

## 7. TRADE SYLLABUS

SYLLABUS FOR MECHANIC MACHINE TOOL MAINTENANCE TRADE			
FIRST YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 300 Hrs; Professional Knowledge 84 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. <i>[Basic fitting operation – marking, Hack-sawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]</i>	<ol style="list-style-type: none"> <li>1. Importance of trade training, List of tools &amp; Machinery used in the trade. (1 hr)</li> <li>2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs)</li> <li>3. First Aid Method and basic training.(2 hrs)</li> <li>4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs)</li> <li>5. Hazard identification and avoidance. (2 hrs)</li> <li>6. Safety signs for Danger, Warning, caution &amp; personal safety message.(1 hr)</li> <li>7. Preventive measures for electrical accidents &amp; steps to be taken in such accidents.(2 hrs)</li> <li>8. Use of Fire extinguishers.(7 hrs)</li> <li>9. Practice and understand precautions to be followed while working in</li> </ol>	<p>All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.</p> <p>Soft Skills, its importance and Job area after completion of training.</p> <p>Importance of safety and general precautions observed in the in the industry/shop floor.</p> <p>Introduction of First aid.</p> <p>Operation of electrical mains and electrical safety.</p> <p>Introduction of PPEs.</p> <p>Response to emergencies e.g.; power failure, fire, and system failure.</p> <p><b>Importance of housekeeping &amp; good shop floor practices.</b></p> <p>Introduction to 5S concept &amp; its application.</p> <p><b>Occupational Safety &amp; Health:</b></p> <p>Health, Safety and Environment guidelines, legislations &amp; regulations as applicable.</p> <p>Basic understanding on Hot</p>

		<p>fitting jobs. (2 hrs)</p> <p>10. Safe use of tools and equipments used in the trade. (1 hr)</p>	<p>work, confined space work and material handling equipment. (07 hrs)</p>
		<p>11. Study the drawing to plan the job/ work. Identification of tools &amp; equipments as per desired specifications for marking, filing &amp; sawing. (3 hrs)</p> <p>12. Visual inspection of raw material for rusting, scaling, corrosion etc.(1 hr)</p> <p>13. Familiarisation of bench vice. (1 hr)</p> <p>14. Filing- Flat and square (Rough finish). (8 hrs)</p> <p>15. Marking with scribe and steel rule (2hrs)</p> <p>16. Filing practice, surface filing, marking of straight and parallel lines with odd leg callipers and steel rule. (10 hrs)</p>	<p>Linear measurements- its units, steel rule dividers, callipers – types and uses, Punch – types and uses. Uses of different types of hammers. Description, use and care of marking off table. (07 hrs)</p>
		<p>17. Filing Channel, Parallel. (5 hrs)</p> <p>18. Filing- Flat and square (Rough finish), (10 hrs)</p> <p>19. Filing practice, surface filing, marking of straight and parallel lines with odd leg callipers and steel rule. (5 hrs)</p> <p>20. Marking practice with dividers, odd leg callipers and steel rule (circles, ARCs, parallel lines). (5</p>	<p>Bench vice construction, types, uses, care &amp; 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,</p>

		hrs)	Metric Units), angular measurements. (07 hrs)
		<p>21. Marking off straight lines and ARCs using scribing block and dividers. (5 hrs)</p> <p>22. Chipping flat surfaces along a marked line. (10 hrs)</p> <p>23. Marking, filing, filing square and check using tri-square.(10 hrs)</p>	<p>Marking off and layout tools, dividers, scribing block, odd leg callipers, punches-description, classification, material, care &amp; maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares.</p> <p>Callipers- types, material, constructional details, uses, care &amp; maintenance of cold chisels- materials, types, cutting angles. (07 hrs)</p>
		<p>24. Marking according to drawing for locating, position of holes, scribing lines on chalked surfaces with marking tools. (5 hrs)</p> <p>25. Finding centre of round bar with the help of 'V' block and marking block. (5 hrs)</p> <p>26. Prepare mushroom head and round bar and bending metal plate by hammering. (15 hrs)</p>	<p>Marking media, Prussian blue, red lead, chalk and their special application, description.</p> <p>Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. (07 hrs)</p>
		<p>27. Chipping flat surfaces along a marked line. (10 hrs)</p> <p>28. Make a square from a round job by chipping upto 20 mm length. (8hrs)</p> <p>29. Slot, straight and angular chipping (7hrs)</p> <p>30. Mark off and drill through holes. (7 hrs)</p> <p>31. Drill and tap on M.S. flat.</p>	<p>Drill, Tap, Die-types &amp; application. Determination of tap drill size.</p> <p>Reamer- material, types (Hand and machine reamer), parts and their uses, determining hole size for reaming, Reaming procedure. (14 hrs)</p>

		<p>(8 hrs)</p> <p>32. Cutting external thread on M.S. rod using Die.(5hrs)</p> <p>33. Punch letter and number (letter punch and number punch) (5 hrs)</p>	
		<p>34. File steps and finish with smooth file to accuracy of <math>\pm 0.25</math> mm. (10 hrs)</p> <p>35. File and saw on M.S. Square and pipe. (15 hrs)</p>	<p>Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer. (07 hrs)</p>
		<p>36. File radius along a marked line (Convex &amp; concave) &amp; match. (15 hrs)</p> <p>37. Chip sheet metal (shearing). (5 hrs)</p> <p>38. Chip step and file. (5 hrs)</p>	<p>Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Calliper, Digital vernier calliper. (07 hrs)</p>
		<p>39. Truing of pedestal grinding wheel. (10 hrs)</p> <p>40. Grinding and re-sharpening of hand tools. (10 hrs)</p> <p>41. Repair and maintenance of hand tools. (10 hrs)</p> <p>42. Dressing of grinding wheel by diamond dresser tool. (20 hrs)</p>	<p>Pedestal grinder – Introduction, care &amp; use. Procedure of wheel mounting &amp; wheel dressing. Related hazards, risk and precautions. (14 hrs)</p>
		<p>43. Counter sinking, counter boring and reaming with an accuracy <math>\pm 0.04</math> mm. (5 hrs)</p> <p>44. Drill blind holes with an accuracy 0.04 mm.(2 hrs)</p> <p>45. Form internal threads with taps to standard size</p>	<p>Drilling machines-types &amp;their application, construction of Pillar &amp; Radial drilling machine. Countersunk, counter bore and spot facing-tools and nomenclature. Cutting Speed, feed, depth of cut and Drilling time</p>

