

**Syllabus for the trade**  
**of**  
**DRAUGHTSMAN (MECHANICAL)**  
**(SEMESTER PATTERN)**  
**Under**  
**CRAFTSMAN TRAINING SCHEME**

**Designed in 2013**

**By**  
**Government of India**  
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**  
**Directorate General of Employment & Training**  
**Ministry of Labour & Employment**  
**EN-81, Sector-V, Salt Lake City,**  
**Kolkata-700091**

List of members of Trade Committee meeting for the trade of “**Draughtsman (Mechanical)**” held on 19.10.2011 at ATI, Mumbai – 22, Maharashtra.

| SL. No. | Name and Designation, S/Shri           | Representing Organization | Remarks  |
|---------|----------------------------------------|---------------------------|----------|
| 1.      | R. K. Pathak<br>Director In Charge/HOD | ATI, Mumbai               | Chairman |
| 2.      | J. M. Tuke, Principal                  | I. T. I, Ambarnath        | Member   |
| 3.      | Abhinoy Nandi<br>Dy. Director of Trg   | ATI, Mumbai               | Member   |
| 4.      | S.S.SONAVANE Training Officer          | ATI, Mumbai               | Member   |
| 5.      | B.P. DHAMI Training Officer            | ATI, Mumbai               | Member   |
| 6.      | S. S.SALUNKE, Instructor               | I. T. I, Ambarnath        | Member   |
| 7.      | J.S.BHAMARE, Gr. Instructor            | I. T. I, Panvel           | Member   |
| 8.      | K.V.NAVALE, Instructor                 | I. T. I, Mumbai-11        | Member   |
| 9.      | S.Y.CHAUDHARI, Instructor              | I. T. I, <u>Thane</u>     | Member   |
| 10.     | S.T.GOLHAR                             | I. T. I, <u>Kurla</u>     | Member   |

**List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May' 2013 at CSTARI, Kolkata.**

| <b>Sl. No.</b> | <b>Name &amp; Designation</b>                             | <b>Organisation</b>                                  | <b>Remarks</b> |
|----------------|-----------------------------------------------------------|------------------------------------------------------|----------------|
| 1.             | R.N. Bandyopadhyaya, Director                             | CSTARI, Kolkata-91                                   | Chairman       |
| 2.             | K. L. Kuli, Joint Director of Training                    | CSTARI, Kolkata-91                                   | Member         |
| 3.             | K. Srinivasa Rao,<br>Joint Director of Training           | CSTARI, Kolkata-91                                   | Member         |
| 4.             | L.K. Mukherjee,<br>Deputy Director of Training            | CSTARI, Kolkata-91                                   | Member         |
| 5.             | Ashoke Rarhi,<br>Deputy Director of Training              | ATI-EPI, Dehradun                                    | Member         |
| 6.             | N. Nath,<br>Assistant Director of Training                | CSTARI, Kolkata-91                                   | Member         |
| 7.             | S. Srinivasu,<br>Assistant Director of Training           | ATI-EPI, Hyderabad-13                                | Member         |
| 8.             | Sharanappa,<br>Assistant Director of Training             | ATI-EPI, Hyderabad-13                                | Member         |
| 9.             | Ramakrishne Gowda,<br>Assistant Director of Training      | FTI, Bangalore                                       | Member         |
| 10.            | Goutam Das Modak,<br>Assistant Director of Trg./Principal | RVTI, Kolkata-91                                     | Member         |
| 11.            | Venketesh. Ch. , Principal                                | Govt. ITI, Dollygunj,<br>Andaman & Nicobar<br>Island | Member         |
| 12.            | A.K. Ghate, Training Officer                              | ATI, Mumbai                                          | Member         |
| 13.            | V.B. Zumbre, Training Officer                             | ATI, Mumbai                                          | Member         |
| 14.            | P.M. Radhakrishna pillai,<br>Training Officer             | CTI, Chennai-32                                      | Member         |
| 15.            | A.Jayaraman, Training officer                             | CTI Chennai-32,                                      | Member         |
| 16.            | S. Bandyopadhyay, Training Officer                        | ATI, Kanpur                                          | Member         |
| 17.            | Suriya Kumari .K , Training Officer                       | RVTI, Kolkata-91                                     | Member         |
| 18.            | R.K. Bhattacharyya, Training Officer                      | RVTI, Trivandrum                                     | Member         |
| 19.            | Vijay Kumar, Training Officer                             | ATI, Ludhiana                                        | Member         |
| 20.            | Anil Kumar, Training Officer                              | ATI, Ludhiana                                        | Member         |
| 21.            | Sunil M.K. Training Officer                               | ATI, Kolkata                                         | Member         |
| 22.            | Devender, Training Officer                                | ATI, Kolkata                                         | Member         |
| 23.            | R. N. Manna, Training Officer                             | CSTARI, Kolkata-91                                   | Member         |
| 24.            | Mrs. S. Das, Training Officer                             | CSTARI, Kolkata-91                                   | Member         |
| 25.            | Jyoti Balwani, Training Officer                           | RVTI, Kolkata-91                                     | Member         |
| 26.            | Pragna H. Ravat, Training Officer                         | RVTI, Kolkata-91                                     | Member         |
| 27.            | Sarbojit Neogi, Vocational Instructor                     | RVTI, Kolkata-91                                     | Member         |
| 28.            | Nilotpall Saha, Vocational Instructor                     | I.T.I., Berhampore,<br>Murshidabad, (W.B.)           | Member         |
| 29.            | Vijay Kumar, Data Entry Operator                          | RVTI, Kolkata-91                                     | Member         |

