Syllabus

for the trade of

DRAUGHTSMAN MECHANICAL

Under

Craftsmen Training Scheme
&
Apprenticeship Training Scheme

Revised in – 2005

Government of India
Ministry of Labour & Employment (DGE&T)
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN Block, sector – V, Salt Lake,
Kolkata – 700 091

General Information

1.	Name of the Trade:	Draughtsman (Mechanical)
2.	N.C.O. Code No.:	030.40
3.	Duration of Craftsmen Training:	2 years
4.	Duration of Apprenticeship Training:	3 years including 2 years of Basic Training.
5.	Entry Qualification:	Passed 10th class examination under 10+2 system of education with Science & Maths or its equivalent.
6.	Rebate for ITI Trainees:	2 years in the same trade.
7.	Ratio of Apprentice to Workers:	1: 5

NOTE FOR APPRENTICESHIP TRAINING

1. The Practical Training Programme of Apprentices under ATS (Apprenticeship Training Scheme) should be as per the facilities available in the Establishment / Industry.

2. At the end of shop floor training, an apprentice shall appear for a final examination to be conducted at establishment level based on the actual shop floor training received by the apprentices. This examination shall comprise of assessment of work diaries maintained by the apprentices and Viva Voice to be conducted by an external examiner (other than an official directly responsible for shop floor training).

List of members attended the Trade Committee Meeting for revising the Syllabus for the Trade of Draughtsman(mechanical) under CTS/ATS held on 15.07.2005

Sl.No.	Name	Designation/Representing Org.	
	S/Sri		
1.	M.M.Gera	Dy. Director, CSTARI	Chairman
2.	Dr. Arun Kiran Pal	Prof. Deptt. Of Ptg.Engg. Jadavpur University,Kolkata	Member
3.	Dr. Samiran Mondal	NITTTR,Kolkata	Member
4.	Dilip Kumar	Sr. Manager Civil, Hindustan Steel Works Construction Ltd., Kolkata	Member
5.	Prabir Nayak	Sr. Instructor, Rly. Workshop, E.Rly.	Member
6.	T.Mukhopadhayay	Dy. Director of Training, CSTARI, Kolkata	Member
7.	S. Kumar	Dy. Director of Training, CSTARI, Kolkata	Member
8.	A.Chakraborty	Asstt. Director of Training, CSTARI, Kolkata	Member
9.	Naren sengupta	Training Officer, RDAT (ER), Kolkata	Member
10.	A.K.Mandal	Training Officer, A.T.I, Kolkata	Member
11.	P.K.Kolay	Training Officer, CSTARI, Kolkata	Member
12.	Hemant Kujur	Jr. D/Man.(mech), CSTARI, Kolkata	Member
13.	Pradip Biswas	Jr. D/Man.(mech), CSTARI, Kolkata	Member

SYLLABUS FOR THE TRADE OF DRAUGHTSMAN (MECHANICAL) UNDER CRAFTSMEN TRAINING SCHEME

Period of Training: 2 Years

Week No.	Practical	Trade Theory	W/shop Calculation and Science
1.	2	3	4
1.	Induction Training. 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 fire fighting equipment & their uses etc.	Importance of safety and general precautions observed in the Instt. and in the Section. Importance of trade in the development of Industrial Economy of the Country. Related instruction. Recreational, medical facilities & other extra curricular activities of the Instt. (All necessary guidance to be provided to the new comers to become familiar with working of Industrial Training Institute. System including stores procedures etc.	
2.	Practice in using instruments. Drawing of straight and curved lines, Drawing angles, circles etc.	Nomenclature, description and use of drawing instruments & various equipment in drawing office. Their care and maintenance. Lay out of a drawing sheet.	British, MKS and SI units-their conversions. More emphasis on MKS&SI units.
3.	Block letters & numerals. Single & double stroke ratio 7: 4, 5:4	Type of lettering proportion and spacing of letters and words.	Units of length and relation between them. Deduction of corresponding units of area & volumes.
4.	Plane geometrical construction triangles, polygons, Circles. Conventional sings and symbols. Different types of section lines and abbreviations as per B.I.S Different types of lines & their uses in drawing. Norms of dimension lay out of drawing sheet as per B.I.S.	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 mass, weight, density, specific gravity, Simple calculation on weight. Applied problems using MKS and SI units.
5	Construction of ellipse parabola & hyperbola, Construction of involutes, cycloid curves, helix and spiral.	Definition of ellipse, parabola, hyperbola, different methods of their construction. Definition and method of drawing involutes cycloid curves, helix and spiral.	Solution of problems on polygons and circles.
6	Projection of points and lines. Projection of plane figures (Lamina)	Planes and their normal, projections, projection and orthographic projection. First angle and Third angle projection.	Solution of problems on polygons and circles.