		(blind holes).(3 hrs) 46. Prepare studs and bolt to standard size and watch with nut. (15 hrs)	calculations. (07 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. <i>[Different Fit – Sliding, Angular, Step fit, Required tolerance: ±0.20 mm, angular tolerance: 1 degree]</i>	47. File and make Step fit, angular fit, with surface accuracy of ±0.20 mm (Bevel gauge accuracy 1 degree). (25 hrs) 48. Make simple open and sliding fits. (25 hrs)	Interchangeability: Necessity in Engg, field, Limit- Definition, types , terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone, allowances. Different standard systems of fits and limits. (British standard system & BIS system) (14 hrs)
Professional Skill 125 Hrs; Professional Knowledge 35 Hrs	Set the different parameters to produce components involving basic operations on different machine observing standard procedure and check for accuracy. <i>[Different machines – Shaper, Lathe &amp; Milling, Different machining parameters – feed, speed &amp; depth of cut.]</i>	49. Perform the holding job on shaper machine vice, setting length of stroke, setting of feed in a shaper machine. (5 hrs) 50. Make a square block in shaper machine. (15 hrs) 51. Perform preventive maintenance of shaping machine. (5hrs) 52. Grinding of R.H & L.H tools, V tool, parting tool, round nose tool & ‘V’ tools. (15 hrs) 53. Perform facing operation to correct length. (5hrs) 54. Centre drilling & drilling operations to required size. (5hrs) 55. Perform parallel turning & step turning. (10hrs)	<b>Shaper:</b> Introduction to Shaper machine parts & constructional details, its function and operations. Quick return mechanism of shaper. Calculation of cutting Speed, feed & depth of cut. (07 hrs)  Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance. (14 hrs)

		56. Perform drilling, boring, undercut, parting, grooving, chamfering operation. (15hrs)	
		57. Demonstrate working principle of milling machine. (4hrs) 58. Set arbor and cutter on arbor of milling machine. (6hrs) 59. Sequence of milling six faces of a solid block. (10hrs) 60. Perform step milling and slot milling with side & face cutter. (15hrs) 61. Make 'V' block using horizontal milling machine (accuracy $\pm 0.02\text{mm}$ ) (15hrs)	<b>Milling:</b> Introduction to milling machine, parts & constructional details, types. Safety precaution followed during milling operation. Milling machine attachments. Different types of milling cutters and its materials. Nomenclature of milling cutters. Milling cutter holding devices, work holding devices, Milling machine operations, Up milling and Down milling. Calculation of cutting speed, feed, machining time for milling machine. Indexing methods and its calculations. (14 hrs)
Professional Skill 75 Hrs;  Professional Knowledge 21 Hrs	Prepare components for assembly by carrying out different Heat Treatment and surface finishing operations.  <i>[Different Heat Treatment: - Hardening, Tempering case hardening, different surface finish-scraping, lapping]</i>	62. Hardening and tempering & Normalising. (10 hrs) 63. Case Hardening. (10 hrs) 64. Hardness Testing. ( 5 Hrs)	Heat Treatment: Iron Carbon Equilibrium Diagram, Time-Temperature-Transformation Curve. Annealing, Case Hardening, Tempering, Normalizing and Quenching (07 hrs)
		65. Scraping practice on flat & curved surface. (20 hrs) 66. Make a plain flat surface of by scraping the high spots using Prussian blue. (20 hrs) 67. Lapping the surface with lapping stone. (5 hrs)	Classification, construction, materials and functional detail of Chisels & Hammers. Chipping technique. Related hazards, risk and precautions while working. <b>Scrapers:</b> Introduction, Its types, material and use.

		68. Fixing hammer handle. (5 hrs)	Types of nuts, bolts, studs, locking devices for nut, wrench and spanner, pliers, screw drivers, Circlip, split pin, washers, spring washer. Concept of torque & torque wrench. Different types of rivets and their applications. Identification of different fasteners & operating them by using proper hand tool (14 hrs)
Professional Skill 100 Hrs;  Professional Knowledge 28 Hrs	Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. <i>[Different Fit – square fits, T fits, hexagonal fit, dovetail fit; surface accuracy: <math>\pm 0.1</math> mm, angular tolerance: 30 min.]</i>	69. Make Male & Female 'T' fitting with an accuracy $\pm 0.15$ mm and 30 minutes. (25hrs)  70. Make male female square fit with accuracy $\pm 0.1$ mm. (25hrs)	Surface finish - importance, symbol, measuring techniques. Lapping & honing process. <b>Gauges:</b> Classification and uses of Sine bar, Slip gauge, Limit gauge, Feeler gauge, thread gauge, screw pitch gauge, taper gauge. (14 hrs)
		71. Make Male & Female Hexagon fitting with accuracy $\pm 0.1$ mm and 30 min. (25 hrs)	Tolerances & interchangeability -Definition and its necessity, basic size, actual size, limits, deviation, Tolerance, allowance, clearance, interference, Fits-definition, types, description with sketches. Method of expressing Tolerance as per BIS, Hole and Shaft basis (BIS standard). Related calculation on Limit, Fit and Tolerance. (07 hrs)
		72. Make male & female dovetail fitting scraping the surface within an accuracy $\pm 0.1$ & 30 min angular (25hrs)	<b>Fasteners:</b> Introduction to fasteners, screw threads, related terminology and specification. Keys- types & use, (parallel,

