

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**Course Title: Mechanical Drafting
(Code: 3321901)**

Diploma Programmes in which this course is offered	Semester in which offered
Mechanical Engineering, Mechatronics Engineering	Second Semester

1. RATIONALE:

The students of mechanical engineering programme are mainly involved in drafting, manufacturing, inspection and planning activities (such as preparing process plan, preparing bill of materials, etc.) at industries. For all such activities, reference documents are drawings only. In this context only, it is of utmost priority to prepare, read and interpret these drawings very correctly. The industrial practices of drafting are also important for the students since drafting practices and symbols are in accordance with codes, norms and standards. Development of sketching ability also strengthens effective engineering communication & presentation.

2. LIST OF COMPETENCIES:

- a: Prepare engineering drawings using codes, norms and standards.
- b: Interpret basic engineering drawings for various planning, inspection and manufacturing activities.

3. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	
2	0	6	8	70	30	40	60	200

Legends: L-Lecture; T ó Tutorial/Teacher Guided Student Activity; P - Practical;
C ó Credit; ESE - End Semester Examination; PA - Progressive Assessment.

4. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes	Sub-topics
UNIT – 1 MULTIVIEW REPRESENTATION	1a.Draw isometric and multiviews of an object. 1b.Interpret multiviews drawings.	1.1 First & third angle projection methods and positions of six views. 1.2 Multi view drawings (all six views) from given isometrics drawing / physical object. 1.3 Missing view drawings from given adequate orthographic views.
UNIT– 2 SECTIONAL ORTHOGRAPHICS	2a.Draw sectional view/s of an object. 2b.Interpret sectional views.	2.1 Need of sections. 2.2 Section lines and cutting plane. 2.3 Rules for sectioning and section lines. 2.4 Types of sections- full, half, revolved, removed, partial, off-set, aligned. 2.5 Sectional view drawings from given isometrics drawing / physical object and cutting plane conditions.
UNIT– 3 PROJECTIONS AND SECTIONS OF SOLIDS	3a.Draw sectional views of different solids. 3b.Interpret sectional views of different solids.	3.1 Types and dimensional specifications of solids (prism, pyramid, cylinder, cone). 3.2 Projections of solids - in various positions with respect to the reference planes.(Parallel, perpendicular and inclined to HP and / or VP.) 3.3 Sectional views of different solids in given various positions. 3.4 True shape of section.
UNIT– 4 INTERSECTION AND PENETRATION	4a.Draw intersectional view/s of an object.	4.1 Importance and field use. 4.2 Intersection curve for Intersection / penetration of : i. Prism into prism. ii. Cylinder into cylinder. iii. Cylinder into prism. iv. Cone into cylinder.
UNIT– 5 SURFACE DEVELOPMENT	5a.Develop the surface requirement of given application.	5.1 Importance of development of surfaces. 5.2 Drawing of development of surfaces of prism, pyramid, cylinder and cone ó independent, sectioned and combination.
UNIT– 6 DRAFTING SYMBOLS	6a.Use & Interpret drafting symbols.	6.1 Machining symbol and its interpretation. 6.2 Geometrical symbols and its interpretation. 6.3 Other drafting symbols like threading, dowels, pins, ribs, bearings, etc. 6.4 Notes in drawing like heat treatment conditions, surface conditions, assembly notes, etc.

		(All symbols as per BIS).
UNIT- 7 WELDED JOINTS, PIPING & DUCT LAYOUTS	7a.Draw & interpret weld joints, piping layout and duct drawings. 7b.Interpret Process flow diagram & piping isometrics	7.1 Weld symbols as per BIS-813 / ASME (primary symbols & supplementary symbols). 7.2 Weld nomenclature. 7.3 Weld dimensions. 7.4 Welding drawing interpretations. (like simple heat exchangers, pressure vessels, etc.) 7.5 Pipe-types, standards and designation methods. 7.6 Pipe line symbol as per passing fluid, air, gas, water etc. 7.7 Piping fitting symbols. 7.8 Pipe line diagram. 7.9 Interpretation of Process flow diagram & piping isometrics & pipe schedule chart. 7.10 Ducts-types and applications. 7.11 Duct layout.
UNIT- 8 DETAILS & ASSEMBLY	8a.Prepare and interpret details and assembly drawing. 8b.Workout material requirement from the given drawing.	8.1 Importance and difference. 8.2 Details drawing from given assembly. 8.3 Assembly drawings from given details. 8.4 Preparing bill of material (part list).
UNIT- 9 FASTENERS	9a.Use appropriate fasteners for given situations.	9.1 Detachable & permanent fasteners. 9.2 Sketches of threads (square, acme, knuckle, Internal & external threads, Left hand & right hand threads, Single & multi start threads). 9.3 Sketches of studs (cap screws, machine screws, set screws). 9.4 Sketches of bolts & nut (hexagonal, square). 9.5 Sketches of rivets (snap, pan, countersunk, conical). 9.6 Sketches of keys.

5. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Multiviews representations	3	0	0	07	07
2.	Sectional orthographic	3	0	0	07	07
3.	Projections and sections of solids	4	0	0	07	07
4.	Intersection and penetration of solids and surfaces	6	0	5	07	12
5.	Surface development	4	0	0	07	07
6.	Drafting symbols	2	5	0	00	05
7.	Welded joints and Piping Layouts	4	2	2	04	08
8.	Details & assembly	2	2		10	12
9.	Fasteners	-	5	0	00	05
	Total	28	14	7	49	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels.

NOTES:

- a:** If midsem test is part of continuous evaluation, unit numbers 1, 2, 3 and 5 are to be considered. It is also compulsory for student to complete ex.no.1 to 5 and 7 to eligible for midsem test.
- b:** Ask the questions from each topic as per marks weightage. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of questions will be equal to marks allotted to each topic.

6. LIST OF EXERCISES:

This is the list of minimum sheets to be drawn.

Ex. No.	Unit No.	Exercises	HOURS
1	1	<p>MULTIVIEWS:</p> <p>a: Given the pictorial view, draw multiviews.-Two problems.</p> <p>b: Student will select one object. The same will be measured by student and will draw multiviews. The selected object has to be approved by Teacher.</p> <p>(Multiviews include Elevation, Plan, Rear view, Bottom view, Right hand side view and Left hand side view.</p>	08
2	1	<p>MISSING VIEWS:</p> <p>Given adequate minimum views, draw additional view/s as asked.-Three problems.</p>	04

3	2	<p>SECTIONAL VIEWS:</p> <p>a: Given the pictorial view with cutting plane/s, draw the views as asked including sectional view/s.-Two problems.</p> <p>b: Student will select one object. The same will be measured by student and will draw the views as asked including sectional view/s. The selected object has to be approved by Teacher.</p>	06
4	3	<p>PROJECTIONS OF SOLIDS:</p> <p>Draw the projection of solids- 4 problems.(1-Prism, 1-Pyramid, 1-Cylinder and 1-Cone.). (With varied dimensions. Refer Note d.)</p>	06
5	3	<p>SECTIONS OF SOLIDS:</p> <p>Draw the sections of solids. Also draw true shape of each sections-4 problems.(1-Prism,1-Pyramid,1-Cylinder and 1-Cone.) (With varied dimensions. Refer Note d.)</p>	08
6	4	<p>PENETRATION AND INTERSECTION:</p> <p>Draw the intersection curves- 4 problems.(Prism into prism. Cylinder into cylinder, Cylinder into prism, Cone into cylinder. (With varied dimensions. Refer Note d.)</p>	08
7	5	<p>SURFACE DEVELOPMENT:</p> <p>Draw development of surface of prism, pyramid, cylinder and cone ó independent, sectioned and combination.-Total 4 problems. (With varied dimensions. Refer Note d.)</p>	04
8	7	<p>WELD JOINT ASSEMBLY:</p> <p>Draw the weld joint drawing with weld symbols and nomenclature. Take minimum 3 parts for weld joint assembly.</p>	08
9	7	<p>PIPING LAYOUT:</p> <p>Prepare piping layout for given application/situation with piping symbols and nomenclature. Also prepare isometric piping layout for the same problem.</p>	08
10	8	<p>DETAILS:</p> <p>Draw the details of all parts for the assembly selected and</p>	12

		sketched as student activity.	
11	8	<p>ASSEMBLY:</p> <p>Draw the assembly of all parts drawn for Sheet No.8. This includes minimum one sectional view. This must also include parts list.</p>	12
12	All	<p>PROBLEM BASED LEARNING:</p> <p>Given the orthographic views of at least three objects with few missing lines, imagine objects and complete the views. Also sketch (free hand) isometrics of them.</p>	-
13	All	<p>SCHOOL WITHIN SCHOOL:</p> <p>a: Explain at least one problem for construction and method of drawing in sheet to all batch colleagues. Teacher will assign the problem of particular sheet to be explained to each batch student.</p> <p>b: Each student will assess at least one sheet of other students (May be 5-6 students- to be assigned-defined by teacher) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.</p>	-

NOTES:

- a: **Use both sides of sheet. For example, draw sheet number 2 on backside of sheet number 1.**
- b: It is compulsory to perform students' activities.
- c: Submission includes sheets, objects, parts/assembly, drawings got for interpretation, student activities performed and sketch book. (Term work must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written/hand drawn by student only.)
- d: The dimensions of solids-like base dimension/diameter, height, number of sides (for prism and pyramid) must be varied for each student in batch so that each student will have same problem, but with different dimensions.
- e: Ask for 6-8 components assembly only.
- f: Keep 'Westernmann Table' (Revised to Indian Standards, New Age International Publishers) during theory and practice periods.
- g: For 40 marks Practical Marks ESE, students are to be assessed for competencies achieved. Students are to be given data for practical ESE to:
 - i. Prepare drawings.
 - ii. Interpret given drawing/s.
 - iii. Refer and interpret data from data book/codes/standards/ Westernmann Table.

