SYLLABUS FOR FITTER TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) with Indicative hrs.**	**Professional Knowledge (Trade Theory)**
Professional Skill 255Hrs; Professional Knowledge 70Hrs	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.]* (Mapped NOS: CSC/N0304)	115. Make 'H' fitting. (13 hrs.) 116. Power tools: Practice operation of power tool for fastening. (5 hrs.) 117. Tightening of bolt/ screw with specified torque. (2 hrs.) 118. 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. (06 hrs.)
		119. Assembly sliding for using keys, dowel pin and screw, ± 0.02 mm accuracy on plain surface and testing of sliding fitting job. (13 hrs.) 120. 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. (06 hrs.)
		121. Drill through and blind holes at an angle using swivel table of drilling machine. (09 hrs.) 122. Precision drilling, reaming and tapping and Test-Job. (12 hrs.)	Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. (07 hrs.)
		123. Make Dovetailed fitting and radius fitting. (18hrs.)	Templates and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance. (05 hrs.)

		124. 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, micrometresetc.(18 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. (06 hrs.)
		125. Drilling and reaming, small dia. holes to accuracy & correct location for fitting. (4 hrs.) 126. Perform drilling using 'V' block and a clamp. (1 hrs.) 127. Make male and female fitting parts, drill and ream holes not less than 12.7 mm. (18 hrs.)	Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards. (05 hrs.)
		128. Make Sliding Diamond fitting. (22 hrs.) 129. 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. (06 hrs.)
		130. Prepare Stepped keyed fitting and test job. (16 hrs.) 131. 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. (05 hrs.)

		132. Dovetail and Dowel pin assembly. (16 hrs.) 133. 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. (06 hrs.)
		134. Scrapping cylindrical bore and to make a fit-(12 hrs.) 135. Scrapping cylindrical taper bore and check taper angle with sine bar. (08 hrs.)	Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas). (07 hrs.)
		136. Make a cotter jib assembly. (20 hrs.)	Tapers on keys and cotters permissible by various standards. (06 hrs.)
		137. Hand reams and fit taper pin. (12 hrs.) 138. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts. (08 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. (05hrs.)
Professional Skill 113Hrs; Professional Knowledge 30Hrs	Make different gauges by using standard tools & equipment and checks for specified accuracy. *[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - ±0.02mm]* (Mapped NOS:CSC/N0304)	139. Making a snap gauge for checking a dia. of 10 ± 0.02 mm. (20 hrs.)	Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. (06 hrs.)
		140. Scrape external angular mating surface and check angle with sine bar. (15 hrs.) 141. 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. (06 hrs.)
		142. Practice in dovetail fitting assembly and dowel pins	Roller and needle bearings: Types of roller bearing.

		and cap screws assembly. (16 hrs.) 143. Industrial visit. (5 hrs.)	Description & use of each. Method of fitting ball and roller bearings (06 hrs.)
		144. Preparation of gap gauges. (12 hrs.) 145. 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). (06hrs.)
		146. Preparation of drill gauges. (10 hrs.) 147. File and fit straight and angular surfaces internally. (13 hrs.) 148. Identify different ferrous metals by spark test (2 hrs.)	The importance of keeping the work free from rust and corrosion. (06 hrs.)
Professional Skill 62 Hrs.; Professional Knowledge 18Hrs	Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages.*[Range of skills – Cutting, Threading, Flaring, Bending and Joining]* (Mapped NOS:CSC/N0304)	149. Flaring of pipes and pipe joints. (02 hrs.) 150. Cutting & Threading of pipe length. (3 hrs.) 151. Fitting of pipes as per sketch observing conditions used for pipe work. (10 hrs.) 152. Bending of pipes- cold and hot. (06 hrs.)	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. (06 hrs.)
		153. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve. (20 hrs.)	Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc. (06 hrs.)
		154. Fit & assemble pipes, valves and test for leakage & functionality of valves. (18 hrs.) 155. Visual inspection for visual defects e.g. dents, surface finish. (1 hr.) 156. Measuring, checking and	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

