7. TRADE SYLLABUS

SYLLABUS FOR FITTER TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) with Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 250 Hrs; Professional Knowledge 70 Hrs	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. *[Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]*	1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.) 3. First Aid Method and basic training. (2 hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.) 5. Hazard identification and avoidance. (2 hrs.) 6. Safety signs for Danger, Warning, caution & personal safety message. (1 hrs.) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs.) 8. Use of Fire extinguishers. (7 hrs.) 9. Practice and understand precautions to be	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations &regulations as applicable.

		followed while working in fitting jobs. (2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hrs.)	Basic understanding on Hot work, confined space work and material handling equipment. (07 hrs.)
		11. Identification of tools &equipment as per desired specifications for marking & sawing. (5 hrs.) 12. Selection of material as per application. (1 hrs.) 13. Visual inspection of raw material for rusting, scaling, corrosion etc. (1 hrs.) 14. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions. (10 hrs.) 15. Sawing different types of metals of different sections. (8 hrs.)	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. (07 hrs.)
		16. Filing Channel, Parallel. (5 hrs.) 17. Filing- Flat and square (Rough finish), (10 hrs.) 18. Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule. (5 hrs.) 19. Marking practice with dividers, odd leg calipers and steel rule (circles, ARCs, parallel lines). (5 hrs.)	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. (07 hrs.)
		20. Marking off straight lines	Marking off and layout tools,

		and ARCs using scribing block and dividers. (5 hrs.) 21. Chipping flat surfaces along a marked line. (10 hrs.) 22. Marking, filing, filing square and check using tri square. (10 hrs.)	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. (07 hrs.)
		23. Marking according to simple blueprints for locating, position of holes, scribing lines on chalked surfaces with marking tools. (10 hrs.) 24. Finding centre of round bar with the help of 'V' block and marking block. (3 hrs.) 25. Joining straight line to an ARC. (12 hrs.)	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. (07 hrs.)
		26. Chipping, Chamfering, Chip slots & oils grooves (Straight). (08 hrs.) 27. Filing flat, square, and parallel to an accuracy of 0.5mm. (07 hrs.) 28. Chip curve along a line- mark out, keyways at various angles & cut keyways. (1 hrs.) 29. Sharpening of Chisel. (2 hrs.) 30. File thin metal to an accuracy of 0.5 mm. (07 hrs.)	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. (07 hrs.)
		31. Saw along a straight line,	Power Saw, band saw,

		curved line, on different sections of metal. (15 hrs.) 32. Straight saw on thick section, M.S. angle and pipes. (10 hrs.)	Circular saw machines used for metal cutting. (07 hrs.)
		33. File steps and finish with smooth file to accuracy of ± 0.25 mm. (15 hrs.) 34. File and saw on M.S. Square and pipe. (10 hrs.)	Micrometer- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer. (07 hrs.)
		35. File radius along a marked line (Convex & concave) & match. (15 hrs.) 36. Chip sheet metal (shearing). (5 hrs.) 37. Chip step and file. (5 hrs.)	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. (07 hrs.)
		38. Mark off and drill through holes. (5 hrs.) 39. Drill and tap on M.S. flat. (10 hrs.) 40. Punch letter and number (letter punch and number punch) (5 hrs.) 41. Practice use of different punches. (5 hrs.)	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size. (07 hrs.)
Professional Skill 125 Hrs;	Manufacture simple sheet metal items as per drawing and join	42. Marking of straight lines, circles, profiles and various geometrical shapes and	Safety precautions to be observed in a sheet metal workshop, sheet and sizes,