		Concept about Horizontal & Vertical plane.	
7.	Projection of solids-Prism, cones, pyramids and frustums.	Principle of Orthographic Projection. Projection of solids like prism, cones, pyramids and frustums in various position.	Determination of sides and areas of triangles regular and irregular polygons, circles, segment and sections.
8.	Projection of solids, finding out the true shape surfaces cut by oblique planes.	Solution of problems to find out the true shape of surfaces when solids are cut by different cutting planes.	Simpson's rule & its practical application, area of ellipse.
9.	Intensive free hand sketching of m/c. parts along with projection of simple machine parts-Ist angle projection. Projection of machine parts drawn in the above exercise 3rd angle projection.	Solution of problems to find out the true shape of surfaces when solids are cut by different cutting planes.	Determination of surface areas and volumes of cube, cylinder, prism, pyramid , cone, sphere etc.
10.	Scale-plain, scales, diagonal scales. Comparative scales, vernier scale & scale of chord.	Construction of different types of scales, their appropriate uses, Principle of R.F diagonal & vernier .	Displacement, velocity, acceleration. Equation of motion. Newton's Laws of motion, simple problems on the above.
11.	Free hand sketching, practice in drawing free hand straight lines, curved lines polygons, circles, elliptical figures, figures with irregular contour and free hand sketch of a machine part such as tool post of a Lathe.	Importance of free hand sketching, machine drawing. Material and equipment required in sketching.	Determination of centre of gravity & moment of inertia by analytical & graphical method.
	Progress Test	Progress Test	Progress Test

ACHIEVEMENT

The Trainees should be able to:

1. Use drawing instruments, lettering and numerals.
2. Construct various types of scales.
3. Exercises on free hand sketching of machine/parts.
4. Draw first angle and third angle projection of points, lines, plane figures, solids and simple machine Components.

1	2	3	4
12.	Sectional views-Different types of sections	Importance of sectional views. Types of Sectional views & their uses. Parts not shown in Section.	Fundamental algebraic formulae for multiplication and factorisation.
13.	Interpenetration of two prisms with their axes intersecting at right angles. Interpenetration of cone cylinder, & pyramids intersecting each other.	Definition of Intersection & interpenetration curves. Common methods to find out the curve of interpenetration.	Simple & simultaneous equation of the first degree.
14.	Interpenetration of prisms with their axis intersecting at an angle. Interpenetration of cones and pyramids with their axes intersecting at an angle.	Solution of problems on interpenetration of prism, cones, and pyramids with their axes intersecting at an angle. Intersection of cylinder.	Quadratic Equation.
15.	General principles of presentation i.e. Orthographic projections in Ist and 3rd angle.	Theory of projection as specified in SP : 46-1938.	Graphs, logarithms.
16.	Development of surfaces bounded by plane. Development of surfaces bounded by plane of revolution.	Definition of development, its need in industry and different method of developing the surfaces.	Measurement of angles trigonometric ratios, Radian measure.
17.	Development of an oblique cone with elliptical base etc. Development of solids intersecting each other.	Principle of Isometric projection, Difference between Isometric drawing and isometric projection. Isometric Scale, Dimensioning an isometric drawing.	Trigonometric Ratios of angles of any magnitude.
18.	Isometric projection of geometrical solids.	-do-	Trigonometric functions of compound angles. Simple solution of triangles.
19.	Isometric projection of a machine part with irregular curves. Free hand isometric drawing of actual objects.	Different methods of drawing Isometric views.	Use of mathematical tables (trigonometric and logarithms). Use of simple scientific calculator.
20.	Isometric projection of a simple Journal Bearing.	Principle and types of oblique projection. Advantage of oblique projection over isometric projection.	Applied problems on trigonometrical application.
21.	Oblique projection of solids, and machine parts perspective projection of solids.	Types of perspective projection Fundamental concept & definition, Location of station point.	Simple problems on stresses & Strains.
22 to 23	Dimensioning technique, Symbols for machining & surface finishes (grades and micron values) 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	Hook's Law, Modulus of Elasticity, Stresses and strains, elastic limit, yield point poison's ratio. Ultimate stress and breaking stress, factor of safety. Load due to impact.

	Ist angle projection with dimensioning of machine parts. 3rd angle projection with dimension of machine parts. - Progress Test	features Limit, fit, tolerance. Tolerances dimensioning, geometrical tolerance. Indication of symbols for machining and surface finishes on drg. (Grades and micron values) - Progress Test -	Composition and resolution of forces. Condition of equilibrium of forces in plane. - Progress Test -

ACHIEVEMENT

The Trainees should be able to:

1. Draw different types of sectional views and dimensioning the drawings.
2. Draw isometric, oblique and perspective projection of simple objects.
3. Draw interpenetration curves and develop simple objects.

