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 plans, preparing bill of materials, etc.) at industries. For all such activities, reference document is the drawing of components/assemblies to be manufactured. In this context, it is of utmost priority to prepare, read and interpret these drawings correctly for production of components and assemblies accurately and precisely. The industrial practices of drafting are also important for the students to make them aware of drafting practices, symbols, codes, norms and standards generally used in industries. Development of sketching ability also strengthens effective engineering communication & presentation.

2. COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

i. **Prepare engineering drawings using codes, norms and standards.**
ii. **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				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
2	0	6	8	70	30	40	60	200

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS:

Unit	Major Learning Outcomes	Sub-topics
Unit – I **Multi views Representation**	1a. Draw isometric and multi views of an object. 1b. Interpret multi views drawings.	1.1 First & third angle projection methods and positions of six views. 1.2 Multi view drawings (all six views) from given isometric drawing / physical object. 1.3 Missing view drawings from given adequate orthographic views.
Unit– II **Sectional Ortho graphics**	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– III **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– IV **Intersection and Penetration of Solids and Surfaces**	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– V **Development of Surfaces**	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 – independent, sectioned and combination.
Unit– VI **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– VII **Welded Joints, Piping & Duct Layouts**	7a. Draw & interpret weld joints, piping layout and duct drawings. 7b. Interpret Process	7.1 Weld symbols as per BIS-813 / ASME (primary symbols & supplementary symbols). 7.2 Weld nomenclature. 7.3 Weld dimensions.

	flow diagram & piping isometrics	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– VIII **Details & Assembly**	8a. Prepare and interpret detail and assembly drawing. 8b.Workout material requirement from a given drawing.	8.1 Importance and difference of these drwaings. 8.2 Detail drawing from given assembly. 8.3 Assembly drawings from given details. 8.4 Preparing bill of material (part list).
Unit– IX **Fasteners**	9a.Use appropriate fasteners for given situations. b. Draw sketches for different types of fasteners.	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. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I.	Multiviews representation	3	0	0	07	07
II.	Sectional orthographics	3	0	0	07	07
III.	Projections and sections of solids	4	0	0	07	07
IV.	Intersection & penetration of solids & surfaces	6	0	5	07	12
V.	Development of surfaces	4	0	0	07	07
VI.	Drafting symbols	2	5	0	00	05
VII.	Welded joints and Piping Layouts	4	2	2	04	08
VIII.	Details & assembly	2	2	0	09	11
IX.	Fasteners	-	4	0	02	06
	Total	**28**	**13**	**7**	**50**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Notes:

1. This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.
2. 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.
3. 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.

5. SUGGESTED LIST OF PRACTICAL/EXERCISES:

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned expected competency. Following is the list of minimum sheets to be drawn.

Sheet No.	Unit No.	Practical/Exercises	Hours
1	I	**MULTIVIEWS:** a: Given the pictorial view, draw multi views.-Two problems. b: Select one object, measure it and draw multi views. The selected object has to be approved by Teacher. (Multi views include Elevation, Plan, Rear view, Bottom view, Right hand side view and Left hand side view.	08
2	I	**MISSING VIEWS:** Given adequate number of minimum views, draw additional view/s as asked.-Three problems.	04
3	II	**SECTIONAL VIEWS:** a: Given the pictorial view with cutting plane/s, draw the views as asked including sectional view/s.-Two problems. b: Select one object, measure it and draw the views as asked including sectional view/s. The selected object has to be approved by Teacher.	06
4	III	**PROJECTIONS OF SOLIDS:** Draw the projection of solids- 4 problems.(1-Prism, 1-Pyramid, 1-Cylinder and 1-Cone.). (With varied dimensions. Refer Note d.)	06
5	III	**SECTIONS OF SOLIDS:** Draw the sections of solids. Also draw true shape of each sections-4 problems.(1-Prism,1-Pyramid,1-Cylinder and 1-Cone.)	08

		(With varied dimensions. Refer Note d.)	
6	IV	**PENETRATION AND INTERSECTION:** Draw the intersection curves- 4 problems.(Prism into prism, Cylinder into cylinder, Cylinder into prism, Cone into cylinder. (With varied dimensions. Refer Note d.)	08
7	V	**SURFACE DEVELOPMENT:** Draw development of surface of prism, pyramid, cylinder and cone – independent, sectioned and combination.-Total 4 problems. (With varied dimensions. Refer Note d.)	04
8	VII	**WELD JOINT ASSEMBLY:** Draw the weld joint drawing with weld symbols and nomenclature. Take minimum 3 parts for weld joint assembly.	08
9	VII	**PIPING LAYOUT:** Prepare piping layout for given application/situation with piping symbols and nomenclature. Also prepare isometric piping layout for the same problem.	08
10	VIII	**DETAILS:** Draw the details of all parts for the assembly selected and sketched as student activity.	12
11	VIII	**ASSEMBLY:** Draw the assembly of all parts drawn for Sheet No.8. This includes minimum one sectional view and also the parts list.	12
12	All	**PROBLEM BASED LEARNING:** Complete the given orthographic views with few missing lines of at least three objects. Also sketch (free hand) isometrics of them.	-
13	All	**SCHOOL WITHIN SCHOOL:** 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. b: Each student will assess at least one sheet of other students (May be 5-6 students- to be assigned by teacher) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.	-
		Total	**84**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

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 under 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. SUGGESTED LIST OF PROPOSED 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 Sastry.	Tata-McGraw Hill Publishing Co.Ltd.-New Delhi
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.

1. Models and cut sections.
2. Various machined parts assemblies.
3. Various weld joints.
4. Set of various industrial updated drawings being used by industries-.
5. Large size drawing equipments and instruments for class room teaching-.
6. Half imperial size drawing board.
7. T-square or drafter (Drafting Machine).
8. Set squires (45^0 and 30^0-60^0).
9. Protector.
10. Drawing instrument box (containing compasses and divider).
11. Drawing sheets.

12. Drawing pencils.
13. Eraser.
14. Drawing pins / clips.

C. List of Software/Learning Websites.

1. http://mvredp.blogspot.in/2010/04/sections-of-solids-introduction.html
2. http://www.youtube.com/watch?v=P5g5omLoDr8
3. http://engggraphics.wordpress.com/2012/04/10/an-advance-tamil-new-year-gift/
4. http://rgpv-ed.blogspot.in/2009/09/development-of-surfaces.html
5. https://sites.google.com/site/middleschooljghs/graphic-communication/geometric-drawing-and-surface-developments
6. http://www.techdrawingtools.com/12/l1201.htm
7. http://www.wermac.org/documents/isometric.html
8. http://www.me.metu.edu.tr/courses/me114/Lectures/assembly.htm
9. http://metal.brightcookie.com/2_draw/draw_t1/htm/draw1_2_1.htm
10. http://www.ductedreversecycleairconditioning.com.au/category/37165122
11. http://www.affordablecomfort.org/images/Events/15/Courses/422/Proctor_TAM07.pdf
12. http://en.wikipedia.org/wiki/Engineering_drawing
13. http://www.sevenhills-h.schools.nsw.edu.au/Graphics_TG201/Orthographic/Drawortho.htm
14. www.design-technology.info
15. www.studyvilla.com
16. www.authorstream.com
17. Computer based learning material published by KOROS.

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

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

Co-ordinator and Faculty Member from NITTTR Bhopal

1. **Prof. Sharad Pradhan**, Associate Professor, Dept. of Mechanical Engineering,