SYLLABUS FOR DRAUGHTSMAN MECHANICAL TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical) (with indicative hour)**	**ProfessionalKnowledge (Trade Theory)**
Professional Skill 140 Hrs; Professional Knowledge 30 Hrs	Construct different Geometrical figures using drawing Instruments following safety precautions.	1. Importance of trade training, List of tools & Machinery used in the trade. (02 hrs) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (05 hrs) 3. First Aid Method and basic training. (03 hrs) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (02 hrs) 5. Hazard identification and avoidance. (02 hrs) 6. Safety signs for Danger, Warning, caution & personal safety message. (02 hrs) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (05 hrs) 8. Use of Fire extinguishers. (07 hrs)	Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the newcomers 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. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies e.g. power failure, fire, and system failure.(06 hrs.)
		Perform assignment using drawing instruments: 9. Draw straight lines of a	Nomenclature, description and use of drawing instruments & various equipments used in

		given length. (01hr) 10. Draw perpendicular, inclined (given angle) and parallel lines. Draw triangles with given sides and angles. (03hrs) 11. Construct regular polygons (up to 8 sides) on equal base. (04hrs) 12. Draw inscribed and circumscribed circles of triangle, pentagon and hexagon. (04hrs) 13. Draw a parallelogram with a given length included angle. (02hrs) 14. Draw an angle bi-sector and a line bi-sector. (08hrs) 15. Divide a line into given equal divisions. (06hrs)	drawing office. Their care and maintenance.(06 hrs.)
		16. Layout a A3 drawing sheet as per Sp -46 : 2003 with margin and name plate. (05hrs) 17. Draw a sample title block providing details as: (*i*) Title of the drawing (*ii*) Sheet number (*iii*)Scale (*iv*)Symbol, denoting the method of projection (*v*) Revision with sign (*vi*) Name of the firm (*vii*) Initials of staff drawn, checked and approved. (05hrs) 18. Draw different types of lines & write their uses in	Lay out and designation of a drawing sheet as per Sp -46 : 2003 Recommended scale of engineering drawing as per Sp -46 : 2003 Types of Lines and their application. Folding of prints for filing Cabinets or binding as per SP: 46-2003. (06 hrs.)

		drawing. (05hrs) 19. Label a drawing views showing most of the types of line.(13hrs)	
		20. Write Block letters & numerals in single & double stroke of ratio 7:4 and 5:4 in drawing sheet. (28hrs)	Type of lettering proportion and spacing of letters and words.(06 hrs.)
		21. Construction of ellipse, parabola & hyperbola in different methods. (16hrs) 22. Construction of involutes, cycloid curves, helix & spiral. 12hrs)	Definition of ellipse, parabola, hyperbola, different methods of their construction. Definition & method of drawing involutes cycloid curves, helix & spiral. (06 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 18 Hrs	Draw orthographic Projections giving proper dimensioning with title block using appropriate line type and scale.	23. Construct object drawing with dimensioning in different alignment as per SP-46. (03hrs) 24. Create dimensions in previous assignments. (25hrs)	Terminology – feature, functional feature, functional dimension, datum dimension, principles. Units of dimensioning, System of dimensioning, Method of dimensioning & common features. (06 hrs.)
		25. Draw orthographic projection of points and lines. (10hrs) 26. Draw projection of plane figures (lamina). (18hrs)	Methods of obtaining orthographic view. Position of the object, selection of the views, three views of drawing. Planes and their normal projections. (06 hrs.)
		27. Draw orthographic projection of solids- prisms, cylinders, cones, pyramids. (12hrs) 28. Draw orthographic projection of cut section/ frustums of solids- prism, cylinders, cones, pyramids.	Orthographic projection. First angle and third angle projection. Principal of orthographic projection. Projection of solids like prism, cones, pyramids and their frustums. (06 hrs.)