24.	Screw threads with B IS conventions (free hand sketching as well as with instruments).	Screw thread, terms and nomenclature, types of screw thread, proportion and their uses, Thread conventions.	Graphical determination of forces in simple frames.
25.	Nuts, bolts, washers and locking devices with B.I.S conventions (free hand sketching as well as with instruments)	Types of bolts and nuts their proportions , uses, Different types of locking devices.	Force, diagram of freely supported beams and cantilevers
26.	Machine screws, Cap screws, studs and set screws, Foundation bolts with B IS conventions (free hand sketching as well as with instruments).	Different types of machine screws Cap screws and their specifications. Different types of foundation bolts.	Bending moments and shearing force diagrams.
27.	Keys, cotters, circlips and pins with BIS conventions.	Purpose, terms, different types of keys (Heavy duty and light duty) and proportions use of cotters, pins and circlips.	Torsional strength of shaft.
28.	Types of rivets, types of riveted joints with B.I.S conventions.	Types of fastening materials, Types of rivets, their proportion & uses. Types of riveted joints, Terms & proportions or riveted joints. Conventional representation.	Moments, principle of lever, Types of lever, Mechanical advantage, Velocity ratio and efficiency.
29.	To prepare working drawing of a riveted structure as per conventional system.	Causes of failure of riveted joints, efficiency of riveted joints.	Simple problems on straight & bell cranked lever.
30.	Welded joints. Use of Welding symbols, Working drawings of Welded Structures.	Description of Welded Joints and their representation (Actual and Symbolic) . Indication of Welding	Motions such as reciprocating, rotary etc. and their mutual conversion.

		Symbols on drawings as per BIS.	
31.	Drafting practice with the help of the drafting machine.	Description and use of Drafting Machine. Different sizes of drawing sheets as per BIS.	Linkage Mechanisms – four bar Mechanisms, slider crank chain mechanisms.
32.	ALLIED TRADE: PATTERN MAKER Use of Saws, chisels, raps, planes etc. Use of steel rules, squares, scribers and dividers for marking 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	Contraction, shrinkage and machining allowances, their calculation for different materials
33.	ALLIED TRADE ; MOULDING Different types of mould, cores and core dressing, use of moulding tools. Simple core making floor and box moulding using to part patterns.	Safety precautions, Hand tools used for moulding. The description, use and care of hand tools. Description of different types of moulding. Description of different types of core, sand, and dressing materials, Description of cupola. PROGRESS TEST	Ferrous and non ferrous metals & Alloys. Physical properties-uses. Brief description of cast iron, mild steel, carbon steel-properties and uses.

ACHIEVEMENT:

The Trainees should be able to :

1. Draw temporary fasteners-screw threads, bolts, nuts, washers, locking Devices, machine screws, cap screws, studs, set screws, foundation bolts, circlips, keys, cotters and pin.
2. Draw types of rivets and riveted joints.
3. Use of important pattern maker's tools, making of simple patterns, use of moulding tools and preparation of simple mould.

1	2	3	4
34.	ALLIED TRADE: FORGER & HEAT TREATER Use of different types of Forger hand tools, hand forging of different types of jobs.	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.	Heat and temperature thermometric scales & their conversions. Absolute temperature. Use of B.I.S Unit in measurement of heat. Names of temperature measuring instruments normally used in workshop.
35.	ALLIED TRADE-FITTING Use of different types of fitters hand tools, use centre punch different types of files, callipers, hacksaws and hacks awing chisels, hammers.	Description and application of simple measuring tools, Description of vices, hammers, cold chisel, files etc. and proper method of using them.	Quantity of heat; specific heat of solid, liquid & gases. Heat gained and heat loss-simple problems.
36.	ALLIED TRADE: TURNING Plain turning, stepped turning, Taper turning with different method.	Safety precaution for Lathes. Description of parts of Lathe & its accessories. Method of using precision measuring instrument such as	Work- unit of work, energy-power unit of power in MKS & BSI units. Applied problems.

