etc. Conversion of solar radiation to electricity. Main materials used to develop solar cells (Silicon, Cadmium tellurides, etc.) Light sensitive properties of PN junction. Difference of photo electric and photo voltaic effects of a PN junction. PV cell characteristics, I–V curve, effects of temperature. Photovoltaic effect. Photo voltaic module: minimal functional specification, cells per module, max watts per module, maximum voltage at max power, maximum current at max power.

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KOLKATA – 700024

EN 2025/05 (J) - SYLLABUS FOR WRITTEN TEST (PART-I PAPER)

(XI) JOURNEYMAN (DIESEL MECHANIC)

Hand & Power Tools: -

- Marking scheme, marking **material** chalk, Prussian blue.
- Cleaning tools- Scraper, wire brush, Emery paper**,**
- Description, care and use of Surface plates, steel rule,measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber,
- Punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch.
- Chisel- flat, cross-cut.
- Hammer- ball pein, lump, mallet. Screw drivers-blade
- Screw driver, Phillips screwdriver, Ratchet screw driver. Allen key, bench vice & C-clamps,
- Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories,
- Pliers - Combination pliers, multi grip, long nose, flat- nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers ,external circlips pliers.
- Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers- Gear and bearing.

Systems of measurement,

- Description, Least Count calculation, care & use of Micrometers- Outside, and depth micrometer,
- Micrometer adjustments,
- Description, Least Count calculation, care & use of Vernier Calliper.

Telescope gauges, Dial bore gauges, Dial indicators, straight edge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

- Different types of metal joint (Permanent, Temporary),methods of, Soldering, etc.

Fasteners

- Study of different types of screws, nuts, studs & bolts, locking devices, Such as locknuts, cotter, split pins, keys, circlips, lockrings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, **oil seals. Types of Gaskets**-– paper, multilayered metallic, liquid, rubber, copper and printed.
- Thread Sealants- Various types like, locking,sealing, temperature resistance, antilocking, lubricating etc.

Cutting tools

Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF- hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
- Description and study of Bench type Drilling machine, Portable electrical Drilling machine,drill holding devices, WorkHolding devices, Drillbits. **Taps and Dies** - Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors **Hand Reamers** Different Type of hand reamers, Drill size for reaming,Lapping, Lapping abrasives, type of Laps.
Introduction to Hydraulics&Pneumatics - Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control, Pressure relief valve, Nonreturn valve, Flow control valve used in automobile.
- Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering trans mission, body and load. Uses of Vehicle hoists– Two post and four post hoist, Engine hoists, Jacks, Stands.
Introduction to Engine: - Description of internal & external combustion engines, Classification of IC engines, Principle &working of 2 & 4-strokediesel engine (Compression ignition Engine (C.I), - Principle of Spark Ignition Engine (SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, - Main Parts of IC Engine - Direct injection and indirect injection, Technical terms used inengine, Engine specification. - Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake- engagement warning light and an Engine-malfunction light. - Different type of startingand stopping method of Diesel Engine - Procedure for dismantling of diesel engine from a vehicle.
Diesel Engine Components: - Description and Constructional feature ofCylinder head, Importance of Cylinder - head design, - Type of Diesel combustion chambers, - Effect on size of Intake &exhaust passages, Head gaskets. - Importance of Turbulence. Valves &Valve Actuating Mechanism -

- Description and Functionof Engine Valves, different types, materials,
- Type of valve operating mechanism, Importanceof Valve seats, Valve seats inserts in cylinder heads,
- importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valvetiming.
- Description of Camshafts& drives ,
- Description of Overheadcam shaft (SOHC and DOHC), importance of Cam lobes, Timing belts & chains, Timing belts &tensioners.

- Description & functions ofdifferent types of pistons, piston rings and piston pins and materials.
- Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy.
- Compression ratio.
- Description & function ofconnecting rod,
- importance of big- endsplit obliquely
- Materials used for connecting rods big end& main bearings. Shells piston pins and locking methods of piston pins.

- Description and function of Crank shaft, camshaft,
  Engine bearings- classification and location – materials used& composition of bearing materials- Shell bearing and their advantages- special bearings materialfor diesel engine
- Application bearing failure & its causes-care& maintenance.
- Crank-shaft balancing,firing order of the engine.

- Description and functionof the fly wheel and vibration damper.
- Crank case & oil pump, gears timing mark, Chainsprockets, chain tensioner etc.
- Function of clutch & coupling units attached to flywheel.

