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 212 Hrs; Professional Knowledge 37Hrs	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, Hacks awing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]* (Mapped NOS: CSC/N0304)	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 followed while working in fitting jobs. (2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hrs.)	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. Basic understanding on Hot work, confined space work and material handling equipment. (04 hrs.)

		11. Identification of tools &equipment as per desired specifications for marking & sawing. (4 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. (9 hrs.) 15. Sawing different types of metals of different sections. (6 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. (04 hrs.)
		16. Filing Channel, Parallel. (5 hrs.) 17. Filing- Flat and square (Rough finish), (08 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). (4 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. (04 hrs.)
		20. Marking off straight lines and ARCs using scribing block and dividers. (4 hrs.) 21. Chipping flat surfaces along a marked line. (9 hrs.) 22. Marking, filing, filing square and check using tri square. (9 hrs.)	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. (04 hrs.)
		23. Marking according to simple blueprints for locating, position of holes,	Marking media, marking blue, Prussian blue, red lead, chalk and their special application,

		scribing lines on chalked surfaces with marking tools. (8 hrs.) 24. Finding centre of round bar with the help of 'V' block and marking block. (2 hrs.) 25. Joining straight line to an ARC. (08 hrs.)	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. (03 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. (3 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. (04 hrs.)
		31. Saw along a straight line, curved line, on different sections of metal. (12 hrs.) 32. Straight saw on thick section, M.S. angle and pipes. (8 hrs.)	Power Saw, band saw, Circular saw machines used for metal cutting. (03 hrs.)
		33. File steps and finish with smooth file to accuracy of ± 0.25 mm. (12 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. (03 hrs.)
		35. File radius along a marked line (Convex & concave) & match. (12 hrs.) 36. Chip sheet metal (shearing). (3 hrs.) 37. Chip step and file. (3 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. (03 hrs.)
		38. Mark off and drill through holes. (5 hrs.) 39. Drill and tap on M.S. flat. (8 hrs.) 40. Punch letter and number (letter punch and number punch) (3 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. (03 hrs.)
Professional Skill 97Hrs; Professional Knowledge 21Hrs	Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting. (Mapped NOS: CSC/N0301)	42. Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. (12 hrs.) 43. Marking out of simple development (5 hrs.) 44. Marking out for flaps for soldering and sweating. (4 hrs.)	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. (05 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. (22 hrs.) 46. Punch holes-using hollow and solid punches. (5 hrs.) 47. Do lap and butt joints. (12 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. (07 hrs.)
		48. Bend sheet metal into various curvature form, wired edges- straight and curves. Fold sheet metal at angle using stakes. (6 hrs.) 49. Make simple Square container with wired edge and fix handle. (13 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. (04 hrs.)

		50. Make square tray with square soldered corner. (11 hrs.) 51. Practice in soft soldering and silver soldering. (7 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. (05 hrs.)
Professional Skill 19Hrs; Professional Knowledge 03Hrs	Join metal components by riveting observing standard procedure. (Mapped NOS: CSC/N0304)	52. Make riveted lap and butt joint. (6 hrs.) 53. Make funnel as per development and solder joints. (8 hrs.) 54. Drill for riveting. (1 hr.) 55. Riveting with as many types of rivet as available, use of counter sunk head rivets. (4 hrs.)	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. (03 hrs.)
Professional Skill 21Hrs; Professional Knowledge 04Hrs	Join metal component by arc welding observing standard procedure. (Mapped NOS: CSC/N0304)	56. Welding - Striking and maintaining ARC, laying Straight-line bead. (21 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. (04 hrs.)
Professional Skill 64Hrs; Professional Knowledge 16Hrs	Cut and join metal component by gas (oxy-acetylene) (Mapped NOS: CSC/N0304)	57. Making butt joint and joint-gas and ARC. (12 hrs.) 58. Do setting up of flames, fusion runs with and without filler rod, and gas. (8 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. (05 hrs.)
		59. Make butt weld and corner, fillet in ARC welding (22 hrs.)	Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode. (05 hrs.)
		60. Gas cutting of MS plates (22 hrs.)	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses. (06 hrs.)
Professional Skill 143Hrs; Professional Knowledge 26Hrs	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]* (Mapped NOS: CSC/N0304)	61. Mark off and drill through holes. (04 hrs.) 62. Drill on M.S. flat. (1 hrs.) 63. File radius and profile to suit gauge. (10 hrs.) 64. Sharpening of Drills. (1 hrs.) 65. Practice use of angular measuring instrument. (04 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. (04 hrs.)
		66. Counter sink, counter bore and ream split fit (three piece fitting). (04 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. (13 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). (03 hrs.)