		inside & outside micrometers, depth gauges, vernier, callipers dial indicators, slip gauges, sine bars, universal bevel protractor, etc.	
37. & 38	ALLIED TRADE: MACHINIST Use of jigs and fixtures. Simple operations on milling machine such as plain milling and key way cutting. Marking out castings and forgings. Setting up & operation of shaping, slotting and planning machines.	Brief Description of milling, shaping, slotting and planning machines. Quick return mechanism of these machines.	Meaning of friction examples. Co-efficient of friction. simple problems Limiting friction, Friction, inclined plane-problems.
39.	ALLIED TRADE: SHEET METAL 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.	Determination of efficiency of simple machine like winch, pulley blocks, wheel and compound axle.
40.	ALLIED TRADE: WELDING Use of hand tools used in Gas and in electric welding. Welding of object by gas and electric according to drawing.	Names 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.	Calculation of areas of triangles, polygons with the aid of trigonometry.
41.	ALLIED TRADE: ELECTRICIAN Familiarisation with the measuring instruments, machinery and panels used in Electrician trade.	A.C. & D.C. Motors, Generators of common types and their uses. Names and brief description of common equipment necessary for sheet metal work.	Electricity its uses; Electric-current; Positive & negative terminals, uses of switches and fuses, conductors and insulators.
42.	ALLIED TRADE: I.C. ENGINE Familiarisation & Identification of different parts of i.e. Engines (Both spark ignition and 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.	Plotting and reading of simple graphs.
43 & 44	Tracing Exercises on tracing paper and Tracing cloth. Ammonia printing with the help of machine.	Types of Ferro-printing papers. Specification of Sensitised. Ammonia Papers-Expiry-precautions in Ammonia Printing.	REVISION
45. & 51	PRACTCE ON COMPUTER Practice on two useful software viz. MS-Word & MS Excel, MS Office & operating system software. Installation of Auto CAD (Latest Version) in the computer. Launching Auto CAD from windows and exiting from Auto	Introduction to computer-DOS, windows and Introduction to AUTO CAD. Related Theory	REVISION & TEST

	CAD. Familiarisation with Auto CAD, main Menu, screen menu, command windows, UCS standard tool bar, model space, etc. Creating simple geometrical entities using different option under DRAW menu viz. line, construction line, ray, multi line, polygon, rectangle, arc, circle, ellipse, etc Editing drawings using different options under modify menu –erase, copy,move,trim,rotate,offset,array ,stretch,lengthen,scale,champher, fillet,break,extend,mirror .		

52 INTERNAL TEST & INDUSTRIAL VISIT

ACHIEVEMENT

The Trainees should be able to:

(i) Use Forger hand tool, forging of simple jobs.
(ii) Use fitters hand tools and measuring instruments.
(iii) Carry out simple operations on shaping, and milling machines.
(iv) Carry out simple operation on Lathe.
(v) Use of sheet metal work and tools, Elementary knowledge of gas and gas welding.
(vi) Elementary knowledge of electrician trade and to be able to identify the different parts of I.C. engine.

1	2	3	4
53.	Handling of Inking instruments.	Procedure of inking a drawing, Conventional colours used for different metals as per I.S.I. materials and equipment for colouring procedure.	Meaning of (metric) Horse Power. Use of SI unit of power i.e. Watt, KW, and MW. Problems on work energy & power using B.I.S units only.
54.	Drawing of a Rams bottom & safety Valve in pencil. Inking and colouring the same.	Related theory	Meaning of (metric) Horse Power. Use of SI unit of power i.e. Watt, KW, MW problems on work energy & power using & B.I.S units only.
55.	Drawing of screw jack (Details and assembly) Preparation of tracing from the drawing on tracing paper by ink.	Necessities of training, equipment and materials (both conventional and modern like rotring pen etc.) required for training procedure for tracing, specification of Tracing paper.	Practice in the use of Logarithmic tables for multiplication, division square, cube, square root, cube root etc. simultaneous use of an electronic scientific calculator.
56.	Drawing of plumber block (Details and assembly). Preparation of tracing from the drawing on tracing cloth	Procedure of tracing on tracing cloth and specification of tracing cloth.	-do-

57	Working drawing of a simple bearing a Foot step bearing pedestal bearing.	Types of assembly drawing. Different types of detailed drawings and preparation of bill of materials.	Working cost simple bills of materials from a working drawing.
58.	Details and assembly drawing of a angular plammer block.	Use of bearing, types of bearing and materials used.	Working cost simple bills of materials from a working drawing.
59.	Details and assembly drawing of Roller and Ball bearing including tapered roller bearing.	Difference between frictional and antifriction bearing. Advantages of antifrictional bearing over frictional bearing. Materials and proportion of parts for drawing purposes	Brief description of properties & uses of copper, aluminium, brass etc.
60.	Pulleys-solid, stepped and built up pulleys.	Belts-power transmitted by belt. Materials of belts slip and creep Velocity of belt. Arc of contact.	Properties and uses of lead, tin, zinc, bronze.
61.	Pulleys-pulley with different types of arms, rope pulleys, belt pulleys and drive.	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.	Properties and uses of different Structure of ferrous metals types of steel.
62.	Working drawing of coupling (Muff coupling, flange coupling, friction grip coupling)	Necessity of coupling. Types uses and proportion of different types of couplings. Materials used for couplings.	Structure of ferrous metals Ferrite, Peerlite, Cementite, etc.
63.	Working drawing of coupling (claw coupling, universal coupling, knuckle joint).	Heat treatment of steel.	-do-

ACHIEVEMENT

The Trainees should be able to

(i) Prepare free hand sketches from existing machine parts. Inking and colouring the drawing. Tracing a drawing on both tracing paper and cloth.

(ii) Draw details & assembly drawings of machine parts like coupling bearing, pulleys etc.