- Description of Cylinder block,
- Cylinder blockconstruction,
- Different type of Cylinder sleeves (liner).

Need for Cooling systems

- -Heat transfermethod, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval,
- Different type of coolingsystems,

Basic cooling system components

- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans,
- Temperature indicators, Radiator pressure cap,Recovery system, Thermo- switch.

Need for lubrication system,

- Functions of oil, Viscosity and its grade as per SAE ,

- Oil additives, Syntheticoils, The lubrication system**,**

Splash system,

- Pressure system
- Corrosion/noise reduction in the lubrication system.
- Lubrication system components
- Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oilpump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.

Intake & exhaust systems–

- Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster,Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.

Intake system components-

- Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material**,**

Exhaust system components

- Description and functionof Exhaust manifold, Exhaust pipe, Extractors,Mufflers-Reactive, absorptive, Combinationof Catalytic converters, Flexible connections, Ceramic coatings, Back- pressure,
- Electronic mufflers.

Fuel Feed System in IC Engine (Petrol & Diesel)

- Gravity feed system, Forced feed system, main parts, Fuel Pumps-Mechanical & Electrical, Feed Pumps.
- Knowledge about function, working &types of Carburetor.

Diesel Fuel Systems

- Description and functionof Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology &Clean diesel technology.

Diesel fuel system components

- Description and functionof Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump,
- Inline injection pump, Distributor-type injectionpump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection.

Electronic Diesel control-

- Electronic Diesel controlsystems, Common Rail Diesel Injection (CRDI) system, hydraulicallyactuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit)used in Diesel Engines.

Marine & Stationary Engine:-Types,

- -double acting engines, opposed piston engines,starting systems, coolingsystems,

lubricating systems, supplying fuel oil, hydraulic coupling,

- Reduction gear drive,electromagnetic coupling, Electrical drive, generators and motors,supercharging.

Emission Control :-Vehicle emissions

- Standards- Euro andBharat II, III, IV, V
  Sources of emission,Combustion,
  Combustion chamber design.

Types of emissions:

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

ENGINEERING DRAWING:

Introduction to Engineering Drawing and DrawingInstruments

• 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 thefree hand sketches.

Dimensioning

• Types of arrowhead
• Leader line with text
• Position of dimensioning (Unidirectional, Aligned)

Symbolic representation –

• Different symbols used in the related trades of MechanicAuto
Body Repair / Electrical and Electronics / Diesel / Tractor /Two and Three-wheeler.

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

WORKSHOP CALCULATION & SCIENCE

Unit, Fractions

Classification of unit system

Fundamental and Derived units F.P.S, C.G.S, M.K.S and SIunits

Measurement units and conversion, Factors, HCF, LCM

Fractions - Addition, subtraction, multiplication &division

Decimal fractions - Addition, subtraction, multiplication & division

Square root, Ratio and Proportions, Percentage

Square and square root

Applications of Pythagoras theorem and related problemsRatio and proportion

Ratio and proportion - Direct and indirect proportions

Percentage - Changing percentage to decimal and fraction

Material Science

Types metals, types of ferrous and non ferrous metalsPhysical and mechanical properties of metals Introduction of iron and cast iron

Difference between iron & steel, alloy steel and carbonsteel

Properties and uses of rubber, timber and insulatingmaterials

Mass, Weight, Volume and Density

Mass, volume, density, weight and specific gravity,

Related problems for mass, volume, density, weight and specific gravity

Speed and Velocity, Work, Power and Energy

Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration andretardation

Speed and velocity - Related problems on speed & velocity

Work, power, energy, HP, IHP, BHP and efficiency

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

Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gaugesused for measuring pressure

Basic Electricity

Introduction and uses of electricity, electric current AC,DCtheir comparison, voltage, resistance and their units Conductor, insulator, types of connections - series and parallel

Ohm's law, relation between V.I.R & related problems

Mensuration

Area and perimeter of square, rectangle andparallelogram

Surface area and volume of solids - cube, cuboid, cylinder,sphere and hollow cylinder

Finding the lateral surface area, total surface area andcapacity in litres of hexagonal,

conical and cylindrical shaped vessels

Levers and Simple machines

Simple machines - Effort and load, mechanical advantage,velocity ratio, efficiency of machine, relationship betweenefficiency, velocity ratio and mechanical advantage

Lever & Simple machines - Lever and its types

Trigonometry Measurement of angles,Trigonometrical ratios Trigonometrical tables

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