7. LIST OF STUDENT ACTIVITIES:

Following is the list of student activities.

S. No.	Activity No.	Details of student activity
1	1	Solve all problems for sheet number 1 to 7 in sketch book (with dimensions).
2	2	Select two objects. Student will measure and sketch* the same in sketchbook for the reference to draw in sheet. One for MULTIVIEW (Sheet No.1) and another for SECTIONAL VIEWS (Sheet No.3). (*Only freehand isometric sketch with dimensions).
3	3	Select one assembly having minimum 6-8 mechanical related components. Student will measure and sketch the same in sketchbook for the reference to draw details and assembly sheets. This may be in group of 3-4 students. (*Only freehand isometric sketch with dimensions).
4	4	Draw freehand sketches for sheet number 8 to 11 in sketch book.
5	5	Draw various drafting symbols in sketch book. This includes mainly: a: Threading symbols. b: Machining symbols. c: Geometrical symbols d: Welding symbols. e: Piping symbols.
6	6	Get ⁺ minimum one industrial drawing each for following , which are in use by industry: a: Machined component. b: Machined part assembly-6-8 components. c: Welded joint based component /assembly. d: Piping layout. Interpret above all drawings and write your conclusions in sketchbook. + Get by Industrial visits, internet search, reference book, etc.
7	7	Freehand sketches (in sketch book) of various fasteners assigned by teacher.
8	8	List at least two questions each for following cases. List those questions you would like to ask to know / improve further. a: More than six views. b: Combination of different solids. c: Impact of ability of manual drafting on computer aided drafting. d: Intersection and duct layout. e: Correlation between details drawings and assembly drawings.

8. SUGGESTED LEARNING RESOURCES:

A. List of Books.

S.No.	Title of Books	Author	Publication
1	Engineering Drawing.	N.D.Bhatt.	Charotar Publishing House, Anand.
2	Engineering Drawing.	K.R.Gopalakrishna.	Subhash Publications, Banglore.
3	Engineering Drawing.	P.J.Shah.	S.Chand, New Delhi.
4	Engineering Graphics.	M.B.Shah, B.C.Rana.	Pearsons.
5	Machine Drawing.	P. Sidheswar, P. Kannaiah & VVS	Tata-McGraw Hill Publishing Co.Ltd.-New Delhi

S.No.	Title of Books	Author	Publication
1	Engineering Drawing.	N.D.Bhatt.	Charotar Publishing House, Anand.
		Sastry.	
6	Fundamentals of Engineering drawing.	Warren J. Luzadder	Prentice-hall of India Pvt. Ltd.- New Delhi
7	Westernmann Table, Revised to Indian Standards	Jutz, Scharkus.	New Age International Publishers

B. List of Major Equipment/ Instrument.

- a: Models and cut sections.
- b: Various machined parts assemblies.
- c: Various weld joints.
- d: Set of various industrial drawings being used by industries-up dated.
- e: Drawing equipments and instruments for class room teaching-large size.
- f: Drawing board-half imperial size.
- g: T-square or drafter (Drafting Machine).
- h: Set squares (45^0 and 30^0-60^0).
- i: Protector.
- j: Drawing instrument box (containing compasses and divider).
- k: Drawing sheets.
- l: Drawing pencils.
- m: Eraser.
- n: Drawing pins / clips.

C. List of Software/Learning Websites.

- a: <http://mvredp.blogspot.in/2010/04/sections-of-solids-introduction.html>
- b: <http://www.youtube.com/watch?v=P5g5omLoDr8>
- c: <http://engggraphics.wordpress.com/2012/04/10/an-advance-tamil-new-year-gift/>
- d: <http://rgpv-ed.blogspot.in/2009/09/development-of-surfaces.html>
- e: <https://sites.google.com/site/middleschooljghs/graphic-communication/geometric-drawing-and-surface-developments>
- f: <http://www.techdrawingtools.com/12/11201.htm>
- g: <http://www.wermac.org/documents/isometric.html>
- h: <http://www.me.metu.edu.tr/courses/me114/Lectures/assembly.htm>
- i: http://metal.brightcookie.com/2_draw/draw_t1/htm/draw1_2_1.htm
- j: <http://www.ductedreversecycleairconditioning.com.au/category/37165122>

- k: http://www.affordablecomfort.org/images/Events/15/Courses/422/Proctor_TAM07.pdf
- l: http://en.wikipedia.org/wiki/Engineering_drawing
- m: http://www.sevenhills-h.schools.nsw.edu.au/Graphics_TG201/Orthographic/Drawortho.htm
- n: www.design-technology.info
- o: www.studyvilla.com
- p: www.authorstream.com
- q: Computer based learning material published by KOROS.

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE:

1. M.K.Dudharejiya, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.
2. A.M.Talsaniya, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.
3. P.L.Bhogayata, Lecturer in Mechanical Engineering, Sir B.P.I., Bhavnagar.