## GENERAL INFORMATION

1. Name of the Trade : **DRAUGHTSMAN(MECHANICAL)**
2. NCO Code No : 030.40
3. Duration : Two year (Four semesters  
of each six months Duration)
4. Power Norms : 3.7 Kw.
5. Space Norms : 64 Sq. Mtrs
6. Entry Qualification : Passed 10th class examination under  
10+2 system of education with Science  
and Mathematics or its equivalent.
7. Unit Size (No. Of students) :16
8. Instructor's/Trainer's Qualification:
  - a) Degree or Diploma in Mechanical Engineering with 1 or 2 years post qualification experience respectively.  
Or,  
NTC in the relevant trade with 5 years post qualification experience.  
Or,  
NAC in the relevant trade with 4 years post qualification experience.
  - b) Desirable Qualification: Preference will be given to a candidate with Craft Instructor Certificate..

**\*Note: At least one Instructor must have Degree or Diploma in Mechanical Engineering.**

# Syllabus for the trade of “Draughtsman (Mechanical)” under C.T.S.

**Duration: Six Month**

## First Semester

**Semester code:- DMM:SEM-I**

| Week no | Trade practical                                                                                                                                                                                                                                                                                                                                                                       | Trade theory                                                                                                                                                                                                                                                                                                                                                                                                                                            | Workshop Cal. & Science                                                                |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1.      | Induction Training<br>Familiarization with the Institute Importance of trade training. Machinery used in the trade. Type of work done by the trainees in the Institute , types of jobs made by the trainees in the trade introduction to safety including firefighting equipment & their uses etc.                                                                                    | Importance of safety and general precautions observed in the Institute. And in the Section. Importance of trade in the development of Industrial Economy of the Country. Related instruction Recreational, medical facilities & other extracurricular activities of the instruction (all necessary) guidance to be provided to the new comers to become familiar with working of Industrial Training Institute. System including stores procedures etc. | Introduction to Iron & Steel – its properties & uses. Difference between Iron & Steel. |
| 2       | Practice in using instruments. Drawing of straight and curved lines, Drawing angles, circles etc.<br>Block letters & numerals. Single & double stroke ratio 7: 4, 5: 4                                                                                                                                                                                                                | Nomenclature, description and use of drawing instruments & various equipment in drawing office. Their care and maintenance. Lay out of a drawing sheet.<br>Type of lettering proportion and spacing of letters and words.                                                                                                                                                                                                                               | - do-                                                                                  |
| 3&4     | Plane geometrical construction triangle, polygons, Circles. Conventional signs and symbols. Different types of section lines and abbreviations as per B.I.S. Different types of lines & their uses in drawing. Norms of dimensions layout of drawing sheet as per B.I.S.<br>Construction of ellipse, parabola & hyperbola, construction of involutes, cycloid curves, helix & spiral. | Terms & definitions- polygons and circles. Lines and their meaning , section lines of different materials, conventional signs, symbols & abbreviations, hatching, & shading, Norms of dimensioning different types of drawing sheets. Definition of ellipse, parabola, hyperbola, different methods of their construction. Definition & method of drawing involutes cycloid curves, helix & spiral.                                                     | Properties and use of non-ferrous materials and its alloy.                             |