Professional Knowledge 35 Hrs	them by soldering, brazing and riveting.	cutting the sheets with snips. (15 hrs.) 43. Marking out of simple development (5 hrs.) 44. Marking out for flaps for soldering and sweating. (5 hrs.)	Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine- description, parts and uses. (07 hrs.)
		45. Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming. (30 hrs.) 46. Punch holes-using hollow and solid punches. (5 hrs.) 47. Do lap and butt joints. (15 hrs.)	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. (14 hrs.)
		48. Bend sheet metal into various curvature form, wired edges- straight and curves. Fold sheet metal at angle using stakes. (8 hrs.) 49. Make simple Square container with wired edge and fix handle. (17 hrs.)	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges. (07 hrs.)
		50. Make square tray with square soldered corner. (15 hrs.) 51. Practice in soft soldering and silver soldering. (10 hrs.)	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. (07 hrs.)
Professional	Join metal	52. Make riveted lap and butt	Various rivets shape and form

Skill 25 Hrs; Professional Knowledge 07 Hrs	components by riveting observing standard procedure.	joint. (9 hrs.) 53. Make funnel as per development and solder joints. (10 hrs.) 54. Drill for riveting. (1 hr.) 55. Riveting with as many types of rivet as available, use of counter sunk head rivets. (5 hrs.)	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. (07 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Join metal component by arc welding observing standard procedure.	56. Welding - Striking and maintaining ARC, laying Straight-line bead. (25 hrs.)	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. (07 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Cut and join metal component by gas (oxy-acetylene)	57. Making square, butt joint and 'T' fillet joint-gas and ARC. (15 hrs.) 58. Do setting up of flames, fusion runs with and without filler rod, and gas. (10 hrs.)	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. (07 hrs.)
		59. Make butt weld and corner, fillet in ARC welding (25 hrs.)	Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode. (07 hrs.)
		60. Gas cutting of MS plates (25 hrs.)	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses. (07 hrs.)
Professional Skill 150 Hrs; Professional Knowledge 42 Hrs	Produce components by different operations and check accuracy using appropriate measuring instruments.*[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	61. Mark off and drill through holes. (5 hrs.) 62. Drill on M.S. flat. (1 hrs.) 63. File radius and profile to suit gauge. (13 hrs.) 64. Sharpening of Drills. (1 hrs.) 65. Practice use of angular measuring instrument. (5 hrs.)	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. (07 hrs.)
		66. Counter sink, counter bore and ream split fit (three piece fitting). (5 hrs.) 67. Drill through hole and blind holes. (2 hrs.) 68. Form internal threads with taps to standard size (through holes and blind holes). (3 hrs.) 69. Prepare studs and bolt. (15 hrs.)	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). (07 hrs.)
		70. Form external threads with dies to standard size. (10 hrs.) 71. Prepare nuts and match with bolts. (15 hrs.)	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. (07 hrs.)
		72. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree). (15 hrs.) 73. Make simple open and sliding fits. (10 hrs.)	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. (07 hrs.)
		74. Enlarge hole and increase internal dia. (2 hrs.) 75. File cylindrical surfaces. (5 hrs.) 76. Make open fitting of curved profiles. (18 hrs.)	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. (07 hrs.)
		77. Correction of drill location by binding previously drilled hole. (5 hrs.) 78. Make inside square fit. (20 hrs.)	Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance. (07 hrs.)
Professional Skill 150 Hrs; Professional Knowledge 42 Hrs	Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality.	79. Make sliding 'T' fit. (25 hrs.)	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

	[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]		fits and limits. British standard system, BIS system. (07 hrs.)
		80. File fit- combined, open angular and sliding sides. (10 hrs.) 81. File internal angles 30minutes accuracy open, angular fit. (15 hrs.)	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. (07 hrs.)
		82. Make sliding fit with angles other than 90^{o} (25 hrs.)	Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and usesWrought iron:- properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses. (07 hrs.)
		83. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. (5 hrs.) 84. Make & assemble, sliding flats, plain surfaces. (15 hrs.) 85. Check for blue math of bearing surfaces- both flat and curved surfaces by wit worth method. (5 hrs.)	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. (07 hrs.)
		86. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. (18 hrs.)	Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical

		87. Locate accurate holes & make accurate hole for stud fit. (2 hrs.) 88. Fasten mechanical components / sub-assemblies together using screws, bolts and collars using hand tools. (5 hrs.)	fasteners and its uses. Screw thread micrometer: Construction, graduation and use. (07 hrs.)
		89. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)(25 hrs.)	Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores. (07 hrs.)
Professional Skill 125 Hrs; Professional Knowledge 35 Hrs	Produce components involving different operations on lathe observing standard procedure and check for accuracy. *[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]*	90. Lathe operations- 91. True job on four jaw chuck using knife tool. (5 hrs.) 92. Face both the ends for holding between centres. (9 hrs.) 93. Using roughing tool parallel turn ± 0.1 mm. (10 hrs.) 94. Measure the diameter using outside caliper and steel rule. (1 hr.)	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. (07 hrs.)
		95. Holding job in three jaw chuck. (2 hrs.) 96. Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, roundthe ends, and use form tools. (11 hrs.) 97. Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted	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

		under cut, square beveled. (11 hrs.) 98. Sharpening of -Single point Tools. (1 hr.)	coolants and lubricants. (07 hrs.)
		99. Cut grooves- square, round, 'V' groove. (10 hrs.) 100. Make a mandrel-turn diameter to sizes. (5 hrs.) 101. Knurl the job. (1 hr.) 102. Bore holes –spot face, pilot drill, enlarge hole using boring tools. (9 hrs.)	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. (07 hrs.)
		103. Make a bush step bore-cut recess, turn hole diameter to sizes. (5 hrs.) 104. Turn taper (internal and external). (10 hrs.) 105. Turn taper pins. (5 hrs.) 106. Turn standard tapers to suit with gauge. (5 hrs.)	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. (07 hrs.)
		107. Practice threading using taps, dies on lathe by hand. (2 hrs.) 108. Make external 'V' thread. (8 hrs.)	Screw thread definition – uses and application. Square, worm, buttress, acme (nonstandard-screw threads), Principle of cutting screw

		109. Prepare a nut and match with the bolt. (15 hrs.)	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. (07hrs.)
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Plan & perform simple repair, overhauling of different machines and check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]*	110. Simple repair work: Simple assembly of machine parts from blueprints. (15 hrs.) 111. Rectify possible assembly faults during assembly. (19 hrs.) 112. Perform the routine maintenance with check list (10 hrs.) 113. Monitor machine as per routine checklist (3 hrs.) 114. Read pressure gauge, temperature gauge, oil level (1 hr.) 115. Set pressure in pneumatic system (2 hrs.)	**Maintenance** -Total productive maintenance -Autonomous maintenance -Routine maintenance -Maintenance schedule -Retrieval of data from machine manuals 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 of handbooks and reference table. Possible causes for assembly failures and remedies. Installation, maintenance and overhaul of machinery and engineering equipment(14 hrs.)
		116. Assemble simple fitting using dowel pins and tap screw assembly using torque wrench. (25 hrs.)	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torqueing. Dowel pins: material, construction, types, accuracy and uses. (07 hrs.)
In-plant training / Project work			

SYLLABUS FOR FITTER TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) with Indicative hrs.**	**Professional Knowledge (Trade Theory)**
Professional Skill 300 Hrs; Professional Knowledge 108 Hrs	Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. *[Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*	117. Make 'H' fitting. (17 hrs.) 118. Power tools: Practice operation of power tool for fastening. (5 hrs.) 119. Tightening of bolt/ screw with specified torque. (2 hrs.) 120. Selection of right tool as for Tightening or loosening of screw/bolt as per accessibility. (1 hr.)	Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance. (09 hrs.)
		121. Assembly sliding for using keys, dowel pin and screw, ± 0.02 mm accuracy on plain surface and testing of sliding fitting job. (13 hrs.) 122. File & fit angular mating surface within an accuracy of ± 0.02 mm & 10 minutes angular fitting. (12 hrs.)	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers. (09 hrs.)
		123. Drill through and blind holes at an angle using swivel table of drilling machine. (10 hrs.) 124. Precision drilling, reaming and tapping and Test-Job. (15 hrs.)	Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. (09 hrs.)
		125. Make Dovetailed fitting and radius fitting. (25	Templates and gauges- Introduction, necessity, types.