		(16hrs)	
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Construct free hand sketches of simple machine parts with correct proportions.	29. Free hand sketch (in proper proportion) of tool post of a Lathe, Bench Vice, Cutting Tools, Bolts, Stud & Nut, gland, Pipe Flange, Hand Wheel, Crane hook, Steel bracket. (28hrs)	Methods of free hand sketching for machine parts.(06 hrs.)
Professional Skill 28 Hrs; Professional Knowledge 06 Hrs	Construct plain scale, comparative scale, diagonal scale and vernier scale	30. Draw plain scales, diagonal scales, comparative scales, venire scale & scale of chords. (28hrs)	Knowledge of different types of scales, scale of cords, their appropriate uses, Principle of R.F, diagonal & vernier. (06 hrs.)
Professional Skill 56 Hrs; Professional Knowledge 12 Hrs	Draw Sectional views of orthographic projections.	31. Sketch Conventional sings and symbols. (10hrs) 32. Sketch different types of section lines and abbreviations for different materials as per SP-46:2003. (10hrs) 33. Draw Orthographic drawing of solids (viz., cube, prisms, cone and pyramids) finding out the true shape surfaces cut by oblique planes. (36hrs)	Knowledge of solid section. Types of sectional views & their uses. Cutting plane and its representation. Parts not shown in section. Conventional signs, symbols, abbreviations & hatching for different materials. Solution of problems to find out the true shape of surfaces when solids are cut by different cutting planes. (12 hrs.)
Professional Skill 112 Hrs; Professional Knowledge 24 Hrs	Develop surface and interpenetration of solid in orthographic projection.	34. Construct the development of surface of cylinder, prisms, Cone, pyramids and their frustum. (28hrs) 35. Draw development of an oblique cone with elliptical base. (05hrs) 36. Draw the development of a 3-pieces pipe elbow, a pipe hole through it, a bucket and a funnel. (23hrs)	Definition of development, its need in industry & different method of developing the surfaces. Development of surfaces bounded by plane of revolution intersecting each other. Development of an oblique cone with elliptical base etc. Calculation of developed lengths of geometrical solids.

			(12 hrs.)
		37. Construct orthographic projection of interpenetrating solids (cylinder, cones, prism & pyramid) of axes right angle to each other and axes inclined to each other. (36hrs) 38. Generate the curves of intersection of cylinder penetrating through a sphere, cone and a cylinder. (20hrs)	Definition of Intersection & interpenetration curves. Common method to find out the curve of interpenetration. Solution of problems on interpenetration of prism, cones, & pyramids with their axes intersecting at an angle. Intersection of cylinder.(12 hrs.)
Professional Skill 112 Hrs; Professional Knowledge 24 Hrs	Draw isometric projection from orthographic views (and vice-versa) and draw oblique projection from orthographic views.	39. Construct the isometric view of Polygons and circular lamina. (10hrs) 40. Draw isometric view of solid geometrical figures from orthographic views with dimension. (10hrs) 41. Draw isometric views of truncated cone and pyramid. (08hrs)	Principle of isometric projection and Isometric drawing. Methods of isometric projection and dimensioning. Isometric scale. Difference between Isometric drawing & Isometric projection. (06 hrs.)
		42. Construct orthographic views from isometric drawing of solid blocks with holes, grooves, notches, dove-tail cut, square cut, round cut, stepped, etc. (18hrs) 43. Construct orthographic views of hanger, bracket & support (10hrs) 44. Draw isometric view of V-block, Angle plate, sliding block. (18hrs) 45. Draw isometric drawing of a	Principles of making orthographic views from isometric drawing. Selection of views for construction of orthographic drawings for clear description of the object. (12 hrs.)