		70. Form external threads with dies to standard size. (08 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. (06 hrs.)
		72. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree). (12 hrs.) 73. Make simple open and sliding fits. (08 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. (04 hrs.)
		74. Enlarge hole and increase internal dia. (2 hrs.) 75. File cylindrical surfaces. (5 hrs.) 76. Make open fitting of curved profiles. (15 hrs.)	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. (04 hrs.)
		77. Correction of drill location by binding previously drilled hole. (04 hrs.) 78. Make inside square fit. (16 hrs.)	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). (05 hrs.)
Professional Skill 126Hrs; Professional Knowledge 28Hrs	Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit*	79. Make sliding 'T' fit. (21 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 fits and limits. British standard system, BIS system. (05 hrs.)
		80. File fit- combined, open	Method of expressing

	and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.] (Mapped NOS: CSC/N0304)	angular and sliding sides. (08 hrs.) 81. File internal angles 30minutes accuracy open, angular fit. (12 hrs.)	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. (04 hrs.)
		82. Make sliding fit with angles other than 90° (21 hrs.)	Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and usesWroughtiron:- properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses. (05 hrs.)
		83. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. (04 hrs.) 84. Make & assemble, sliding flats, plain surfaces. (12 hrs.) 85. Check for blue match 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. (04 hrs.)
		86. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. (15 hrs.) 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.)	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. (05 hrs.)

		89. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)(21 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. (05 hrs.)
Professional Skill 95 Hrs; Professional Knowledge 15 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)]* (Mapped NOS: CSC/N0110)	90. Lathe operations- 91. True job on four jaw chuck using knife tool. (5 hrs.) 92. Face both the ends for holding between centres. (06 hrs.) 93. Using roughing tool parallel turn ± 0.1 mm. (06 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. (04 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. (08 hrs.) 97. Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled. (08 hrs.) 98. Sharpening of -Single point Tools. (1 hr.)	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. (03 hrs.)
		99. Cut grooves- square, round, 'V' groove. (08 hrs.) 100. Knurl the job. (1 hr.) 101. 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. (02 hrs.)
		102. Turn taper (internal and external). (10 hrs.) 103. Turn taper pins. (5 hrs.) 104. 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. (03 hrs.)
		105. Practice threading using taps, dies on lathe by hand. (2 hrs.) 106. Make external 'V' thread. (8 hrs.) 107. Prepare a nut and match with the bolt. (10 hrs.)	Screw thread definition – uses and application. Square, worm, buttress, acme (nonstandard-screw threads), Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread. (03 hrs.)
Professional Skill 63 Hrs; Professional Knowledge 12Hrs	Plan & perform simple repair, overhauling of different machines and check for functionality. *[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]*	108. Simple repair work: Simple assembly of machine parts from blueprints. (10 hrs.) 109. Rectify possible assembly faults during assembly. (14 hrs.) 110. Perform the routine maintenance with check list (08 hrs.) 111. Monitor machine as per routine checklist (3 hrs.) 112. Read pressure gauge, temperature gauge, oil level (1 hr.)	**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

		113. Set pressure in pneumatic system (2 hrs.)	handbooks and reference table. Possible causes for assembly failures and remedies. Installation, maintenance and overhaul of machinery and engineering equipment (10 hrs.)
		114. Assemble simple fitting using dowel pins and tap screw assembly using torque wrench. (15 hrs.)	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torqueing. Dowel pins: material, construction, types, accuracy and uses. (02 hrs.)
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	**Engineering Drawing:** Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument 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 (definitionand difference) Reading of Job drawing of related trades.	
WORKSHOP CALCULATION & SCIENCE: 38 Hrs.			

Professional Knowledge WCS- 38 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**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 Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction **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, ~~molecule, atom, how electricity is produced~~, 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
In-plant training / Project work		