64.	Application of shade lines on machine drawings.	Shade lines & their use on machine drawings. Conventional method for drawings shade lines, surface shading by means of lines.	Definition of pressure, unit of pressure. Atmospheric pressure gauge pressure and absolute pressure in MKS and SI unit.
65.	Pipe fittings flanges, unions , valves, etc.	Piping materials and specifications of W.I. & Steel pipes. Pipe threads pipe fittings. Specifications of fittings.	Design considerations of pipes, longitudinal stress and circumferential stress.
66.	Different types of pipes layout systems.	-Do-	Calculation of weight of various products (whose drawings are given) & related costs.
67.	Different types of pipe joints.	Brief description of different types	-Do-

		of pipe joints.	
68 & 69.	Working drawings of gears such as spur, 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 odontograph for drawing profile of gears etc.	Gear elements, transmission of power by gear. Velocity radio Simple problems.
70 & 71.	Cams with different motions to followers, different types of followers - Drawing.	Use of cams in industry. Types of cam, kinds of motion, displacement diagrams. Terms used in cam. Types of followers.	Simple problems involving trigonometric functions. Height and Distance problems with trigonometrical ratios.
72.	Working drawings of Eccentrics. Piston (I.C.C. Engines) with the application of tolerances.	Related theories.	Density of solids & liquids, simple experimental determination.
73.	Working drawings of connecting rods (I.C. Engine) with the application of tolerances.	Brief description of petrol, diesel and gas engines.	Specific gravity principal of Archimedes, Relation between specific gravity & density, simple experimental determination.
74.	Valve: such as lever safety valve, Dead wt. safety valve.	Working principle of valves and their description.	Experimental determination of equilibrium on Lever, Lever transmission.
75.	Assembly drawing of a reciprocating pump.	Brief description and function of reciprocating & centrifugal pump and water turbines.	Experimental determination of forces acting on inclined plane.
76.	Sketching and drawing of a tail stock. On the spot sketching to be done.	Brief description, working principle and function of hydraulic jack, press accumulator, ram etc. PROGRESS TEST	Experimental determination of work & friction, co-efficient of friction.

ACHIEVEMENT

The Trainees should be able to :

(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 parts and engine parts.

77.	Electrical and Electronic symbols and simple wiring diagrams.	Electrical units and quantities. Laws of electricity. Simple examples of calculation of current voltage, resistance in series and parallel connection (D.C.Circuit).	Experiments on voltage and its measurement series & parallel connection.
78.	Detailed drawing of a built up and north light roof truss elevated gallery for a workshop.	Structural Steel B.I.S. Specification for rolled sections. Structural steel roof trusses, truss joints and supports.	Triangle of forces & parallelogram of forces simple problems.
79.	Drawing of a drilling Jig	Different locating methods clamping devices.	-do-
80.	Detailed drawing of a milling	Different locating methods	Resolution and composition of

	fixture	clamping devices.	forces.
81.	Practice in designing a simple drilling Jig for drilling holes in a given component.	Lay out of Machine foundations. Brief treatment of the principal involved and the precautions to be observed. Lay out of machine foundation.	Representation of the forces by vectors, simple problems of lifting tackle, like jib crane, wall crane etc. & solution of problem with the aid of vectors.
82.	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-
83.	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.	Examples on simply supported beams and cantilevers with dead loads uniformly distributed loads. B.M., S.F. diagrams.
84.	Blow off crock & simple carburettor.	Working of Blow off cock & simple carburettor.	-do-
85.	Making foundation drawing for machinery section of Rolled Steel Joist and beams. Simple plate girder and built up trusses.	General arrangements of drawing, standard method of drawing.	-do-
86.	Sketching & Assembly Drg. of Machine Swivel vice & pipe vice.	Numbering of drawings and standard parts. Familiarisation with B I.S. 696.	-do-
87.	-do-	-do- PROGRESS TEST	-do-

ACHIEVEMENT

The Trainees should be able to :

(i) Draw working drawings of Jigs, fixtures, gauges, press tools.
(ii) Draw welding drawings, use of welding symbols on drawings.
(iii) Draw foundations drawings f0r machinery.
(iv) Draw and sketch assembly drawing of Bench Drilling and slotting machines.

Theory & Practical

88 to 91

Familiarisation with different options for creating dimensions & adding text to Drawings.
Creating Drawings in different layers, line type & colour under Format menu.
Creating sectional Drawing and adding different types of pattern under Hatch command in draw menu.
Analysing the Drawing using inquiry option under Tools menu.
Working with UCS, understanding meaning of WCS, UCS, shifting & rotating the Co-ordinate System, with the help of UCS option under Tools menu.
Creating isometric drawing from orthographic views & vice versa.
Controlling display of drawing using Zoom option under view menu.
Editing properties of the drawing under Modify menu.
Editing dimension & tolerance styles under Format menu
Making block under Draw menu & inserting block under Insert menu
Setting up of drawing limits, units & scale under Format & View menu

Creating layout, page set up & plotting a drawing from File menu.
Getting help from Help menu.