|          |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                 |                                                                        |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 5        | Dimensioning technique,<br>Symbols for machining and surface finishes (grades and microns values)<br>Trimming of prints, Folding of prints for filing Cabinets or binding as per SP: 46-1988.                                                                                                               | Terminology – feature, functional feature, functional dimension, datum dimension, principles. Units of dimensioning, system of dimensioning, Method of dimensioning and common features Limits, fit, tolerance. Tolerance dimensioning, geometrical tolerance. Indications of symbols for machining and surface finishes on drawing. (Grades and micron values) | -do-                                                                   |
| 6        | Projection of points and lines. Projection of plane figures (Lamina)<br>Projection of solids- prism, cones, pyramids and frustums.                                                                                                                                                                          | Planes and their normal, projections, projections and orthographic projection. First angle and third angle projection. Principal of orthographic projection. Projection of solids like prism, cones, pyramids and frustums in various position                                                                                                                  | Solving problems percentage, ratio and proportion.                     |
| 7 to 8   | Projection of solids, finding out the true shape surfaces cut by oblique planes.<br>Intensive free hand sketching of m/c parts along with projection of simple machine parts- list angle projection. Projection of machine parts drawn in the above exercise 3 <sup>rd</sup> angle projection.              | Solution of problems to find out the true shape of surfaces when solids are cut by different cutting planes.                                                                                                                                                                                                                                                    | -do-                                                                   |
| 9 to 10  | Scale- plain, scales, diagonal scales. Comparative scales, venire scale & scales of chords. Free hand sketching, practice in drawing free hand straight lines, curved lines polygons, circles, elliptical figures with irregular contour & free hand sketch of a machine part such as tool post of a Lathe. | Constructions of different types of scales, their appropriate uses, Principle of R.F diagonal & vernier. Importance of free hand sketching, machine drawing. Material and equipment required in sketching.                                                                                                                                                      | -do-                                                                   |
| 11       | Sectional views – Different types of section                                                                                                                                                                                                                                                                | Importance sectional views. Types of sectional views & their uses. Parts not shown in section.                                                                                                                                                                                                                                                                  | -do-                                                                   |
| 12 to 13 | Interpenetration of two prisms with their axes intersecting at right angles. Interpenetration                                                                                                                                                                                                               | Definition of Intersection & interpenetration curves. Common method to find out the curve of                                                                                                                                                                                                                                                                    | Definition of Various heat treatment processes of Steel and its alloy. |

|          |                                                                                                                                                     |                                                                                                                                                     |                                                                                    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|          | of cone cylinder, & pyramids intersecting each other.                                                                                               | interpenetration.                                                                                                                                   |                                                                                    |
| 14 to 15 | Interpenetration of prisms with their axis intersecting at an angle. Interpenetration of cones & pyramids with their axes intersecting at an angle. | Solution of problems on interpenetration of prism, cones, & pyramids with their axes intersecting at an angle. Intersection of cylinder.            | -do-                                                                               |
| 16 to 17 | General principles of presentation i.e. Orthographic projections in 1 <sup>st</sup> & 3 <sup>rd</sup> angle.                                        | Theory of projection as specified in SP: 46-1938.                                                                                                   | Algebra – addition, subtraction multiplication and division.                       |
| 18       | Development of surfaces bounded by plane. Development of surfaces bounded by plane of revolution.                                                   | Definition of development, its need in industry & different method of developing the surfaces.                                                      | -do-                                                                               |
| 19       | Development of an oblique cone with elliptical base etc. Development of solids intersecting each other.                                             | Principle of isometric projection, Difference between Isometric drawing & Isometric projection. Isometric scale. Dimensioning an isometric drawing. | Algebra – factors & factorization, fractions.                                      |
| 20       | Isometric projection of geometrical solids.                                                                                                         | -do-                                                                                                                                                | -do-                                                                               |
| 21       | Isometric projection of a machine part with irregular curves. Free hand isometric drawing of actual objects.                                        | Different methods of drawing Isometric views.                                                                                                       | -do-                                                                               |
| 22       | Isometric projection of a simple Journal Bearing.                                                                                                   | Principle and types of oblique projection. Advantage of oblique projection over isometric projection.                                               | -do-                                                                               |
| 23 to 24 | Oblique projection of solids and machine parts perspective projection of solid.                                                                     | Types of perspective projection Fundamental concept and definition, Location of station point.                                                      | Algebra- solving of simple equations, quadratic equations & simultaneous equation. |
| 25       | Project Work / Industrial Visit (Optional)                                                                                                          |                                                                                                                                                     |                                                                                    |
| 26       | Examination                                                                                                                                         |                                                                                                                                                     |                                                                                    |

### **Achievements:**

After completion of the semester-1,

The CTS trainees will be able to:

1. Use drawing, Inst., their care & maintenance.
2. Layout of sheets & folding of sheet.
3. Construct, read & use of plain, comparative, diagonal, vernier scales.
4. Construct plain geometrical figures.
5. Solve simple problems on projecting of points, lines surfaces & solids.
6. Draw sketches from models (plan, section, & elevation)
7. Have thorough knowledge in conventional signs & symbols.
8. Basic concept about Building Materials and Surveying.