			<p>sunk, tangential, gib head, woodruff, key ways.)            Related hazards, risk and precautions, while working.            (07 hrs)</p>
<p>Professional Skill 150 Hrs;             Professional Knowledge 42 Hrs</p>	<p>Dismantle, Repair and Assemble of mechanical power transmission elements in machine tools and check for functionality.</p>	<p>73. Identify different components of power transmission. (5 hrs)            74. Dismantle and assemble different components of power transmission. (15 hrs)            75. Safety precautions related to power transmission. (5 hrs)</p>	<p><b><u>Maintenance Practice and Mechanical Assembly</u></b>            Introduction to various maintenance practices such as preventive maintenance, predictive maintenance, breakdown maintenance &amp; reconditioning.            Organization Structure for maintenance, Roles and responsibility, advantage and disadvantage of TPM.  <b><u>Transmission of Power</u></b>            Elements of mechanical power transmission, type of spindles and shafts (Universal spindle, Plain shaft, Hollow shaft, crank shaft, cam shaft).            Positive and Non-positive drive, Friction drive, Gear drive, Belt drive, Chain drive and Rope drive. (07 hrs)</p>
		<p>76. Identify different types clutches in machine tools and their maintenance. (05 hrs)            77. Making key and mounting of coupling on the shaft with key. (05 hrs)            78. Identification and inspection of components of different types of brakes in machine tools. (05hrs)</p>	<p><b>Clutches</b>            Function of Clutches, its types and use in power transmission system. Function of mechanical &amp; electromagnetic system in clutch mechanism.  <b>Couplings:</b>            Concept of coupling and its type            viz. Rigid coupling- Muff coupling, Flange coupling,</p>



		<p>79. Fitting of hub and shaft with key. (05 hrs)</p> <p>80. Installation of belt in transmission with adjusting the tension. (05 hrs)</p>	<p>Flexible coupling, Pin-bush coupling, Chain coupling, Gear coupling, Spider coupling, Tyre coupling, Grid coupling, Oldham-coupling, Fluid coupling, Universal coupling and their specific applications.</p> <p><b>Brakes</b>&amp; Braking Mechanism: Types &amp; Functions. Inspection of brakes for safe &amp; effective working.</p> <p><b>Belts-</b>          Belt types (Flat and V) and specifications.          Pulleys used for belt drive.          Installation, Alignment of belts.          Problems related to belts(Creep and slip)          Belt maintenance.          Sheave alignment, Chain drive- Roller chain, Silent chain, alignment of sprockets, and maintenance of chain drive. (07 hrs)</p>
		<p>81. Identification of various types of bearings in machine tools. (5 hrs)</p> <p>82. Impression testing of split bush bearing for proper contact on journal &amp; housing. (5 hrs)</p> <p>83. Preloading of Precision angular contact bearing (5 hrs)</p> <p>84. Dismantling, inspection and mounting of ball bearing on shaft with</p>	<p><b>Bearing:</b>          Description and function of bearing, its types - Solid Bush, Split Bush, Collar, Pivot and Plummer Block Bearing.          Mounting of bearings, measurement and adjustment of clearances in bearings.          Types of bearing fitting on shaft and hubs.          Type of Roller contact bearings- Ball bearings- single</p>

		<p>press &amp; pullers. (12hrs)</p> <p>85. Dismantling &amp; assembly of tail stock of a lathe. (12hrs)</p> <p>86. Demonstrate of different types of knots and hitches used in material handling. (5 hrs)</p> <p>87. Splicing of manila rope. (2 hrs)</p> <p>88. Inspection of wire rope/ steel rope/belts. (2 hrs)</p> <p>89. Lift an object by using slings. (2 hrs)</p>	<p>row &amp; double row, Deep groove ball bearing, Angular contact, Self aligning and Thrust bearing.</p> <p>Roller bearing- Cylindrical, Needle roller, Taper roller, Spherical roller, self aligning and Spherical roller thrust bearing.</p> <p>Use of ISO bearing designation code to generate market survey and purchase.</p> <p>Checking and adjustment of bearing clearance.</p> <p>Methods of Mounting and dismounting of roller contact bearing, taper roller bearing and angular contact ball bearing. (Back-to-back, Face-to-face, tandem)</p> <p>Mounting-dismounting and adjustment of Taper bore bearings with adopter and withdrawal sleeve.</p> <p>Handling and storage of bearings.</p> <p>Related hazards, risk and precautions. Rigging</p> <p>Knowledge of different tools &amp; tackles used in rigging.</p> <p>Construction and capacity of wire rope/steel rope/belts.</p> <p>Application of knots and hitches.</p> <p>Care and maintenance of all types of ropes. (14 hrs)</p>
		<p>90. Identification different types of gears and gear</p>	<p><b>Gear:</b>  Type, description and</p>