		simple Journal Bearing. (10hrs.)	
		46. Draw oblique projection of circular lamina in receding axis at 30° & 45°. (05hrs) 47. Draw oblique projection of levers and hollow blocks. (23hrs)	Principle and types of oblique projection. Advantage of oblique projection over isometric. Projection. (06 hrs.)
Professional Skill 168 Hrs; Professional Knowledge 36 Hrs	Draw and indicate the specification of different types of fasteners, welds and locking devices as per SP-46:2003	48. Draw Screw threads with SP-46:2003 conventions. (10hrs) 49. Draw different types of bolts, studs, nuts and washers as per SP-46:2003 conventions.(10hrs) 50. Draw different locking arrangement of nuts, machine screws, caps screw set screw as per convention. (10hrs) 51. Draw a half sectional view of a coupler nut. (06hrs) 52. Draw four different types of foundation bolt. (20hrs)	Screw threads, terms nomenclature, types of screw thread, proportion and their uses, threads as per SP-46:2003 conventions. Types of bolts, nuts and studs, and their proportion, uses. Different types of locking devices. Different types of machine screws, cap screws, set screws as per specification. Different types of foundation bolts and their uses.(12 hrs.)
		53. Draw fillet weld and butt weld joint specifying the basic term of the joint. (05hrs) 54. Draw a weld joint representing the position and dimensioning of the weld with conventional symbols on the drawing. (08hrs) 55. Draw section of welded steel structural column & bracket fabricated by plate. (15 hrs)	Description of Welded Joints and their representation (Actual and Symbolic) Indication of Welding Symbol on drawing as per SP-46. (06 hrs.)
		56. Draw a half-sectional view of	Different types of keys (Heavy

		Cotter joint with socket and spigot ends. (18 hrs) 57. Draw different types of Keys, splined shaft, circlips and pins as per convention. (10 hrs)	duty and Light duty) cotters, splined shaft, pins and circlips. Calculation of sizes and proportions of keys. (06 hrs.)
		58. Draw the different types of pipe fittings. (08hrs) 59. Draw pipe joints: flanged joint, welded joint, threaded joint, socket and spigot joint. (20hrs)	Pipe Joints: selection of materials as per carrying fluid and conditions. Description of different pipe joints fitted on pipe. Expansion joint, loop and other pipe fittings. (06 hrs.)
		60. Draw rolled steel sections as per IS specification. (05hrs) 61. Draw the different types of rivet heads indicating the dimensions related to diameter of the rivet as per convention. (10hrs) 62. Draw riveted joints of lap and butt with covers in chain and zig-zag orientation. (13hrs)	Types of rivets, their size proportions and uses. Types of riveted joints, terms and proportions of riveted joints. Conventional representation. Relation between rivet size and thickness of plates and calculation for arrangement of rivets position. Causes of failure of riveted joint efficiency of riveted joints. (06 hrs.)
Professional Skill 168 Hrs; Professional Knowledge 36 Hrs	Acquire basic knowledge on tools and equipments and their application in Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles.	Allied Trade- Fitting 63. Use of different types of fitters hand tools. (08hrs) 64. Work on MS plate by filing, hack sawing, check dimensions, mark the plate, punch centre mark, cut a v-notch by chisel, drill a hole on the center mark. (20hrs)	Description and application of simple measuring tools. Description of vices, hammers, cold chisel, files, drills, etc.- proper method of using them. Method of using precision measuring instrument. Maintaining sequence of operation in fitting shop and safety precaution.(06 hrs.)
		Allied Trade Turning 65. Cut a round bar in power saw, centering and facing	Safety precaution for lathes. Description of parts of Lathe & its accessories. Method of