1	2	3	4
92 to 96.	Preparation of Detailed drawings from Assembly. Drawings of simple Machine parts such as : Tool Post of Shaping machine, head stock etc.Valves-Non-return and safety valves.	Production of interchangeable parts, Fits Limits, tolerance & familiarisation with IS-919 & IS 2709. Different methods of showing machine surfaces on drawings.	
97 & 98.	Making working drawing of projects.	Familiarisation with : IS-1444 (Drg. Board) IS-1360 (T-Sqr.) IS-1561 (Set Sqr.) IS-696 (Code of Engg. Drg.)	Revision

99. Industrial cum study Tour at least three different types of Industries having big drawing and design offices.

100.	Test	Test	Test
101.	Open discussion on the basis of difficulties and weaknesses of students as disclosed by the test.		
102.	Revision	Revision	Revision
103.	Revision	Revision	Revision
104.	Final Examination	Final Examination	Final Examination

Note: 1. An effort should be made to ensure that the work is done in trade drawing, that the trainees are prepared for the industrial drawing office. The drawing exercises must introduce the trainees to the current Industrial techniques. Such as the use of symbols and separate drawings for the various processes like casting, forging, machining. The trainees are required to go through reference books and standard specifications to find dimensional data required to complete drawing. Practice should be given on modern drawing tools and equipment which are used by progressive industrial establishment, like drafting m/cs Rotoring-inking pens etc. Practice should be given in measuring components and producing working drawing from the dimensions taken. Trainees should be sent to the workshop to measure and sketch components and then return to their drawing hall to make working drawings.

2. For Allied training according to the syllabus, the facilities available in the institutes should be utilised. The trainees may be rotated according to the schedule prepared by the Section In charge in consultation With the Instructors of different trades concerned. No additional equipment for allied training have been provided separately. The syllabus given above is a guide for the Instructor and the schedule of training will depend on the facilities available in the Institute concerned.

3. In the syllabus, names of a number of objects to be drawn have been mentioned in various weeks. These are only examples and should be taken as a guide for instruction.

FINAL ACHIEVEMENT

The Trainees should be able:

(a) To prepare working drawing of machine parts and components independently taking sketches from the shop floor.
(b) To prepare a complete project drawing independently.
(c) To reproduce the drawing by making tracing and taking prints.
(d) To record and preserve the drawing prepared in the section.
(e) To make simple design of machine parts and simple jigs and fixtures.
(f) To calculate the weight and cost of simple machine components.
(g) To follow the different processes involved in course of manufacturing different mechanical components.
(h) To follow the latest Indian Standard specification related to trade.
(i) To understand the basic concept of Computer.
(j) To draw drawing by using CAD.

LIST OF TOOLS & EQUIPMENT FOR A BATCH OF 16 TRAINEES

Sl.No.	Description	Quantity
	TRAINEES KIT	
1.	Draughtsman Drawing instrument Box containing compasses with Pencil point, point driver, interchangeable, divider penpoint interchangeable, divider spring bow, pen spring bow lengthening bar, pen drawing liner, screw driver instrument, tube with leads,	16 sets
2.	Scale set card board in case (Metric)	16 sets
3.	Set square celluloid 45° (250 x 1.5 mm)	16 sets
4.	-do- 60° (do)	16 sets
5.	French-curves (set of 12 celluloid)	16 sets
6.	Drawing Board (700 x 500 IS: 1444	16 nos.
7.	Tee-Square (700 mm blade) IS: 1360	16 nos.
8.	Steel Rule 300 mm (inches and millimetres)	16 nos.
	GENERAL OUTFIT	
1.	Mini Drafter	16 nos.
2.	Rotring Pens (0.1 to 0.7)	8+2 nos.
3.	Plastic models for development and geometrical solids	2 sets
4.	Universal Drafting Machine 1500 x 1000 mm complete with Accessories.	2 nos.
5. A)	Computer (Pentium IV) Latest version compatible with the latest version of the software GB-HDD, 1.7 GHz CPU, 52xCD ROM,15" Colour Monitor, KB+Mouse	8 nos.
B)	Server (True Dedicated Server)	1 no.
C)	Software: MS-Office 2000 or latest version Auto-CAD 2000 with power pack or latest version	8 users licenced
D)	Plotter (Max. A3 size)	1 No.
E)	LaserJet printer Latest model 1200x1200 dpi, 16 MB	1 no.
F)	UPS - 5 KVA	2 Nos.