		<p>bones used in machine tools. (5 hrs)</p> <p>91. Checking of gear elements as PCD, gear tooth thickness, clearance concentricity. (10 hrs)</p> <p>92. Checking of backlash and root clearance by feeler gauge, DTI &amp; lead wire in gear meshing. (10hrs)</p>	<p>function of gears- Spur, Helical, Spiral, Bevel, Straight and Spiral bevel, Worm gears, Rack and pinion. Gear Terminology. Gear train- simple, compound, reverted and epicyclic. (07 hrs)</p>
		<p>93. Inspection &amp; replacing the lubricating oil of a given gearbox.(5hrs)</p> <p>94. Overhauling of gear box of lathe &amp; milling machine. (10hrs)</p> <p>95. Write a inspection report for maintenance job. (5hrs)</p> <p>96. Prepare a action plan for maintenance work. (5 hrs)</p>	<p>Types of Gear box  Gear meshing: Checking of backlash and root clearances with Feeler Gauge, Dial Test Indicator and lead wire.  Impression testing of gear mesh with Prussian blue.  Running maintenance  Related hazards, risk and precautions. (07 hrs)</p>
<p>Professional Skill 75 Hrs;  Professional Knowledge 21 Hrs</p>	<p>Carryout preventive maintenance of lubrication &amp; cooling system of different machines as per manufactures guidelines.  <i>[Different machines- lathe, drilling, grinding]</i></p>	<p>97. Identification of various types of lubrication system and their components. (5hrs)</p> <p>98. Cleaning of lubrication lines and oil filters. (10 hrs)</p> <p>99. Fittings of different types of seals and oil rings. (10hrs)</p> <p>100. Preparing and fitting of gasket for different joint surface. (10hrs)</p> <p>101. Preventive maintenance of lubrication system of lathe, drilling and grinding machines. (10hrs)</p> <p>102. Lubrication schedule-</p>	<p>Lubrication and its importance, lubricating systems  Concept of lubrication  Types and properties of Oil and Grease.  Methods of oil lubrication- Once through and centralized lubrication system. (07 hrs)  Methods of grease lubrication system- grease guns, centralized lubrication system.  Warning &amp; protective devices used in centralized lubrication system (Pressure switch, temperature gauge, level indicator and relief valve.)</p>

		daily, weekly, monthly concept. (05 hrs)	Lubrication fittings. Storage and handling, Contamination control, Leakage prevention- Shaft seals, sealing devices and “O” rings. (07 hrs)
		103. Identification of components of coolant system. (5hrs) 104. Preventive maintenance of coolant system. (10hrs) 105. Breakdown maintenance of coolant system. (10hrs)	Cutting Fluids and Coolants. Essential parts of a basic coolant system used in the cutting of metals. Various types of coolants, its properties and uses ,coolant system type-soluble oils-soaps, sudsparaffin,soda water etc. Effect of cutting fluids in metal cutting. Difference between coolant and lubricants. (07 hrs)
Professional Skill 100 Hrs;  Professional Knowledge 28 Hrs	Prepare machine foundation for erection, install different machines and carry out geometrical tests. <i>[Different machines – shaper, pedestal grinding]</i>	106. Marking location, grouting and installation of foundation bolts. (10hrs) 107. Erection and installation of a small machine like shaper/ pedestal grinder machine. (15hrs)	<b>MACHINE FOUNDATION</b> Purpose & methods employed for installation & erection of precision & heavy duty machines. <b>Location &amp; excavation for foundation. Different types of foundations</b> –structural, reinforced, wooden, isolated foundations. (07 hrs)
		108. Levelling of small machine like shaper. (10hrs) 109. Levelling of a lathe & milling machines. (15hrs)	Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, 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

			<p>advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.</p> <p>Energy usage in relevance for Mechanical assembly. (07 hrs)</p>
		<p>110. Alignment of shaft with the help of feeler gauge &amp; dial test indicator &amp; taper gauges. (5hrs)</p> <p>111. Alignment of pulley &amp; sprocket with straight edge &amp; thread. (5hrs)</p> <p>112. Geometrical alignment test of machine as per test chart. (10hrs)</p> <p>113. Dismantling, checking and assembly of various parts of drilling machine such as Motor, spindle head, gear box &amp; arm. (15hrs)</p> <p>114. Measure Current, Voltage and Resistance using Simple Ohm`s Law Circuit And Familiarizing Multi-meter. (3hrs)</p> <p>115. Soldering Techniques. (3hrs)</p> <p>116. Step up and step down transformers. (3hrs)</p> <p>117. Working with Solenoids and Relays. (3hrs)</p> <p>118. Working of Motor &amp; Generators. (3hrs)</p>	<p><b>Maintenance</b></p> <ul style="list-style-type: none"> <li>-Total productive maintenance</li> <li>-Autonomous maintenance</li> <li>-Routine maintenance</li> <li>-Maintenance schedule</li> <li>-Retrieval of data from machine manuals</li> </ul> <p>Geometrical tests and inspection method with instruments.</p> <p>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.</p> <p>Hazardous waste management.</p> <p><b>Basic Electrical:</b></p> <p>Study of basic Electricals-Voltage –Current etc.</p> <p>Working Of Solenoids, Inductors, Motors, Generator Based On Electromagnetic Induction Principle. (14 hrs)</p>
Professional	Conduct preventive	119. Perform taper turning in	Safely precautions to be

<p>Skill 25 Hrs; Professional Knowledge 07 Hrs</p>	<p>maintenance, perform dismantling &amp; assembly of different components and test for accuracy to carryout advance lathe operation. <i>[Different components- head stock apron, saddle, tool post tail stock; Different advance lathe operation – taper turning, thread cutting]</i></p>	<p>the lathe by different methods. (05 hrs) 120. Perform external thread cutting operation on the lathe machine. (05 hrs) 121. Dismantling and assembly of head stock apron, saddle, tool post tail stock, Removing Broken Studs / Bolts of lathe machine. (10hrs) 122. Accuracy checking of lathe machine after assembly. (3hrs) 123. Perform preventive maintenance of lathe machine. (2hrs)</p>	<p>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. (07 hrs)</p>
<p><b>In-plant training/ Project work</b> <b>Broad area:</b></p> <ul style="list-style-type: none"> <li>a) Manufacturing of machine spares by conventional methods of manufacturing.</li> <li>b) Changing of shearing pin of milling machine.</li> <li>c) Setting up of Lathe machine.</li> </ul>			