		hrs.)	Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge). (09 hrs.)
		126. File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy and check adherence to specification and quality standards using equipment like Vernier-calipers, micrometres etc.(25 hrs.)	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. (09 hrs.)
		127. Drilling and reaming, small dia. holes to accuracy & correct location for fitting. (4 hrs.) 128. Perform drilling using 'V' block and a clamp. (1 hrs.) 129. Make male and female fitting parts, drill and ream holes not less than 12.7 mm. (20 hrs.)	Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards. (09 hrs.)
		130. Make Sliding Diamond fitting. (20 hrs.) 131. Lap flat surfaces using lapping plate. (5 hrs.)	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. (09 hrs.)
		132. Prepare Stepped keyed fitting and test job. (20 hrs.) 133. Lapping holes and cylindrical surfaces. (5 hrs.)	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance. (09 hrs.)
		134. Dovetail and Dowel pin assembly. (20 hrs.) 135. Scrape cylindrical bore. (5 hrs.)	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods - normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart. (09 hrs.)
		136. Scrapping cylindrical bore and to make a fit-(15 hrs.) 137. Scrapping cylindrical taper bore and check taper angle with sine bar. (10 hrs.)	Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas). (09 hrs.)
		138. Make a cotter jib assembly. (25 hrs.)	Tapers on keys and cotters permissible by various standards. (09 hrs.)
		139. Hand reams and fit taper pin. (15 hrs.) 140. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts. (10 hrs.)	The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing. (09hrs.)
Professional Skill 125 Hrs;	Make different gauges by using standard tools & equipment	141. Making a snap gauge for checking a dia. of 10 ± 0.02 mm. (25 hrs.)	Gauges and types of gauge commonly used in gauging finished product-Method of

Professional Knowledge 45 Hrs	and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]*		selective assembly 'Go' system of gauges, hole plug basis of standardization. (09 hrs.)
		142. Scrape external angular mating surface and check angle with sine bar. (15 hrs.) 143. Scrape on internal surface and check. (10 hrs.)	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row. (09 hrs.)
		144. Practice in dovetail fitting assembly and dowel pins and cap screws assembly. (20 hrs.) 145. Industrial visit. (5 hrs.)	Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings (09 hrs.)
		146. Preparation of gap gauges. (15 hrs.) 147. Perform lapping of gauges (hand lapping only) (10 hrs.)	Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, Teflon polyamide (nylon). (09hrs.)
		148. Preparation of drill gauges. (10 hrs.) 149. File and fit straight and angular surfaces internally. (13 hrs.) 150. Identify different ferrous metals by spark test (2 hrs.)	The importance of keeping the work free from rust and corrosion. (09 hrs.)
Professional Skill 75 Hrs.; Professional Knowledge	Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and	151. Flaring of pipes and pipe joints. (3 hrs.) 152. Cutting & Threading of pipe length. (3 hrs.) 153. Fitting of pipes as per	Pipes and pipe fitting-commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads-

27 Hrs	test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*	sketch observing conditions used for pipe work. (12 hrs.) 154. Bending of pipes- cold and hot. (7 hrs.)	Std. Pipe threads Die and Tap, pipe vices. (09 hrs.)
		155. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve. (25 hrs.)	Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc. (09 hrs.)
		156. Fit & assemble pipes, valves and test for leakage & functionality of valves. (22 hrs.) 157. Visual inspection for visual defects e.g. dents, surface finish. (1 hr.) 158. Measuring, checking and recording in control chart. (2 hrs.)	Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and household taps and pipe work. Inspection & Quality control -Basic SPC -Visual Inspection. (09 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 09 Hrs.	Make drill jig & produce components on drill machine by using jigs and check for correctness.	159. Make a simple drilling jig. (20 hrs.) 160. Use simple jigs and fixtures for drilling. (5 hrs.)	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses. (09 hrs.)
Professional Skill 200 Hrs. Professional Knowledge 72 Hrs.	Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. *[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]*	161. Marking out for angular outlines, filing and fitting the inserts into gaps. (8 hrs.) 162. Exercises on finished material such as aluminium/ brass/ copper / stainless steel, marking out, cutting to size, drilling, tapping etc. without damage to surface of finished	Aluminum and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminum etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing

		articles. (12 hrs.)	properties of bronze and brass. (07 hrs.)
		163. Making an adjustable spanner: - Marking out as per Blueprint, drilling, cutting, straight and curve filing, threading, cutting slot and cutting internal threads with taps. (20 hrs.)	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. (07 hrs.)
		164. Dismantling and mounting of pulleys. (15 hrs.) 165. Making & replacing damaged keys. (15 hrs.) 166. Dismounting, repairing damaged gears and mounting and check for workability. (20 hrs.) 167. Repair & replacement of belts and check for workability. (15 hrs.)	Vee belts and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions-coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses. 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. (24 hrs.)
		168. Making of template/gauge to check involute profile. (22 hrs.)	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.

			(08 hrs.)
		169. Repair of broken gear tooth by stud and repair broker gear teeth by dovetail. (23 hrs.)	Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method. (08 hrs.)
		170. Make hexagonal slide fitting. (20 hrs.) 171. Prepare different types of documentation as per industrial need by different methods of recording information. (5 hrs.)	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. (09 hrs.)
		172. Marking out on the round sections for geometrical shaped fittings such as spline with 3 or 4 teeth. Finishing and fitting to size, checking up the faces for universality. (25 hrs.)	Fluid power, Pneumatics, Hydraulics, and their comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law. (09 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator,*	173. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs.) 174. Dismantle, replace, and assemble FRL unit. (5	Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems.

	Valves and Actuators.]	hrs.) 175. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE). (2 hrs.) 176. Identify the parts of a pneumatic cylinder. (1 hrs.) 177. Dismantle and assemble a pneumatic cylinder. (8 hrs.) 178. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder. (7 hrs.)	Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. (09 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	179. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals. (5 hrs.) 180. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve. (10 hrs.) 181. Dismantling & assembling of solenoid valves. (10 hrs.)	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 single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay

			unit, Logic controls. (09 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	182. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) (5 hrs.) 183. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses (5 hrs.) 184. Inspect fluid levels, service reservoirs, clean/replace filters (5 hrs.) 185. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings (5 hrs.) 186. Identify internal parts of hydraulic cylinders, pumps/ motors (5 hrs.)	- Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses. (09 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 09 Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	187. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2- & 4/3-way valves. (10 hrs.) 188. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video).	- Hydraulic cylinders –Types - Hydraulic motors –Types - Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-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,

		(15 hrs.)	Speed control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils. (09 hrs.)
Professional Skill 100 Hrs; Professional Knowledge 36 Hrs	Plan & perform basic day to day preventive maintenance, repairing and check functionality. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	189. Dismantle, overhauling & assemble cross-slide & hand-slide of lathe carriage. (25 hrs.)	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. (09 hrs.)
		190. Simple repair of machinery: - Making of packing gaskets. (5 hrs.) 191. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. (5 hrs.) 192. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. (20 hrs.) 193. Dismantling, assembling of different types of bearing and check for functionality. (25 hrs.)	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. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Washers-Types and calculation of washer sizes. The making of joints and fitting packing. Chains, wire ropes and

		194. Perform routine check of machine and do replenish as per requirement. (20 hrs.)	clutches for power transmission. Their types and brief description. (27 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	195. Inspection of Machine tools such as alignment, levelling. (10 hrs.) 196. Accuracy testing of Machine tools such as geometrical parameters. (15 hrs.)	Lubrication and lubricants- purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings. (09 hrs.)
		197. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. (5 hrs.) 198. Erect simple machines. (45 hrs.)	Foundation bolt: types (Lewis cotter bolt) description of each erection tools, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts. (18 hrs.)
In-plant training/ Project work			