# Syllabus for the trade of “Draughtsman (Mechanical)” under C.T.S.

Duration: Six Month

Second Semester

Semester code:- DMM:SEM-II

| Week No. | Trade Practical                                                                                                                                                                                                                                                                               | Trade Theory                                                                                                          | Workshop cal. & science                                                                       |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1        | Screw threads with BIS conventions (free hand sketching as well as with instruments).                                                                                                                                                                                                         | Screw threads, terms nomenclature, types of screw thread, proportion and their uses, threads conventions.             | Logarithm – its applications in multiplication, division, powers, roots (by using log table). |
| 2        | Nuts, bolts, washers and locking device with BIS convention (free hand sketching as well as with instruments). Keys, cotters, circlips and pins with BIS conventions.<br>Purpose, terms, different types of key (Heavy duty and Light duty) and proportions use of cotters, pins and circlips | Types of bolts and nuts their proportions, uses, different types of locking device.                                   | -do-                                                                                          |
| 3        | Machine screws, Cap screws, studs and set screws, Foundation bolt with BIS convention ( free hand sketching as well as with instruments).                                                                                                                                                     | Different type of machine screw<br>Cap screw and their specification.<br>Different types of foundation bolt.          | -do-                                                                                          |
| 4        | Keys, cotters, circlips and pins with BIS conventions.                                                                                                                                                                                                                                        | Purpose, terms, different types of key (Heavy duty and Light duty) and proportions use of cotters, pins and circlips. | -do-                                                                                          |



|    |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                          |                                                            |
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| 5  | Types of rivets, types of riveted joints with BIS conventions.                                                                                                                                                                                                                                                          | Types of fastening materials, types of rivets, their proportions and uses. Types of riveted joints, terms and proportions or riveted joints. Conventional representation.                                                                                                                                                                                                                                | -do-                                                       |
| 6  | To prepare working drawing of riveted structure as per conventional system Welder joints. Use of welding symbols, Working drawing of welded Structures.                                                                                                                                                                 | Causes of failure of riveted joint efficiency of riveted joints. Description of Welded Joints and their representation (Actual and Symbolic) Indication of Welding Symbol on drawing as per BIS.                                                                                                                                                                                                         | -do-                                                       |
| 7  | <u>ALLIED TRADE: PATTERN MAKER</u><br>Use of Saws, chisels, raps, planes etc. Use of steel rules, square, scribes and divider for making out from drawing.                                                                                                                                                              | Safety precaution descriptions uses and care of hand tools including contraction rule. Brief description of production of cast iron, wrought iron steel and alloy steel.                                                                                                                                                                                                                                 | -do-                                                       |
| 8  | <u>ALLIED TRADE; MOULDING</u><br>Different types of mould, cores and core dressing, use of molding tools. Simple core making floor and box molding using to part patterns.                                                                                                                                              | Safety precautions, Hand tools used for molding. The description, use and care of hand tools. Description of different types of molding. Description of different types of core, sand, and dressing materials, Description of cupola.                                                                                                                                                                    |                                                            |
| 9  | <u>ALLIED TRADE: FORGER AND HEAT TREATER</u><br>USE OF DIFFERENT TYPES OF Forget hand tools, hand forging of different types of jobs.<br><u>ALLIED TRADE- FITTING</u><br>Use of different types of fitters hand tools, use centre punch different types of files, callipers, hacksaws and hack sawing chisels, hammers. | Description of measuring tools and hand tools used in forge work. Description and use of the mechanical hammer. Colour coding of different metals and identification.<br>Description and application of simple measuring tools, Description of vices, hammers, cold chisel, files, etc. And proper method of using them.<br>Method of using precision measuring instrument such as vernier height gauges | Definition of mass & weight – their units and differences. |
| 10 | ALLIED TRADE TURNING<br>Plain turning , stepped turning ,Taper turning with different method                                                                                                                                                                                                                            | Safety precaution for lathes<br>Description of parts of Lathe & its accessories. Method of using precision measuring instrument such as inside & outside micrometers, depth gauges , vernier, callipers , dial indicators,                                                                                                                                                                               | -do-                                                       |