<b>SYLLABUS FOR MECHANIC MACHINE TOOL MAINTENANCE TRADE</b>			
<b>SECOND YEAR</b>			
<b>Duration</b>	<b>Reference Learning Outcome</b>	<b>Professional Skills (Trade Practical) With Indicative Hours</b>	<b>Professional Knowledge (Trade Theory)</b>
Professional Skill 50 Hrs;  Professional Knowledge 18 Hrs	Make / Produce different joints by setting up of gas and arc welding machines and carry out the welding.	124. Setting up an Arc welding machine. (5hrs) 125. Edge preparation of material for Arc welding. (5hrs) 126. Perform square lap joint, butt joint, tee joint and Pipe Joint in Arc welding. (15hrs) 127. Making straight beads in gas welding. (5hrs) 128. Perform square lap joint, but joint & tee joint in Gas welding. (10hrs) 129. Perform gas cutting of MS plate. (10hrs)	<p><b><u>Arc Welding:</u></b> Introduction to arc welding and its safety. Welding types, Common tools used in welding. Basic Electricity as applied to Welding            Arc Length &amp; its effects            Arc Welding Machines: - advantages &amp; disadvantages of AC &amp; DC Arc Welding Machine. Electrodes: - Sizes &amp; Coding.            Edge Preparation: Nomenclature of butt &amp; fillet welding. Welding Symbols &amp; Weld defects.</p> <p><b><u>Gas Welding:</u></b> Introduction to gas welding process, its classifications, accessories and its safety.</p> <p><b><u>Gas Cutting:</u></b> Principle of gas cutting.            Systems of Oxy-Acetylene Welding- Flashback &amp; backfire. Types of Oxy-Acetylene flames: - Gases used in welding &amp; Gas flame combination.            Safety in gas cutting process. (18 hrs)</p>
Professional Skill 75 Hrs;	Identify, dismantle, replace and	130. Demonstrate knowledge of safety procedures in	<p><b><u>Hydraulics &amp; Pneumatics</u></b>            Basic principles of Hydraulics -</p>



<p>Professional Knowledge 27 Hrs</p>	<p>assemble different pneumatics and hydraulics components. <i>[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]</i></p>	<p>hydraulic systems (Demo by video). (4 hrs)</p> <p>131. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses. (11 hrs)</p> <p>132. Inspect fluid levels, service reservoirs, clean/replace filters. (10hrs)</p> <p>133. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs)</p> <p>134. Dismantle, replace, and assemble FRL unit. (5 hrs)</p> <p>135. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE). (2 hrs)</p> <p>136. Identify the parts of a pneumatic cylinder.(1 hr)</p> <p>137. Dismantle and assemble a pneumatic cylinder.(8 hrs)</p> <p>138. Construct a circuit for the direction &amp; speed control of a small-bore single-acting (s/a) pneumatic cylinder. (7 hrs)</p>	<p>Advantages &amp; limitation of hydraulic system, hydrostatic transmission, Pascal’s law, Brahma’s press, pressure Temperature &amp; flow, speed of an actuator. Control valves: Different type of control valves used in hydraulic System. Function of pressure control valve, directional control valve, check valve, flow control valve. (09 hrs)</p> <p>Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards &amp; safety precautions in pneumatic systems.</p> <p>Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders.</p> <p>Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO &amp; NC types) (manually-actuated &amp; pneumatically-actuated) &amp; 5/2-way valves, Check valves, Flow control valves, One-way flow control valve</p>
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		<p>139. Construct a control circuit for the control of a double acting pneumatic cylinder with momentary input signals. (5 hrs)</p> <p>140. Construct a circuit for the direct &amp; indirect control of a double acting pneumatic cylinder with a single &amp; double solenoid valve. (10 hrs)</p> <p>141. Dismantling &amp; Assembling of solenoid valves. (10 hrs)</p>	<p>Pneumatic valves: Roller valve, Shuttle valve, Two-pressure valve</p> <p>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 &amp; NC type) and Electromagnetic relay unit, Logic controls (18 hrs)</p>
<p>Professional Skill 125 Hrs;</p> <p>Professional Knowledge 45 Hrs</p>	<p>Construct circuit of pneumatics and hydraulics observing standard operating procedure &amp; safety aspect.</p>	<p>142. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings. (5 hrs)</p> <p>143. Identify internal parts of hydraulic cylinders, pumps/motors. (10 hrs)</p> <p>144. Construct a circuit for the control of a single acting hydraulic cylinder using a 3/2-way valve (Weight loaded double acting cylinder may be used as a single acting cylinder), 4/2 &amp; 4/3 way valves. (10 hrs)</p> <p>145. Perform overhauling of hydraulic pump. (10hrs)</p> <p>146. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video).</p>	<ul style="list-style-type: none"> <li>- Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control</li> <li>- Hydraulic Filters – types, constructional features, and their typical installation locations, cavitations, Hazards &amp; safety precautions in hydraulic systems</li> <li>- Hydraulic reservoir &amp; accessories, Pumps, Classification – Gear/vane/piston types, Pressure relief valves – Direct acting and pilot-operated types</li> <li>- Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses</li> <li>- Hydraulic cylinders –Types</li> <li>- Hydraulic motors –Types</li> </ul>



		(15 hrs)	<ul style="list-style-type: none"> <li>- Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves</li> <li>- Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves</li> <li>- Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function</li> <li>- Flow control valves: Types, Speed control methods – meter-in and meter-out</li> <li>- Preventive maintenance &amp; troubleshooting of pneumatic &amp; hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitations, and proper sampling of hydraulic oils (18 hrs)</li> </ul>
		<p>147. Construct Electro Hydraulic circuit –Speed and Pressure control of double acting cylinder. (10 hrs)</p> <p>148. Perform overhauling of pneumatic cylinders. (15hrs)</p> <p>149. Perform overhauling of hydraulic actuators. (10hrs)</p> <p>150. Disassembly of power pack, hydraulic pipes, ferrules, hydraulic cylinders, pistons etc.</p>	<p>Electro hydraulic circuit, Electrical components</p> <ul style="list-style-type: none"> <li>- Switches</li> <li>- Solenoid</li> <li>- Relay</li> </ul> <p>Introduction to Pneumatic actuators</p> <p>Pneumatic Symbols</p> <p>Pneumatic circuit</p> <p>Electrical control components</p> <ul style="list-style-type: none"> <li>- Switches</li> <li>- Solenoid</li> <li>- Relay</li> </ul> <p>Study &amp; working of a hydraulic press along with its</p>