		the bar, perform the turning, grooving, stepped and taper operation on the bar. (28hrs)	using precision measuring instrument such as inside & outside micrometers, depth gauges, vernier callipers, dial indicators, slip gauges, sine bars, universal bevel protractor, etc. (06 hrs.)
		Allied Trade Machinist: 66. Use of jigs and fixtures Simple operations on milling machine such as plain-milling and key way cutting. (14 hrs) 67. Mark out on castings and forgings work piece, set up and perform operation of shaping, slotting and planning machines. (14 hrs)	Brief Description of milling, shaping, slotting and planning machines. Quick return mechanism of these machines. Maintaining sequence of operation in machine shop and safety precaution. (06 hrs.)
		68. Allied Trade: Sheet Metal Use of hand tools such as planishing,hammers stakes, mallet, bricks prick punch etc. Mark and cut a sheet to make a container. (28hrs)	Brief description of common equipment required for sheet metal work. Different types of joints used in sheet metal work. (06 hrs.)
		Allied Trade: Welding 69. Use of hand tools used in gas and in electric arc welding Weld an object according to drawing. (14 hrs) 70. Foudryman/Moulder Different types of mould, cores and core dressing, use of moulding tools. (14 hrs)	Maintaining sequence of operation in machine shop and safety precaution. Brief description of the hand tools used gas & arc welding. Different types of welded joints and necessary preparation required for these. Safety precautions, Hand tools used for molding. The description, use and care of hand tools.(06 hrs.)
		Allied Trade: Electrician	Safety precaution maintained

		71. Prepare a simple wiring for residential room. Identify the electrical equipment and measuring instruments. (14hrs) Allied Trade: MMV- IC Engine 72. Identify different parts of IC Engines (Both spark ignition & compression ignition-2 stroke & 4 stroke engines). (14hrs)	in electrician shop. A.C & D.C Motors Generators of common types and their uses and brief description of common equipment necessary for sheet metal work. Electrical units and quantities. Laws of electricity. Simple examples of calculation of current voltage, resistance in series and parallel connection (D.C.Circuit). Brief description of internal combustion engines, such as cylinder block piston, carburettor spark plug, camshaft, crank shaft, injector fuel pump etc. (06 hrs.)
Professional Skill 140 Hrs; Professional Knowledge 30 Hrs	Construct different types of gears, couplings and bearings with tolerance dimension and indicating surface finish symbol.	73. Draw the diagram illustrating basic size deviations and tolerances. (05hrs) 74. Draw symbols for machining and surface finishes (grades and micron values) (05hrs) 75. Draw the system of indication of geometrical tolerances of form and position as per standard: Straightness, flatness, circularity, cylindricity, parallelism, perpendicularity, angularity, concentricity, coaxiality, symmetry, radial run-out, axial run-out. (10hrs) 76. Construct a machine part	Limits, fit, tolerance. Toleranced dimensioning, geometrical tolerance. Indications of symbols for machining and surface finishes on drawing(grades and micron values) Production of interchangeable parts, geometrical tolerance. Familiarization with IS: 919, IS:2709.(06 hrs.)

		indicating geometrical tolerance. (08hrs)	
		Construct the sectional view of: 77. Muff coupling, (08hrs) 78. Flanged coupling, (12hrs) 79. Friction grip coupling,(12hrs) 80. Pin type flexible coupling, (12hrs) 81. Universal coupling.(12hrs) (conventional method)	Couplings, necessity of coupling, classification of couplings. Uses and proportion of different types of couplings. Materials used for couplings. (12 hrs.)
		Draw detailed and assembly drawing of: 82. Simple bearing (05hrs) 83. Foot step bearing. (05hrs) 84. Plummer block. (10hrs) 85. Self-aligning bearing (swivel bearing). (08hrs)	Knowledge of bearing to reduce friction, types of bearing, frictional and anti-frictional bearings. Material used for frictional bearings. Properties of frictional bearing (sliding bearing) materials. Parts of anti-frictional bearings (ball, roller, thrust ball, needle & taper roller). Materials and proportion of parts. Difference between frictional and anti-frictional bearings. Advantages of anti-frictional bearings. (06hrs.)
		86. Construct tooth profile of a spur gear above 30 teeth. (10hrs) 87. Draw two spur gears in mesh (08hrs) 88. Draw two bevel gears in mesh (10hrs)	Gears and gear drives- uses, types, nomenclature and tooth profiles. (06 hrs.)
Professional Skill 84 Hrs; Professional Knowledge	Perform computer application and create 2D objects on CAD drawing space using	89. **Perform Computer operation**: (10 hrs) i) create new folder, ii) add subfolders, iii) create application files,	Introduction to computer, Windows operating system, file management system. Computer hardware and software specification.