|         |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                |                                                                                                                                            |
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|         |                                                                                                                                                                                                                                                 | slip gauges , sine bars, universal bevel protractor, etc.                                                                                                                                                                                                                                                      |                                                                                                                                            |
| 11      | ALLIED TRADE MACHINIST<br>Use of jigs and fixtures Simple operations on milling machine such as plain is milling and key way cutting.<br>Marking out castings and forgings. setting up and operation of shaping, slotting and planning machines | Brief Description of milling shaping slotting and planning machines Quick return mechanism of these machines                                                                                                                                                                                                   | Definition of speed, velocity & acceleration and their units.<br>Difference between speed & velocity.                                      |
| 12      | ALLIED TRADE : SHEET METAL<br>Use of hand tools such as planishing hammers stakes, mallet, bricks prick punch etc. Development of surfaces from blue print.                                                                                     | Name and brief description of common equipment necessary for sheet metal work. Different types and uses of joints employed in sheet metal work.                                                                                                                                                                | -do-                                                                                                                                       |
| 13      | ALLIED TRADE :WELDING<br>Use of hand tools used In Gas and in electric welding of object by gas and electric according to drawing                                                                                                               | Name and brief description of the Hand tools identification of gas cylinders. Different types of welded joints and necessary preparation required for these. Welding symbols as applied to drawing.                                                                                                            | Forces – definition - its unit, compressive, tensile and shear force.<br>Newton’s laws of motion.<br>Laws of gravitation.                  |
| 14      | ALLIED TRADE: ELECTRIAN<br>Familiarization with the measuring instruments machinery and panels used in electrician trade Electrical and Electronic symbols and simple wiring diagrams.                                                          | A.C & D.C Motors Generators of common types and their uses Names 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). | -do-                                                                                                                                       |
| 15      | ALLIED TRADE:MMV- I.C ENGINE<br>Familiarization & Identification of different parts of i.e. Engines (Both spark ignition & compression/ignition-2 stroke & 4 stroke engines).                                                                   | Brief description of internal combustion engines, such as cylinder block piston, carburettor spark plug, camshaft, crank shaft< injector fuel pump etc.                                                                                                                                                        | -do-                                                                                                                                       |
| 16 to23 | Drawing of a Ram bottom & safety Valve Drawing of screw jack (Details & assembly) Preparation Drawing of plumber block (Details and assembly).<br>Drawing of plumber block (Details                                                             | Types of assembly drawing. Different types of detailed drawings and preparations of bill of materials.<br>Use of bearing, types of bearing and materials used                                                                                                                                                  | Calculation of areas of plane figures formed by the combination of standard figures.<br>Definition of work, Power & energy – their units’. |

|    |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                   |                                                  |
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|    | <p>and assembly).</p> <p>Working drawing of a simple bearing a Foot step bearing pedestal bearing.</p> <p>Details and assembly of a angular Plummer block.</p> <p>Details and assembly drawing of a angular Plummer block</p> | <p>Difference between frictional and antifriction bearing. Advantages of antifriction bearing over frictional bearing. Materials and proportion of parts for drawing purposes.</p> <p>Production of interchangeable parts, Fits Limits, tolerance &amp; familiarization with IS-919 &amp; IS 2709. Different methods of showing machine surfaces on drawings.</p> | <p>Calculations of work, Power &amp; energy.</p> |
| 25 | Project Work / Industrial Visit (Optional)                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                   |                                                  |
| 26 | Examination                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                   |                                                  |

### **Achievements:**

After completion of the semester-II

1. Use Forger hand tool, forging of simple jobs
2. Use fitters hand tool and measuring instruments.
3. Carry out simple operations on shaping, and milling machines.
4. Carry out simple operation on Lathe.
5. Use of sheet metal work and tool, Elementary knowledge of gas and gas welding.
6. Elementary knowledge of electrician trade and to be able to identify the different parts of I.C. engine
7. Draw temporary fasteners –screw threads, bolts, and nuts, washers, locking Devices, machine screws, Caps screws, and studs, set screw, foundation bolts, circlips keys, cotters and pins
8. Draw types of rivets and riveted joints 3. Use of important patterns makers tools, making of simple patterns, use of moldings tools and preparation of simple mould.