		<p>(15hrs)</p> <p>151. Replacing &amp; refitting of hydraulic pipes, seals etc. (10hrs)</p> <p>152. Assemble the parts and testing of the power press after air bleeding. (15hrs)</p>	<p>components. Breakdown &amp; preventive maintenance of a hydraulic press. Safety in use of and maintenance of hydraulic presses.</p> <p>Proximity Sensors Classification And Operation- Proximity Sensor-Types Of Proximity Sensor And Their Working-Industrial Application Sensors For Distance And Displacement -LVDT-Linear (27 hrs)</p>
<p>Professional Skill 100 Hrs;</p> <p>Professional Knowledge 36 Hrs</p>	<p>Make pipe/tube fittings and valve connections for lubricants and coolants, test for leakages.</p>	<p>153. Flaring of pipes and pipe joints. (3 hrs)</p> <p>154. Cutting &amp; Threading of pipe length.(3 hrs)</p> <p>155. Fitting of pipes as per sketch observing conditions used for pipe work. (12 hrs)</p> <p>156. Bending of pipes- cold and hot.(7 hrs)</p> <p>157. Fit &amp; assemble pipes, valves and test for leakage &amp; functionality of valves.(22 hrs)</p> <p>158. Visual inspection for visual defects e.g. dents, surface finish.(3hrs)</p>	<p>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.</p> <p>Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and house hold taps and pipe work.</p> <p>Inspection &amp; Quality control -Visual Inspection - Basic 7 Quality tools (18 hrs)</p>
		<p>159. Dismantle &amp; assembly of globe valve, gate valve, butterfly, diaphragm, direction control valve, pressure relief, non return &amp; flow control valve. (40hrs)</p> <p>160. Making &amp; replacement of gaskets, washer. (10hrs)</p>	<p>Pipe colour code.</p> <p>Safety precautions to be observed while working at pipeline.</p> <p>Constructional detail of different type of valve &amp; their uses like: Gate, Globe, butterfly, Diaphragm. (18 hrs)</p>

Professional Skill 50 Hrs;  Professional Knowledge 18 Hrs	Conduct preventive maintenance, perform dismantling and assembly of different components machine and test for accuracy of milling machine.	161. Dismantle and assemble of head stock, gear box lead screw, table of milling machine. (35 hrs) 162. Check the accuracy of milling machine of after assembly. (10hrs) 163. Do the preventive maintenance of milling machine. (5hrs)	Breakdown maintenance and preventive maintenance of a milling machine. (18 hrs)
Professional Skill 75 Hrs;  Professional Knowledge 27 Hrs	Set the different grinding machine and produce component to appropriate accuracy. [ <i>Different machine:- Surface &amp; cylindrical grinding; appropriate accuracy <math>\pm 0.02\text{mm}</math></i> ]	164. Demonstrate working of grinding machine. (05 hrs) 165. Set the machine, stroke length & do wheel balancing. (10 hrs) 166. Perform grinding of parallel and perpendicular surfaces (accuracy $\pm 0.02\text{mm}$ ). (15 hrs) 167. Perform grinding of angular surfaces grinding (accuracy $\pm 0.02\text{mm}$ ). (15 hrs) 168. Setting the cylindrical grinding machine for grinding internal and external surfaces. (15 hrs) 169. Setting the machine for grinding taper holes. (15 hrs)	<b>Grinding:</b> Grinding machine – introduction, parts & constructional details, types – surface grinding and cylindrical grinding machines. Safety precaution followed while working on grinding machines. Grinding wheels – abrasives, bond and bonding process, grit, grade, and structure of grinding wheels and its marking system. Procedure for mounting of grinding wheels, balancing of grinding wheels, dressing and truing of grinding wheels, glazing and loading in grinding wheel. (27 hrs)
Professional Skill 50 Hrs;  Professional Knowledge 18 Hrs	Conduct preventive maintenance, perform dismantling & assembly of different components of	170. Dismantle and assembly of grinding head, lead screw, table, hydraulic cylinders of grinding machine. (30hrs) 171. Check the accuracy of	Preventive and breakdown maintenance of grinding machine. (18 hrs)

	grinding machine and test for accuracy. <i>[Different components grinding head, lead screw, table, hydraulic cylinders]</i>	grinding machine after assembly. (10hrs) 172. Do the preventive maintenance of surface grinder and cylindrical grinding machine. (10hrs)	
Professional Skill 125 Hrs;  Professional Knowledge 45 Hrs	Identify and explain basic functioning of different electrical equipment, sensors and apply such knowledge in industrial application including basic maintenance work. <i>[Different electrical &amp; electronics equipment- DC/ AC motors, passive &amp; active electronic components, resistor, capacitor, inductors, rectifier, diode transistor, SCRS &amp; ICS; Different sensors – proximity &amp; ultrasonic]</i>	173. Behaviour of Proximity Sensors. (5hrs) 174. Behaviour of ultrasonic sensors. (5hrs) 175. Logical Operation of Sensors. (5hrs) 176. Limit & Level Control using Sensors. (5hrs) 177. Interfacing of Sensors with Electrical Actuators. (5hrs) 178. Making simple wiring circuits and measurement of current and voltage. (5hrs) 179. Testing of power supply (AC & DC).(5 hrs) 180. Demonstration of use of test lamp and megger. (8 hrs) 181. Connections of DC/AC motors and its speed control - demonstration only. (7 hrs)	Switches, Fuse And Circuit Breakers. Introduction To Sensors-- Fundamental Of Sensor. Potentiometer -Ultrasonic And Optical Sensors-Industrial Application. Basic principles of DC generators and motors, Alternators and AC motors and transformers. Various types of switches, circuit breakers, fuses, lamps, proximity switches, relays and contactor in electrical circuits. Passive circuit elements – resistors, capacitors and inductors. Its identification and testing. Colour code. (18 hrs)
		182. Identification of passive & active electronic components. (8hrs) 183. Use of oscilloscope. (10hrs) 184. Demonstrate of logic gate operations. (5hrs) 185. Testing and	<b>BASIC ELECTRONICS</b> Introduction to electronics and its industrial applications. Introduction to digital electronics – numbers system and logic gates. Study of electronic circuit –