18 Hrs	commands from ribbon, menu bar, toolbars and by typing in command prompt.	iv) change appearance of windows, v) search for files, vi) sort files, vii) copy files, viii) create shortcut folder, ix) create shortcut icon in desktop and taskbar x) move files to and from removable disk/ flash drive. xi) install a printer from driver software in operating system. 88. Create, save and print a document, worksheet and pdf (portable document format) files.(18hrs)	Knowledge of installation of application software. (06 hrs.)
		89. Perform application in CAD: i) Change the Workspace dropdown menu in CAD screen and follow the ribbon and toolbar settings. ii) Locate origin and the graphical limit of drawing space from co-ordinate display. iii) Use buttons of mouse for pan,zoom in and zoom out. iv) Use functional keys to access certain commands. v) Use commands from icons in the ribbon, from menu bar and from floating toolbar. vi) Drag and drop figures	Introduction to CAD Advantages of using CAD, CAD main Menu, screen menu, command line, model space, layout space. Drawing layouts, Tool bars, File creation, Save, Open existing drawings, creation of Drawing Sheet as per ISO. (06 hrs.)

		from tool palettes. vii) Type the command at the command prompt and invoke. viii) Open existing drawings ix) Create of drawing Sheet layout x) Open drawing sheet layout from template. (28hrs.)	
		90. Create 2D objects using Absolute Co-ordinate system, Polar Co-ordinate System and Relative Co-ordinate System. (10hrs) 91. Create geometrical figures using draw tools. (18hrs)	Absolute Co-ordinate system , Polar Co-ordinate System and Relative Co-ordinate System Create Line, Break, Erase, Undo. (06 hrs.)
In-plant training/ Project work **Broad area:** a. Prepare model of square threaded bolt (by thermocole). b. Prepare models of different riveted joints (by thermocole). c. Prepare models of different welding joints (by thermocole). d. Prepare a poster of illustrating basic size deviations and tolerances. e. Prepare model of a spur gear (by thermocole).			

SYLLABUS FOR DRAUGHTSMAN MECHANICAL TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical) With Indicative Hour**	**Professional Knowledge (Trade Theory)**
Professional Skill 140 Hrs; Professional Knowledge 40 Hrs	Construct projection views of geometrical figures with dimension and annotation on CAD in model space and viewport in layout space.	92. CAD: draw 2D object using line, polyline, ray, polygon, circle, rectangle, arc, ellipse commands. (28 hrs)	Drawing of Line, polyline, ray, polygon, circle, rectangle, arc, ellipse using different options. (08 hrs.)
		93. CAD: modify 2D objects using Break, Erase, Trim, Offset, Fillet, Chamfer Commands. (16 hrs) 94. CAD: manage 2D objects using Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands. (12 hrs)	Trim, Offset, Fillet, Chamfer, Arc and Circle under modify commands. Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands. (08 hrs.)
		95. CAD: Create templates, Insert drawings. Create objects in different Layers and Modify Layer properties. (28 hrs)	Creating templates, Inserting drawings, Layers, Modify Layers. (08 hrs.)
		96. CAD: Provide dimension on object. Create dimension by customizing dimension styles (lines, arrows, text, unit and alignment) Put dimension with scale factor. (28 hrs)	Format dimension style, creating new dimension style, Modifying styles in dimensioning. Writing text on dimension line and on leader. Edit text dimension. (08 hrs.)
		97. CAD: Construct orthographic sectional view of a steel bracket with dimension using shortcut keyboard command.(10 hrs) 98. Construct isometric view of machine blocks. (10 hrs)	Knowledge of shortcut keyboard command. Customization of keyboard command. Customization of drafting settings, changing orthographic snap to