# Syllabus for the trade of “Draughtsman (Mechanical)” under C.T.S.

**Duration: Six Month**

**Third Semester**

**Semester code:- DMM:SEM-III**

| Week No. | Trade Practical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Trade Theory                                                                                                                                                                                     | Workshop Cal.& Science                                                                                              |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1&6      | <p><b>PRACTICE ON COMPUTER</b></p> <p>Practice on two useful software via MS-Word &amp; MS Excel, MS Office &amp; operating system software Installation of Auto CAD (Latest Version) in the computer. Launching Auto CAD from windows and exiting from Auto CAD. Familiarization with Auto CAD main Menu screen menu, command windows, UC standard tool bar, model space, etc. Creating simple geometrical entitles using different option under DRAW menu viz. line, construction line, ray, multi line, polygon, rectangle, arc, circle, ellipse, etc. Editing drawing using different option under modify menu –erase, copy, lengthen, scale, champ her, fillet, break, extend, minor.</p> | <p>Introduction to computer- DOS, windows &amp; Introduction to AUTO CAD. Related Theory</p>                                                                                                     | <p>Elementary trigonometry - ratios, use of trigonometric tables. Sine &amp; Cosine rule.</p>                       |
| 7 & 8    | <p>Pulleys-solid, stepped and built up pulleys. Pulleys-pulley with different types of arms, rope pulleys, belt pulleys and drive.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>Belts-power transmitted by belt. 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,</p> | <p>Friction – definitions, its effect, types. Laws of friction, angle of friction and its related calculations.</p> |

|          |                                                                                                                                                                                                       |                                                                                                                                                                                                  |                                                                                                                                                |
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|          |                                                                                                                                                                                                       | velocity, pulley ratio etc.<br>Standard pulleys width of pulley face, velocity ratio chain drive.                                                                                                |                                                                                                                                                |
| 9        | Working drawing of coupling (Muff coupling, flange coupling, friction grip coupling)                                                                                                                  | Necessity of coupling. Types uses and proportion of different types of coupling. Materials used for coupling.                                                                                    | -do-                                                                                                                                           |
| 10 to 11 | Working drawing of coupling (claw coupling, universal coupling, knuckle joint). Pipe fittings flanges, unions, valves, etc. Different types of pipes lay out systems. Different types of pipe joints. | Heat treatment of steel. Piping materials and specifications of W.I. & Steel pipes. Pipe threads pipe fittings. Specifications of fittings. Brief description of different types of pipe joints. | Centre of gravity(CG) – definitions, calculation of CG of regular & irregular shape body. Effect of (CG) centre of gravity in the trade work.  |
| 12 to 16 | Working drawing of gears such as spurs helical, bevel & worm, worm and worm wheel.                                                                                                                    | Use of gears in transmission of power. Different types of gears. Cast gears and machined gears. Use of udomograph for drawing profile of gears etc.                                              | Definition of specific gravity, density and relative density. Difference between specific gravity & density. Calculation of density of a body. |
| 17&20    | Cams with different motions to followers, different types of follower Drawing                                                                                                                         | Use of cams in industry. Types of cam, kinds of motion, displacement diagrams. Terms used in cam. Types of followers.                                                                            | Levers – definitions, its types, working principle of levers.                                                                                  |
| 21&23    | Working drawings of Eccentrics. Piston (I.C.C. Engines) with the application of tolerances.                                                                                                           | Related theories.                                                                                                                                                                                | Moment of a force. Problems with respect to levers of all the three orders.                                                                    |
| 24       | Working drawing of connecting rods (I.C. Engine) with the application of tolerances.                                                                                                                  | Brief description of petrol, diesel and gas engines.                                                                                                                                             | -do-                                                                                                                                           |
| 25       | Project work / Industrial visit(Optional)                                                                                                                                                             |                                                                                                                                                                                                  |                                                                                                                                                |
| 26       | Examination                                                                                                                                                                                           |                                                                                                                                                                                                  |                                                                                                                                                |

## **Achievements:**

After completion of the semester -3,

1. Draw details & assembly drawing of machine parts like coupling bearing, pulleys etc.
2. prepare piping drawing main line layout as done previously
3. prepare working drawings of different types of gears
4. Prepare details and assembly drawings of important machine parts and engine parts.
5. Draw working drawings of jigs, fixtures gauges press tools
6. draw welding drawings use of welding symbols on drawings
7. draw foundations drawings of machinery
8. draw and sketch assembly drawing of bench drilling and slotting machines