6.	Wooden Geometry Box for Black-board work	1 set
7.	Chest of drawers (8 drawers)	2 nos.
8.	Ammonia Printing Machine (continuous type)	1 no.
9.	Caliper Outside 150 mm (Spring)	8 nos.
10.	Caliper Inside 150 mm (Spring)	8 nos.
11.	Stencil set complete in box	2 sets
12.	Steel tape 2 meters (Pull type)	1 no.
13.	Radius and Fillet templates	1 set
14.	Drawing table	16 nos.
15.	Stools	16 nos.
16.	Print Trimmer 1050 mm cutting edge	1 no.
17.	Chalk Board (Roll type)	1 no.
18.	Instructor Desk	1 no.
19.	Instructor Chair	1 no.
20.	Almirah Steel	2 Nos.
21.	OHP Should be provided in each class room	1 no.
22.	Computer table	8 Nos.
23.	Computer chairs	16 Nos.
24.	Table for server printers	1 No. each
25	L.C.D. Projector (Optional)	1 no.
26	White board for using L.C.D. Projector (Optional)	1 no.

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 8 under trainee's kit.

LIST OF REFERENCE BOOKS
TRADE: D/MAN (MECHANICAL)

1. Engineering Drawing and Graphic Technology by Toomas E. Frenco and Charles, J. Vierek-Mcgraw-Hill Book Company
2. Elementary Engineering Drawing –N.D. Bhatt,- Character Book Stall, Anand India.
3. Geometrical Drawing for Beginners – D.N. Ghosh – Dhanpat Rai & Sons, Delhi-6.
4. Engineering Drawing with worked Examples – F. Pickup and M.A. Penken –Hutchinason Education.
5. The Theory and Practice of Drawing in 59 units- A.W. Barnes, A.W. Tilbrook – the English University Press Ltd.
6. Graphics for Engineers – Warren J. Luzadder- Prentice-Hall of India (P) Ltd., New Delhi
7. Manual for D/Man (Mech.)- DGE&T, Min. of Labour, Govt. of India.
8. Simplified Applied Mechanics – D.N. Ghosh-Dhanpat Rai & Sons, Delhi-6.
9. Mechanics for Engineering Students – P.D.S. Verma-Lyall Book Depot, Ludhiana
10. Workshop Science- CSTARI, DGET., Min. of Lab. Govt. of India.
11. Workshop Science – B.R. Das
12. Workshop Calculation – CSTARI, Calcutta, DGET.
13. Elements in Mechanical Engineering- S.K. Hazra Chowdhury & K.P.Roy.
14. IS-696, IS-1561, IS-1444, IS-1360, IS-919 – Indian Standard Institute, New Delhi.
15. Workshop Technology – S.K. Hazra Chowdhury & S.K. Basu
16. Mensuration – Part I & II, - A.E. Pierpoint.
17. Machine Drawing- T. Johns, and T. Johns.
18. Eng. Drg. – R.B. Gupta, Satya Prakashni.
19. Machine Drg.- N. Siddeswar, P. Kanaiya, V.V. Shastri-Megro Hill.
20. Computer
21. Books related with computer auto cad.

SYLLABUS FOR THE TRADE OF

DRAUGHTSMAN (MECHANICAL)
UNDER
APPRENTICESHIP TRAINING SCHEME

PERIOD OF TRAINING – 3 YEARS
(Syllabus for1st year and 2nd year are same as that of under C.T.S.)

TRADE PRACTICAL: 3rd year

1. Practice and review on drafting techniques as per I.S.I. in number of jobs mentioned in the basic training syllabus according to the type of work carried out in the establishment to which he is attached to develop the method of work, speed, accuracy as well as finish.
2. Scaled-assembly to details drawing (without the application of tolerance)- swing table or jig table, Belt drive.
3. Assembly to details drawing (with the inclusion of tolerance) and preparation of working drawing- Simple Tool holder, hand vice.
4. Concept and application of geometrical tolerance with the exercises on harder blue print reading.
5. Working drawing of a worm and worm wheel with complete specifications including tooth details (tabular) surface roughness, from tolerances with special notes.
6. Method of plotting cam diagrams-plate cam, cylindrical cam-development of a cylinder is employed, layout of harmonic motion and constant velocity.
7. Method of preparation of a casting drawing and a forging drawing.
8. Preparation of working drawings from a given assembled component, preparing sketches and transferring measurement and deciding justified tolerance and limits, sealed shaft unit-crane hook standard parts are not to be detailed, References are to be made from standard hand book.
9. preparation of an assembly drawing of different types pumps and compressors from the given details.
10. Preparation of welding drawing of a bracket showing the correct specification of the welding by symbols as per I.S.I.
11. Drawing of a scale layout of piping with pipe fittings-diagrammatic drawing of piping of the above with the standard symbols of the fitting as per I.S.I.
12. Drawing of a single point cutting tool. Preparation of production tool drawings (assembly and details). Detailing of a simple drilling Jig and assembly-plate jig, diameter jig, channel jig-with screw (clamp), bushing leaf jig, tumble jig.
13. Details and assembly of milling fixtures.
14. Details and assembly of a simple piercing and blanking tool.
15. Preparation of Engineering graphs and charts.
16. Reproduction and duplication of Engineering Drawing.
17. Numbering and preservation of drawings.
18. PROJECT DRAWING
    Details and assembly of Bench grinder, a flanged vice making sketches on the shop floor and taking direct dimensions from there.
19. Advanced applications of Auto cad 2 D draft & exposure of 3 D modelling.