		99. Create viewports in layout space and place views for model space in different scale. (08 hrs)	isometric snap. Procedure to create viewport in layout space in zooming scale. (08 hrs.)
Professional Skill 196 Hrs; Professional Knowledge 56 Hrs	Draw in CAD detail and assembly Drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams applying range of cognitive and practical skills.	100. Construct Pulleys: solid, stepped and built up pulleys. (25 hrs) 101. Construct pulley with different types of arms. (21hrs) 102. Draw rope pulley and v-belt pulley using CAD. (10 hrs)	Belt-drive. Materials of belts, slip and creep, Velocity of belt. Arc of contact. Simple exercise in calculation of belt speeds, nos. of belts needed in V-belt drive, velocity, pulley ratio etc. Standard pulleys width of pulley face, velocity ratio chain drive. (08 hrs.)
		103. Draw pipe fittings: tee, elbow (90° & 45°), flange, union and valve. (15 hrs) 104. Draw conventional symbols of different types of valves and joints used in pipe line diagram. (10 hrs) 105. Draw a piping layout systems from a sump to an overhead tank through a pump with possible fittings and valves. (15 hrs) 106. Draw sectional views of different types of pipe joints using CAD. (16 hrs)	Knowledge of different pipe materials and specifications of Steel, W.I. & PVC pipes. Brief description of different types of pipe joints. Pipe threads. Pipe fittings (threaded, welded and pressed). Specifications of pipe fittings. Different types of valves. (16 hrs.)
		107. Draw: i) spur gear, (10 hrs) ii) helical gear, (08 hrs) iii) bevel gear, (10 hrs) iv) worm and worm wheel. (18hrs) 108. Construct involute tooth profile of a gear (using CAD). (10 hrs)	Gear drive- Different types of gears. Cast gears and machined gears. Knowledge of profile of gears etc. (16 hrs.)

		109. Draw a symmetrical cam profile. (28 hrs) 110. Draw different types of follower (using CAD).(28 hrs)	Use of Cams in industry. Types of cam, kinds of motion in cam, displacement diagrams. Terms used in cam. Types of follower. (16 hrs.)
Professional Skill 140 Hrs; Professional Knowledge 40 Hrs	Construct drawing of engine parts with detailed and assembly in template layout applying quality concept in CAD.	111. Construct detailed and assembly drawing (using CAD) of i) Eccentrics (10 hrs), ii) Stuffing box (18 hrs) iii) Piston assembly of a petrol engine (28 hrs), iv) IC engine connecting rod. (28 hrs)	Knowledge of engine mechanism. Transmission of motion from reciprocating to circular through eccentric, crank and connecting rod. (24 hrs.)
		112. Construct detailed drawing of an air valve. (28 hrs) 113. Construct detailed drawing of a fuel injector of a diesel engine. (28 hrs) (using CAD)	Knowledge of fuel injection system in petrol and diesel engine. (16 hrs.)
Professional Skill 56 Hrs; Professional Knowledge 16 Hrs	Create 3D solid by switching to 3D modeling workspace in CAD, generate views, Print Preview and Plotting.	114. **3D Modeling**: i) Create 3D solid objects using command from 3D primitive (viz. box, sphere, cylinder and poly-solids) , from solid (extrude, revolve, sweep and loft), from Boolean (union, subtract and intersect) (28 hrs) ii) Create 3D drawing using User co-ordinate systems. (15 hrs) iii) Annotate and dimension of the 3D model. (05 hrs) iv) Generate views from	Introduction to 3D modeling, 3D primitives (viz. box, sphere, cylinder, mesh and poly-solids), solid figure by extrude, revolve, sweep and loft command, solid editing: fillet, offset, taper, shell and slice command. Setting of User co-ordinate Systems, Rotating, Print preview and Plotting. (16 hrs.)

