

## Indicative Syllabus

<b>Name of Post</b>	Plant Assistant - Mechanical
<b>Minimum Educational Qualification</b>	High School (10th) passed from the Board recognized by GoMP /Govt. of India and Regular ITI trade certificate from institute recognized by GoMP/Govt. of India in Machinist, Fitter, Welder/ H.P. Welder/ Mechanic Pump/ Mechanic Vehicle/ Motor Mechanic/ Diesel Mechanic trades.

So No.	Trade Theory
1	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. <b>Soft Skills: its importance and Job area after completion of training.</b> Introduction of First aid. Operation of electrical maintenance. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.
2	Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, their description and uses of different types of hammers. Description, use and care of „V“ Blocks, marking off table.
3	Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Measuring standards (English, Metric Units), angular measurements, subdivisions, try square, ordinary depth gauge, protractor- description, uses and cares.
4	Marking off and layout tools, dividers, scribing block, odd leg calipers, punches- description, classification, material, care & maintenance.
5	Calipers- types, material, constructional details, uses, care & maintenance of cold chisels- materials, types, cutting angles.
6	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of scribing block.
7	Surface plate and auxiliary marking equipment, „V“ block, angle plates, parallel block, description, types and uses, workshop surface plate- their uses, accuracy, care and maintenance. Types of files- convexing, taper, needle, care and maintenance of files, various types of keys, allowable clearances & tapers, types, uses of key pullers.
8	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.
9	Power Saw ,band saw, Circular saw machines used for metal sections cutting

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10	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer.
11	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper.
12	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size.
13	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening, case hardening and tempering. Power hammer – construction, features, method of operating and uses.
14	Marking and measuring tools, wing compass, Prick punch, tinman’s square tools, snips, types and uses. Tin man’s hammers and mallets type-sheet metal tools, Soldering iron, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses.
15	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges -
16	Solders-composition of various types of solders, and their heating media of soldering iron, fluxes types, selection and application-joints
17	Rivets-Tin man’s rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, shearing machine- description, parts and uses.
18	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.
19	Setting up parameters for arc welding machines-selection of Welding electrodes
20	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch- description, parts, function and uses.
21	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.

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22	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 (course 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).
23	Dies : British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
24	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.
25	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts function and metric, different dimensions, convex and concave uses care and maintenance.
26	Radius gauge, feeler gauge, hole gauge, and their uses.
27	Interchangeability: 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
28	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 : manufacturing process ( by using)Blast furnace types, of pig Iron , properties and uses.
29	Cast Iron: manufacturing process by using (cupola furnace) types, properties and uses. Wrought iron- : manufacturing process (Puddling and Aston process ) properties and uses. Steel: manufacturing process plain carbon steels, types, properties and uses.
30	Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.
31	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.
32	Simple scraper- cir., flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces)

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33	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.
34	Dial test indicator, construction, parts, material, graduation, Method of use., Care and maintenance. Digital dial indicator. Comparators- measurement of quality in the cylinder bores.
35	Preventive maintenance-objective and function of P.M., section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies.
36	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
37	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 centers, works with catch plate, dog, simple description of a facing and roughing tool and their applications.
38	Lathe cutting tools- Brief study of the nomenclature of Lathe cutting tools 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.
39	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.
40	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.
41	Screw thread definition – uses and application. Terminology of screw threads, 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.

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42	Screws: material, different types (inch & metric), uses Testing scraped surfaces: ordinary surfaces without a master plate.
43	Special files: types (pillar, Dread naught, Barret, warding) description.
44	System of drill size, Fractional size: number, letter and metric. Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses.
45	Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge),
46	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar-Principle, application & specification. Procedure to check adherence to specification and quality standards.
47	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use.
48	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.
49	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
50	. Manufacture: The name and types of gauge commonly used in gauging finished product-Method of selective assembly „Go“ system of gauges, hole plug basis of standardization
51	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row.
52	Roller and needle bearings: Types of roller bearing. Description & use of each
53	Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
54	Method of fitting ball and roller bearings
55	Bearing metals – types, composition and uses, lubricants purpose of using different types, description and uses of each type
56	Hardening and tempering, purpose of each method, tempering colour chart.

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57	Annealing and normalising, purpose of each method.
58	Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
59	Solder and soldering: Introduction-types of solder and flux. Method of soldering, Hard solder- Introduction, types and method of brazing. Production of gauges, templates and jigs. The objective of importance for preparing interchangeable components.
60	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses.
61	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices.
62	Standard pipefitting-. Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc.
63	Fire precautions-causes and types of fires, precautions against out break of fire. Fire Extinguishers-types and use.
64	Working material with finished surface as aluminium, duralumin, stainless steel, the importance of keeping the work free from rust and corrosion. The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as chromium silver plating and nickel plating, and galvanising.
65	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel.
66	Tapers on keys and cotters permissible by various standards. Discuss non-ferrous metals as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes where and why used, advantages for specific purposes, surface wearing properties of bronze and brass.
67	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. V belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation.
68	Power transmissions, coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses.

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69	Pulleys-types-solid, split and „V“ belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle.
70	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set, Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gear. Repair to gear teeth by building up and dovetail method.
71	Method or fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears.
72	Lubrication and lubricants- Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal. Bearings, method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Chains, wire ropes and clutches for power transmission. Their types and brief description. Discuss the various rivets shape and form of heads, riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting.
73	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
74	Installation, maintenance and overhaul of machinery and engineering equipment and Hydraulics & pneumatic symbols & exercise. Hydraulics pneumatic circuits. Clutch: Type, positive clutch (straight tooth type, angular tooth type) .
75	Washers-Types and calculation of washer sizes. The making of joints and fitting packing. 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.
76	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, pipe 2 X 4“, wire rope, manila rope, wooden block.