TRADE THEORY – 3rd Year

1. Revision of previous years syllabus.
2. Power transmitted by belts, and gears-belt materials, sleep, Creep, velocity of belt, out of contact, width of pulley face, length of belt, velocity ratio and types of gears.
3. Cast and machine cut gears, use of special drawing instrument for drawing profile of gears calculations related to bevel gear, worm and worm wheel.
4. Cams-uses in industry-types-materials-kinds of motion-Types of followings-cam diagrams – timing diagrams terms used-theoretical and working curves.
5. Principle followed for casting drawings and forging drawings.
6. I.C. Eng. Elec. Locomotive parts-purpose, working principle of 2 strokes 4 strokes petrol engine, diesel engine and gas-engine.
7. Pumps-types and function of parts-working principle of different types of pumps.
8. Welding drawings-Method of preparation, essential differences in construction of a part identical in function but made up by C.I . and welding fabrication.
9. Different type of pipe joints, pipe fittings, pipe threads-piping drawings and their dimensioning.
10. Different angles related to a cutting tool-their purposes.
11. Jig and fixtures-types, parts-clamps, locating devices bushing, body etc.-principle of design.
12. Gauges-function, types of templates.
13. Limits fit tolerance and allowance-production of interchangeable parts-selection of fits as per ISI.
14. The fundamental of press work-plain blanking –piercing bending or forming-drawing-coining- Assembling. Parts of die set-punch holder (upper shoe), die holder (lower shoe), guide posts, shanks, bushing. Information related to preparation of a die set-shut height of the die, shank diameter, type and size of press, press stroke.
15. Classification of charts, graphs and diagrams.
16. Blue prints, Ozalid prints (Ammonia print), Photo copies, microfilming drawings, Xerox printing, litho printing.
17. Method of numbering and preserving of drawings. Preparation of the Master register of the drawing.
18. Special instruments used by draughtsman-Proportional dividers, beam compass, ellipsograph, special pens, border pen, contour pen, different curves rotring pens, section liner, lettering devices.
19. Use of engineering catalogues, tables and hand books-finding dimensions by calculation, using table, and charts.

NOTE

1. Duration of the training shall be of three years in the trade under the Apprenticeship Training Scheme of the govt. of India.
2. The content of training during the first year and second year shall be exactly the same as that of the first year and second year respectively of the I.T.I. training in the trade under Craftsman Training Scheme of Govt. of India.
3. All freshers recruited should undergo basic training for two years.
4. Those who have successfully completed two years craftsmen course in the trade from an ITI can also be re recruited for apprenticeship training in which case they will have to undergo third year course only.
5. Syllabus for related instruction is given here. This is also based on the syllabus for the first two years portion.

WORKSHOP SCIENCE AND CALCULATION – (3rd year)

1. Revision of Previous years syllabus.
2. Theory of indices, surds, quadratic equation. Use of logarithm and mathematical tables.
3. Determination of area of sectors, segments, ellipse irregular figures, surface area and volumes of pyramids cone, sphere – their frusta including pyramidal formula.
4. Solution of triangles and problems of height and distance.
5. Calculation on moments, centre of gravity. Moment of inertia and modules of sections. Calculation and drawing of B.M. & S.F. diagrams for simple supported beams and cantilevers with concentrated and uniformly distributed loads, selection of steel joints from hand books for given loading.
6. Use of pocket electronic calculators.
7. Calculation of material and cost from working drawing.
8. Electricity-units-quantities-laws of electricity brief description, working principle and function of a generator, calculation of currents, voltage, resistance in series and parallel D.C. circuit-working principle and function of D.C. and A.C. motor and transformers.
9. Elementary Hydraulics: Pressure of a fluid pressure head of a fluid-total pressure in a surface-centre of pressure, elementary idea of hydraulic press, Hydraulic jacks flow of fluids-velocity and total heads of fluids. Venturi meter flow through orifices and mouths with various co-efficient-loss of head due to friction and other factors of flowing, fluid flow, flow through pipes lines and open channels.

NOTE:

1. The content of syllabus for W/Sc. and calculation during the first year and second year shall be exactly the same as that of the first year and second year respectively of the I.T.I. syllabus in the trade under craftsman training scheme of Govt.of India.

2. Syllabus for W/Sc. and calculation is given here only for the third year. This is also based on the syllabus for the first two years portion.

SOCIAL STUDIES

The syllabus had already been approved and is same for all the trades.