# Syllabus for the trade of “Draughtsman (Mechanical)” under C.T.S.

Duration: Six Month

## Fourth Semester

Semester code:- DMM:SEM-IV

| Week No. | Trade Practical                                                                                                                | Trade Theory                                                                                                                                | Workshop Cal.& Science                                                                                                                                   |
|----------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 to 2   | Valve: such as lever safety vale, Dead wt. Safety valve. Assembly drawing of reciprocating pump.                               | Working principle of valves and their description.                                                                                          | Definition, difference and unit of heat and temperature. Sources of heat and its effect on bodies. Types of heat transfer methods and their differences. |
| 3        | Hydraulic and pneumatic conventional signs and symbols                                                                         | Brief description, working principle and function of hydraulic jack, press accumulator, ram etc.                                            | -do-                                                                                                                                                     |
| 4        | Structural steel roof truss joints.                                                                                            | Structural Steel B.I.S. Specification for rolled sections. Structural steel roof truss joints and supports.                                 | Relation between thermometric scales and their calculations. Calculation of quantity of heat of a body                                                   |
| 5        | Drawing of a drilling Jig                                                                                                      | Different locating methods clamping devices.                                                                                                | -do-                                                                                                                                                     |
| 6        | Detailed drawing of a milling fixture                                                                                          | Different locating methods clamping devices.                                                                                                | -do-                                                                                                                                                     |
| 7        | Practice in designing a simple drilling jig for drilling holes in a given component.                                           | Lay out of Machine foundations. Brief treatment of the principle involved and the precautions to be observed. Lay out of machine Foundation | Stress and strain – definitions, types, Hook’s Law. Ultimate strength and factor of safety.                                                              |
| 8        | Different types of gauges, such as plug, snap, thread, taper etc.                                                              | Function of gauges, different types of gauges and their uses. Use of templates in industry.                                                 | -do-                                                                                                                                                     |
| 9 to 11  | Sketching of a Press Tool giving nomenclature of each part. Drawing of dies & punches for the production of simple work pieces | Related theories of press tool with tolerance.                                                                                              | Problems on ultimate stress and factors of safety, Poisson’s Ratio, Modules of rigidity.                                                                 |
| 12       | Blow off cock & simple carburettor.                                                                                            | Working of Blow off cock & simple carburettor.                                                                                              | Electricity – definitions, Ohm’s Law, electrical power, energy and units.                                                                                |

|          |                                                                                                                                                                                                                                                                                        |                                                                               |                                                                                                                                                                                                                               |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 & 14  | Making foundation drawing for machinery section of Rolled Steel Joist and beams.<br>Simple plate girder and built up trusses.                                                                                                                                                          | General arrangements and of drawing, standard method of drawing.              | Magnetism – introduction, magnetization and magnetic materials. Use of magnets. Laws of attraction and repulsion.                                                                                                             |
| 15       | Sketching & Assembly Drawing of Machine Swivel vice & pipe vice.                                                                                                                                                                                                                       | Numbering of drawings and standard parts.<br>Familiarization with B.I.S. 696. | Definition of machines mechanical advantages (MA), velocity ratio (VR), Basic principle of machines, its efficiency. Relation between friction and efficiency in case of idle machines. Relation between efficiency and load. |
| 16 to 18 | Develop mechanical and computer-aided drafting and design skills, including preparing assembly and detail drawings, operating CADD software, and producing solid model drawings.                                                                                                       | Related theory                                                                | Efficiency of machines - winch, pulleys, wheel and axle, screw jack and its calculations.                                                                                                                                     |
| 19 to 24 | Solid Works and Solid Modelling Designer program introduces the student with 2D CAD experience to 3D solid modelling. Using applications including Auto Desk Inventor and Solid Works, Catia, pro-e, Delcam ,students learn to create parts and other assemblies on prototype machine. | Related theory                                                                | Calculation of belt pulley drive, gear drive, cutting speed and feed.                                                                                                                                                         |
| 25       | Revision                                                                                                                                                                                                                                                                               |                                                                               |                                                                                                                                                                                                                               |
| 26       | Examination                                                                                                                                                                                                                                                                            |                                                                               |                                                                                                                                                                                                                               |

### **Achievements:**

After completion of the semester -4

- (i) Prepare piping drawing. Main line layout as done previously.
- (ii) Prepare working drawings of different types of gears.
- (iii) Prepare details and assembly drawings of important machine part and engine parts