		model space to layout space. (05 hrs) v) Generate Print preview and Plotting. (03 hrs)	
Professional Skill 364 Hrs; Professional Knowledge 104 Hrs	Construct detailed and assembled drawing applying conventional sign & symbols using CAD.	115. Construct detailed drawing of a lever safety valve. (28 hrs) 116. Construct detailed drawing of a gate valve.(28 hrs) (using CAD)	Working principle of valves and their description. (16 hrs.)
		117. Construct detailed drawing of a steam stop valve and blow off cock. (28 hrs) (using CAD)	Knowledge of simple stationary fire tube boiler, boiler mountings. Function and purpose of blow off cock. (08 hrs.)
		118. Create library folder containingblocks of hydraulic and pneumatic conventional signs and symbols. (10 hrs) 119. Draw a sectional view of a hydraulic jack and a pneumatic valve actuator. (18 hrs) (using CAD)	Brief description of a typical hydraulic system, components, working principle and function of hydraulic jack. Different types of hydraulic actuator. Symbol and working of hydraulic DC valve, non-return valve and throttle valve. Knowledge of typical pneumatic system, FRL or air service unit and pneumatic actuator. (08 hrs.)
		120. Draw detail and full sectional view of a volute casing centrifugal pump(using CAD). (28 hrs)	Different types of pump systems.Characteristics of a pump system: pressure, friction and flow.Energy and head in pump systems. (08 hrs.)
		121. Draw assembly and detailed drawing of tool post of a lathe. (using	Different clamping devices on lathe. (08 hrs.)

		CAD) (28 hrs)	
		122. Construct detailed &assembly drawing of tail stock and revolving centre. (using CAD) (28 hrs)	Description of different job holding devices in lathe operation. (08 hrs.)
		123. Construct detailed drawing of a milling fixture. (using CAD) (28 hrs)	Different clamping devices on milling operation. (08 hrs.)
		124. Construct detailed & assembly drawing of shaper tool head slide. (using CAD) (28 hrs)	Different clamping devices on shaping operation. (08 hrs.)
		125. Draw a simple drilling jig for drilling holes in a given component. (using CAD) (28 hrs)	Knowledge of accuracy and interchangeabilityinthe manufacturing of products. (08 hrs.)
		126. Draw a Press Tool giving nomenclature of each part. (08 hrs) 127. Draw dies & punches for the production of simple work pieces. (using CAD) (10 hrs) 128. Develop isometric drawing for manufacturing 2 cavity injection moulds with side cavities. (using CAD) (10 hrs)	Knowledge of various parts of press tools and their function. Knowledge of different moulding processes. Introduction to Die casting, gating system design, force calculation, defects and remedies and estimation. (08 hrs.)
		129. Construct detailed drawing of a simple carburetor.(using CAD) (28 hrs)	Description of different parts of petrol engine. (08 hrs.)
		130. Construct detailed and assembly drawing of a simple pressure vessel. (using CAD) (28 hrs)	Knowledge of design, manufacture, and operation of pressure vessels. (08 hrs.)
Professional	Prepare drawing of	131. Prepare detailed drawing	Proper measurement

Skill 28 Hrs; Professional Knowledge 08 Hrs	machine parts by measuring with gauges and measuring instruments.	of a C-clamp and a machine vice by taking measurement using gauges and measuring instrument. (using CAD) (28 hrs)	practice in workshop. Principles of good measurement result: right measurement, right tools, right sketching, review and right procedures.(08 hrs.)
Professional Skill 28 Hrs; Professional Knowledge 08 Hrs	Draw a machine shop layout considering process path and ergonomics (human factor).	132. Draw a machine shop layout of small production industry showing material inflow to finished product stock. (using CAD) (28 hrs)	Lay out of Machine foundations. Brief treatment of the principle Involved and the precautions to be observed. Lay out of machine Foundation. Consideration of ergonomics (human factor) for shop layout. (08 hrs.)
Professional Skill 140 Hrs; Professional Knowledge 40 Hrs	Create and plot assembly and detail views of machine part with Dimensions, Annotations, Title Block and Bill of materials in SolidWorks/AutoCAD Inventor/ 3D Modeling.	**SolidWorks/AutoCAD Inventor/ 3D Modeling:** 133. Draw 3D solid figures by Sketching features & applied features. (10 hrs) 134. Sketch an angle plate and a block – Create/ Modify constraints. (08 hrs) 135. Create a sketch of a new part. (10 hrs)	Introduction to SolidWorks/ AutoCAD Inventor/ 3D Modeling User interface - Menu Bar – Command manager – Feature manager – Design Tree – settings on the Default options – suggested settings – key board short cuts. Create the best profile – create a sketch – create a new part. (08 hrs.)
		136. Create 3D solid and edit using: i) Copy & Paste, (04 hrs) ii) Filleting, (04 hrs) iii) Chamfering, (04 hrs) iv) Editing a feature definition. (04 hrs) v) Create ribs, mirror pattern, the Hole wizard,	Extrude bosses and cuts, add fillets, and chamfer changing dimensions. Revolved features using axes, circular patterning changes and Rebuild problems. (08 hrs.)