		<p>measurement of resistors, capacitors, inductors using multimeter. (8hrs)</p> <p>186. Perform soldering and de-soldering of components on printed circuit board. (PCB). (12hrs)</p> <p>187. Study of rectifiers and testing with multimeter. (8hrs)</p> <p>188. Preparing and checking of rectifier circuits. (6hrs)</p> <p>189. Demonstrate of solid state devices –diode transistors. (5hrs)</p> <p>190. SCRS &amp; ICS – identification &amp; testing. (5hrs)</p> <p>191. Assembly of simple battery eliminator circuit using bright rectifier &amp; fitter capacitor. (8hrs)</p>	<p>macro level with block diagram. (27 hrs)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 18 Hrs</p>	<p>Programme PLC and interface with other devices to check its Applications.</p>	<p>192. Ascertain various modules, controls, and indicators of given PLC. (9 hrs)</p> <p>193. Program and configure the PLC to perform a simple start/stop routine. (8 hrs)</p> <p>194. Program the PLC using Timer and Counter instructions. (15 hrs)</p> <p>195. Program the PLC to perform Move, Arithmetic, and Logical operations. (3 hrs)</p>	<p><b>PLC:</b>            Overview of different control systems. Introduction about PLC. Block diagram of PLC. Different types of PLC, PLC Architectures (Fixed and Modular). Selection of PLC. Advantages of PLC. Applications of PLC. Various types of modules used in PLC. Familiarization of AND, OR and NOT logics with examples. Registers Basics. Timer Functions. Counter Functions. Introduction and importance</p>

		<p>196. Program the PLC for performing comparator operations. (3 hrs)</p> <p>197. Practice on PLC wiring. (9 hrs)</p> <p>198. Program PLC for controlling analog parameter(s). (3 hrs)</p>	<p>of Sequential Control Systems. Communication protocols used in PLC: RS-232, RS-485, Ethernet, Profibus.</p> <p>Different programming languages of PLC: LDR, STL, FBD, CSF.</p> <p>Basic ladder programming of PLC. Configuration of PLC and its modules.</p> <p>Wiring of PLC. (18 hrs)</p>
<p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 27 Hrs</p>	<p>Prepare part programme, test on simulation software and interpret different errors.</p>	<p>199. Knowledge rules of personal and CNC machine safety, safe handling of tools, safety switches and material handling equipment using CNC didactic/simulation software and equipment. (5hrs)</p> <p>200. Identify CNC lathe machine elements and their functions. (5hrs)</p> <p>201. Understand the working of parts of CNC lathe, using CNC didactic/simulation software. (10hrs)</p> <p>202. Identify common tool holder and insert shapes by ISO nomenclature. (5hrs)</p> <p>203. Select cutting parameters from tool manufacturer's catalogue. (2hrs)</p> <p>204. Write CNC programs for simple tool motions and</p>	<p>Concept of Co-ordinate geometry, concept of machine coordinate axis, axes convention on CNC lathes, work zero, machine zero.</p> <p>Converting part diameters and lengths into co-ordinate system points. Absolute and incremental programming.</p> <p>Programming – sequence, formats, different codes and words.</p> <p>ISO G codes and M codes for CNC turning.</p> <p>Describe CNC interpolation, open and close loop control systems. Co-ordinate systems and Points.</p> <p>Cutting tool materials, application of various materials.</p> <p>Cutting tool geometry for internal and external turning,</p>

		<p>parts using linear and circular interpolation; check on program verification/ simulation software. (07hrs)</p> <p>205. Write CNC part programs using canned cycles for stock removal, grooving, threading operations, with drilling and finish turning. Use TNRC commands for finish turning. Check simulation on program verification/ simulation software. (06 hrs)</p> <p>206. Avoiding collisions caused by program errors. Knowing causes and effects of collisions due to program errors, by making deliberate program errors and simulation on program verification/ simulation software. (6hrs)</p> <p>207. Simple turning &amp; Facing (step turning) without using canned cycles, on CNC simulator. (08 hrs)</p> <p>208. Program checking in dry run, single block modes, on CNC simulator (2hrs)</p> <p>209. Absolute and incremental programming assignments and simulation. (6hrs)</p> <p>210. Checking finish size by</p>	<p>grooving, threading, face grooving, drilling. Insert holding methods for each.</p> <p>Writing part programs as per drawing &amp; checking using CNC program verification/ simulation software. Process planning, work holding, tool and cutting parameters selection according to the part geometry and dimensions.</p> <p>Collisions due to program errors, effects of collisions. Costs associated with collisions – tool breakage, machine damage, injuries.</p> <p>Find out alarm codes and meaning of those codes.</p> <p>Program execution in different modes like MDI, single block and auto.</p> <p>Process planning &amp; sequencing, tool layout &amp; selection and cutting parameters selection.</p> <p>Work and tool offsets. Inputs value to the offset/ geometry page into machine.</p> <p>First part checking: Program checking in single block and dry run modes – necessity and method.</p>
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		<p>over sizing through tool offsets, on CNC simulator. (2hrs)</p> <p>211. Recovering from axes over travel, on CNC simulator. (1 hr)</p> <p>212. Interpret different messages generated against different errors. (10hrs)</p>	(27 hrs)
Professional Skill 100 Hrs;  Professional Knowledge 36 Hrs	Troubleshoot & Overhaul of pumps, fans, blowers & compressors and perform preventive maintenance.	<p>213. Demonstrate various types of machine related centrifugal pump and their parts. (8hrs)</p> <p>214. Overhauling of pumps with fitting of gland packing. (20hrs)</p> <p>215. Priming of pump. (4hrs)</p> <p>216. Testing of pump. (2hrs)</p> <p>217. Perform preventive and schedule maintenance. (4hrs)</p> <p>218. Trouble shooting in pump operation. (12hrs)</p>	<p><b>Centrifugal Pump, Fan, Blower and Compressor:-</b> <b>Pump</b></p> <p>Function of pump. Types and working principle of centrifugal pump (machine related). Constructional detail of pump Starting and stopping Pump performance and characteristics. Capitation &amp; aeration Preventive &amp; schedule maintenance of pumps. Gland packing changing procedure. Concept of Mechanical seal Trouble shooting in pump. (18 hrs)</p>
		<p>219. Identification of various types of fans, blowers and their parts. (5hrs)</p> <p>220. Dismantle, inspect, repair/ replace work out part and assemble the same. (15hrs)</p> <p>221. Demonstrate compressors and their parts. (8 hrs)</p>	<p><b>Fan &amp; Blowers:</b></p> <p>Types and working principle Constructional detail of Fans &amp; Blowers. Starting and stopping of Fans and Blowers Different parts of Fans &amp; Blowers Concept of surge. Preventive &amp; scheduled</p>