## List of tools & Equipment for the Trade of Draughtsman (Mechanical)

### TRAINEE'S TOOLS KIT

| Sl. No. | Name of the items                                                                                                                                                                                                                                                                | Quantity |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1.      | Draughtsman drawing instrument box containing<br><br>Compasses with pencil point, point driver, interchangeable,<br>Divider pen point interchangeable, divider spring bow, pen<br><br>Spring bow lengthening bar, pen drawing liner, screw driver<br>Instrument, tube with lead. | 16+1 set |
| 2.      | Set square celluloid 45 <sup>0</sup> (250 X 1.5 mm)                                                                                                                                                                                                                              | 16+1 set |
| 3.      | Set square celluloid 30 <sup>0</sup> -60 <sup>0</sup> (250 X 1.5 mm)                                                                                                                                                                                                             | 16+1 set |
| 4.      | French-curves (set of 12 celluloid)                                                                                                                                                                                                                                              | 4 nos    |
| 5.      | Mini drafter                                                                                                                                                                                                                                                                     | 16+1 set |
| 6.      | Drawing board (700mm x500 mm) IS: 1444                                                                                                                                                                                                                                           | 16+1 set |

### GENERAL MACHINERY SHOP OUTFIT

| Sl. No. | Name & Description of Machine                                                                                  | Quantity   |
|---------|----------------------------------------------------------------------------------------------------------------|------------|
| 1.      | Chest of drawer 8 drawers( Standard)                                                                           | 2 Nos.     |
| 2.      | Draughtsman table                                                                                              | 16 Nos.    |
| 3.      | Draughtsman stool                                                                                              | 16 Nos.    |
| 4.      | Computer Latest version compatible for running CAD software,<br>preloaded with windows and 20" colour Monitor. | 8 Nos      |
| 5.      | Sever (True dedicated sever)                                                                                   | 1 No.      |
| 6.      | Software: MS- office latest version, CAD with latest Licensed<br>version ,3D Graphics cad software             | 8 users    |
| 7.      | Plotter (Max. A3 size)                                                                                         | 1 No.      |
| 8.      | Laser Jet printer latest model                                                                                 | 1 No.      |
| 9.      | UPS - 5 KVA                                                                                                    | 2 Nos.     |
| 10.     | White Board for using LCD projector(optional)                                                                  | 1 No.      |
| 11.     | Instructor Table                                                                                               | 1 No.      |
| 12.     | Instructor Chair                                                                                               | 2 Nos.     |
| 13.     | Almirah steel                                                                                                  | 1 No.      |
| 14.     | 3D Visualiser                                                                                                  | 1 No.      |
| 15.     | Computer table                                                                                                 | 8 Nos.     |
| 16.     | Computer chairs                                                                                                | 16 Nos.    |
| 17.     | Table for server, printers                                                                                     | 1 No. each |
| 18.     | LCD projector /OHP                                                                                             | 1 No.      |
| 19.     | External storage device (8 GB )                                                                                | 2 Nos.     |

Note: No additional items are required to be provided for the batch working in the second shift except the items from sl. No. 1 to 6 under trainee's kit.

To impart the training based on computer based training CBT and ICT Information and communication Technology FROM **SEMESTER 3 & 4.**

Training must be imparted with the help of AutoCAD to compete in the global market.

This Training offers the student a theoretical basis for the development of drafting skills necessary to work in drafting, design, engineering, and technical professions. Emphasis is placed on terminology and procedures used in multiview projection, auxiliary and sectional views, intersections and developments, dimensioning, and pictorial drawings. Students are encouraged to develop an awareness of proper drafting techniques, the geometry of technical drawing, and new technological advancements in the field of drafting. Hence Computer aided drafting (CAD) is introduced.

#### **Achievement of Training on AutoCAD.**

- **Completely self-contained resource-**
  - Gives students all the direction they need to begin drafting in an easily understandable, clearly laid out, and direct manner.
- **Complies with all versions of AutoCAD-Including up to 2012 & latest version.**
  - Uses keyboard commands vs. pull-down menus, allowing users to focus on drafting skills and AutoCAD basics without being tied to a specific release of AutoCAD.
- **“Prompt/Response” format.**
  - Takes students step-by-step through each new AutoCAD command or activity.
- **All assignments are included.**
  - Gives students everything they need in one place so they won't spend time searching for other resources or materials.
- **Step-by-step methodologies.**
  - Illustrates for students the different ways processes can be done to attain the same goal.
- **A hierarchy of drawings plus a relations to parts list.**
- **List of objectives at the beginning of each chapter.**
  - Summarizes the areas that the student should be proficient in upon completion of the chapter.
- **Practice exercises in each chapter.**
  - Gives students ample opportunity to practice what they have just learned.
- **Numerous figures and illustrations.**
  - Assists students in following along and makes the text a useful study tool for review and practice.
- **Graduated assignments build in level of difficulty.**
  - Allows students to build on previously-learned concepts and allows them to build confidence in their drafting skills.