		(04 hrs) vi) Create part configurations, Part design tables, (04 hrs) vii) Inset Design Table, Inset new design table. (04 hrs)	
		137. Create New assembly part: i) Create a new assembly (08 hrs) ii) Insert components into an assembly, (04 hrs) iii) Add mates (degree of freedom). (04 hrs) iv) Perform components configuration in an assembly, (04 hrs) v) Insert subassemblies, (04 hrs) vi) Perform Interference detection. (04 hrs)	Bottom up assembly modeling Components configuration in an assembly, Insert subassemblies, Interference detection. (08 hrs.)
		138. Create a 3D model putting: i) Driving dimensions, (02 hrs) ii) Bill of materials, (04 hrs) iii) Driven (Reference) Dimensions, (02 hrs) iv) Annotations, (02 hrs) v) Alternate position view. (02 hrs) 139. Prepare drawings & detailing: i) Create drawing sheets, (04 hrs) ii) Add drawing items, (02 hrs) iii) Named views, standard 3 views, auxiliary views, section views, detail views. (02 hrs) iv) Reattach and replace dimensions, (02 hrs)	Drawings & Detailing, create drawing sheets, Add drawing items, Named views, std. 3 views, auxiliary views, section views, detail views. Drawings & Detailing, create drawing sheets, Add drawing items, Named views, standard 3 views, auxiliary views, section views, detail views. (08 hrs.)

		v) Edit sketch, (02 hrs) vi) Edit sketch plane, (02 hrs) vii) Edit definition. (02 hrs)	
		140. Create a 3D transition figure • using loft feature. (03 hrs) • using sweep feature. (03 hrs) • using library features.(03 hrs) i) Create 3D model by annotating Holes and Threads, (05 hrs) ii) Create Centerlines, symbols and leaders, (05 hrs) iii) Create Simulation. (03 hrs) iv) Plot the model. (01 hr) 141. Convert or save as Solid Works and Inventor file into .dwg format. (05 hrs)	Difference between sweep and loft. Exploded views – Configuration manager, Animation controller. Annotating Holes and Threads, Creating Centerlines, symbols and leaders, Simulation. Introduction to plot & Different ways of plotting. (08 hrs.)
Professional Skill 28 Hrs; Professional Knowledge 08 Hrs	Create production drawing of machine part.	142. Create production drawing of a simple Drill jig – Part model – assembly-detailing (using CAD). (14 hrs) 143. Create production drawing of a Screw jack – Part model – assembly-detailing. (12 hrs) (using CAD) 144. Create a check list by self-assessment and provide Revision mark by noting in the Revision table. (02 hrs)	Knowledgeof production drawing, name plate and bill of materials, etc. Study of production drawing. Procedure of preparing Revision Drawing: putting revision mark, writing remarks in the table as per check list. (08 hrs.)
In-plant training / Project work (work in a team) a. Prepare a model of a drill jig. b. Prepare a chart of exploded view of a centrifugal pump. c. Prepare a model of pipeline layout with necessary fittings.			