		<p>222. Cleaning and changing of filters of compressors. (8 hrs)</p> <p>223. Perform schedule and preventive maintenance of blower &amp; compressor. (6hrs)</p> <p>224. Change compression ring &amp; oil rings in a reciprocator compressor. (8 hrs)</p>	<p>maintenance.</p> <p><b>Compressors:</b>  Compression theory, Types of compressors  Constructional detail of compressors, working mechanism  Different parts and their function.  Loading unloading system  Concept of air dryer.  Preventive &amp; schedule maintenance.  (18 hrs)</p>
<p>Professional Skill 125 Hrs;</p> <p>Professional Knowledge 45 Hrs</p>	<p>Identify fault carryout maintenance work and break down of different machineries/ equipments viz., shaper, surface grinding, drilling, lathe, milling, in the shop floor, using appropriate tools &amp; equipments to ensure its functionality.</p>	<p>225. Demonstrate mechanical &amp; hydraulic jack, rope puller, chain puller, chain block, and winch. (7 hrs)</p> <p>226. Inspection of tools and tackles of material handling equipments. (6 hrs)</p> <p>227. Shift a small machine from layout to loading centre/ different work place. (12 hrs)</p>	<p>Different type of jacks, chain block and pull lift.  Knowledge of different types of scaffolding.  Material movement by using different rigging tools and techniques.  Safety appliances &amp; precautions in rigging.  Maintenance of tools and tackles.  (09 hrs)</p>
		<p>228. Practice various belt &amp; chain joining methods. (20 hrs)</p> <p>229. Demonstrate belt conveyor system, vibratory screen &amp; feeder. (Video demo)(5 hrs)</p>	<p>Bulk Material Handling (Conveyor belt, Vibratory screen, Feeders)  Principle &amp; mode of material handling.  Various components used in belt conveyor system &amp; their functions.  (Pulleys, idlers, scrapers, skirts, belt, take up unit system and safety devices).  Vibratory screen- working</p>

			<p>mechanism.</p> <p>Feeders- types, working mechanism.</p> <p>Maintenance practice- Pulley lagging, belt sway control belt joining methods.</p> <p>(09 hrs)</p>
		<p>230. Trouble shooting on machine tools such as drill, shaper, lathe &amp; power saw machine. (20 hrs)</p> <p>231. Perform overhauling of feed units of lathe milling &amp; grinding. (20hrs)</p> <p>232. Geometrical testing of machine tools. (10hrs)</p>	<p>Breakdown Maintenance, Preventive Maintenance, Predictive Maintenance &amp; Concepts of TPM, OEE.(without calculations)</p> <p>Difference between breakdown and preventive maintenance – Its importance in productivity, types.</p> <p>Normal procedure followed for maintenance of machine tools on the shop floor.</p> <p>Accuracy testing of machine tools.</p> <p>Various maintenance practices.</p> <p>Concepts &amp; Measurement of machine performance: MTBF, MTTR. (without calculations)</p> <p>(18 hrs)</p>
		<p>233. Preparation of check list for inspection of different machine tools. (5hrs)</p> <p>234. Temperature measurement of machine tools. (5hrs)</p> <p>235. Vibration measurement of machine tools. (5hrs)</p> <p>236. Fault finding practice on machine tools. (10hrs)</p>	<p>Inspection &amp; Condition Monitoring.</p> <p>Maintenance strategy – Reactive, Preventive, Predictive and proactive.</p> <p>Corrective Maintenance &amp; Plan Maintenance. Condition Base Maintenance (CBM), Reliability Centered Maintenance (RCM), Importance of inspection.</p> <p>Type / methods of equipment</p>

			<p>inspection.          Commonly used gadgets for inspection.          Concept of inspection check-list.          Importance of condition monitoring and Various techniques used for condition monitoring. (vibration, temperature, sound and lubricant condition)          Concept of Industry 4.0 <b>and Digital Manufacturing.</b> (09 hrs)</p>
<p><b>In-plant training/ Project work</b>  <b>Broad area:</b>          a) Visit to CNC manufacturing industry /nearby industry involving CNC operation for production purpose(mandatory)          b) Recondition electrical panel and motor of lathe/ milling and test functionality.          c) Reconditioning of a lathe/ milling with testing report.</p>			