		recording in control chart. (2 hrs.)	-Basic SPC -Visual Inspection. (06 hrs.)
Professional Skill 24 Hrs.; Professional Knowledge 06 Hrs.	Make drill jig & produce components on drill machine by using jigs and check for correctness. (Mapped NOS:CSC/N0304)	157. Make a simple drilling jig. (20 hrs.) 158. Use simple jigs and fixtures for drilling. (04 hrs.)	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses. (06 hrs.)
Professional Skill 152Hrs. Professional Knowledge 43 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.]* (Mapped NOS:CSC/N0304)	159. Marking out for angular outlines, filing and fitting the inserts into gaps. (06 hrs.) 160. 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 articles. (09 hrs.)	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 properties of bronze and brass. (04 hrs.)
		161. Making an adjustable spanner: - Marking out as per Blueprint, drilling, cutting, straight and curve filing, threading, cutting slot and cutting internal threads with taps. (16 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. (04 hrs.)
		162. Dismantling and mounting of pulleys. (12 hrs.) 163. Making & replacing damaged keys. (12 hrs.) 164. Dismounting, repairing damaged gears and mounting and check for workability. (16 hrs.) 165. Repair & replacement of belts and check for workability. (12 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. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Chains, wire ropes and clutches for power transmission. Their types and brief description. (15 hrs.)
		166. Making of template/gauge to check involute profile. (17 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. (05 hrs.)
		167. Repair of broken gear tooth by stud and repair broker gear teeth by dovetail. (17 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. (05 hrs.)
		168. Make hexagonal slide fitting. (16 hrs.) 169. Prepare different types of documentation as per industrial need by different methods of recording information. (04 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. (05 hrs.)
		170. Marking out on the round sections for geometrical	Fluid power, Pneumatics, Hydraulics, and their

		shaped fittings such as spline with 3 or 4 teeth. Finishing and fitting to size, checking up the faces for universality. (15 hrs.)	comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law. (05 hrs.)
Professional Skill 21Hrs; Professional Knowledge 07Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	171. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs.) 172. Dismantle, replace, and assemble FRL unit. (5 hrs.) 173. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE). (2 hrs.) 174. Identify the parts of a pneumatic cylinder.(1 hrs.) 175. Dismantle and assemble a pneumatic cylinder.(6 hrs.) 176. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder. (5 hrs.)	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. Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. (07 hrs.)
Professional Skill 20Hrs; Professional Knowledge 07Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	177. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals. (4 hrs.) 178. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve. (08 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

		179. Dismantling &assembling of solenoid valves. (08hrs.)	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. (07 hrs.)
Professional Skill 20Hrs; Professional Knowledge 07Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	180. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) (04 hrs.) 181. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses (04 hrs.) 182. Inspect fluid levels, service reservoirs, clean/replace filters (04 hrs.) 183. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings (04 hrs.) 184. Identify internal parts of hydraulic cylinders, pumps/motors (04 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. (07 hrs.)
Professional Skill 18 Hrs.; Professional Knowledge 05Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	185. 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. (8 hrs.) 186. Maintenance, troubleshooting, and safety aspects of	- 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

		pneumatic and hydraulic systems (The practical for this component may demonstrated by video). (10 hrs.)	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, cavitation, and proper sampling of hydraulic oils. (05 hrs.)
Professional Skill 80Hrs; Professional Knowledge 23Hrs	Plan & perform basic day to day preventive maintenance, repairing and check functionality. *[Simple Machines – Drill Machine, Power Saw and Lathe]* (Mapped NOS:CSC/N0304)	187. Dismantle, overhauling & assemble cross-slide & hand-slide of lathe carriage. (20 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. (05 hrs.)
		188. Simple repair of machinery: - Making of packing gaskets. (04 hrs.) 189. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. (04 hrs.) 190. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. (16 hrs.) 191. Dismantling, assembling of different types of bearing and check for functionality. (20 hrs.) 192. Perform routine check of machine and do replenish	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. Washers-Types and calculation of washer sizes. The making of joints and fitting packing. (18 hrs.)

		as per requirement. (15 hrs.)	
Professional Skill 75 Hrs; Professional Knowledge 16Hrs	Plan, erect simple machine and test machine tool accuracy. *[Simple Machines – Drill Machine, Power Saw and Lathe]*	193. Inspection of Machine tools such as alignment, levelling. (10 hrs.) 194. 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. (04 hrs.)
		195. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. (5 hrs.) 196. 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. (12 hrs.)
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	**<u>Engineering Drawing:</u>** • Reading of drawing of nuts, bolt, screw thread, different types oflocking devices e.g., Double nut, Castle nut, Pin, etc. • Reading of foundation drawing • Reading of Rivets and rivetted joints, welded joints • Reading of drawing of pipes and pipe joints Reading of Job Drawing, Sectional View & Assembly view	
WORKSHOP CALCULATION & SCIENCE: 28 Hrs.			
Professional Knowledge WCS- 28 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**<u>WORKSHOP CALCULATION & SCIENCE:</u>** **Friction** Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication Friction - Co- efficient of friction, application and effects of friction in workshop practice	

		Centre of Gravity Centre of gravity - Centre of gravity and its practical application **Area of cut out regular surfaces and area of irregular surfaces** Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle Area of irregular surfaces and application related to shop problems **Elasticity** Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress **Heat Treatment** Heat treatment and advantages Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening **Estimation and Costing** Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
In-plant training/ Project work		