

Program Name : Diploma in Mechanical Engineering
Program Code : ME
Semester : Third
Course Title : Mechanical Working Drawing
Course Code : 22341

1. RATIONALE

A Mechanical Engineering Diploma holder, irrespective of his field of operation in an industry, is expected to possess a thorough understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings. The course aims at developing the ability to visualize and draw curves of intersection and develop lateral surfaces of various solids. Knowledge of conventional representation, limits, fits and tolerances, geometrical tolerances, surface roughness representation are also included in the course which helps in reading and drawing various production drawings. In industry, the components are manufacture on the basis of their detailed drawings. Theses drawings comprise of all the information required to produce the component. The course aims to develop ability to visualize and draw assembly and detail drawings. This course envisages reinforcing and enhancing the knowledge and skill acquired in the earlier two courses viz. Engineering Graphics & Engineering Drawing.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Interpret and prepare mechanical working drawing /production drawing of a given component.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Draw development of lateral surface of various solids.
- Draw intersection curves of different solids.
- Use various drawing codes, conventions and symbols as per IS SP-46.
- Draw production drawings used to produce products.
- Draw assembly and detailed drawings of products.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	4	7	4	70	28	30*	00	100	40	50@	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
Sheet No.:1			
1	Develop surfaces of solids like cube, prisms, cylinders, pyramids. (Part I)		
2	Develop surfaces of solids like pyramids, cones. (Part II)	I	02
Sheet No.:2			
3	Draw curves of intersection of any two objects like Prism with prism(Tri-angular and square), Cylinder with cylinder, Square Prism with Cylinder, Cylinder with Cone. (Part I)	II	02
4	Draw curves of intersection of any two objects like Prism with prism(Tri-angular and square), Cylinder with cylinder, Square Prism with Cylinder, Cylinder with Cone. (Part II)	II	02
5	Draw curves of intersection of any two objects like Prism with prism(Tri-angular and square), Cylinder with cylinder, Square Prism with Cylinder, Cylinder with Cone. (Part III)	II	02
6	Draw curves of intersection of any two objects like Prism with prism(Tri-angular and square), Cylinder with cylinder, Square Prism with Cylinder, Cylinder with Cone. (Part IV)	II	02
Sheet No.:3			
7	Draw various Conventional Representations as per SP – 46 (1988) (Part I)	III	02
8	Draw various Conventional Representations as per SP – 46 (1988) (Part II)	III	02
9	Draw various Conventional Representations as per SP – 46 (1988) (Part III)	III	02
Sheet No.:4			
10	Draw Dimensional and Geometrical Tolerances, welding symbols, surface roughness and Machining Symbols on given figures and tables. (Part I)	IV	02
11	Draw Dimensional and Geometrical Tolerances, welding symbols, surface roughness and Machining Symbols on given figures and tables. (Part II)	IV	02
12	Draw Dimensional and Geometrical Tolerances, welding symbols, surface roughness and Machining Symbols on given figures and tables. (Part III)	IV	02
Sheet No.:5			
13	Develop Production drawing of at least two machine components showing dimensional and geometrical tolerance, surface finish etc. (Part I)	IV	02
14	Develop Production drawing of at least two machine components showing dimensional and geometrical tolerance, surface finish etc. (Part II)	IV	02
15	Develop Production drawing of at least two machine components showing dimensional and geometrical tolerance, surface finish etc. (Part III)	IV	02
16	Develop Production drawing of at least two machine components showing dimensional and geometrical tolerance, surface finish etc.	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	conventional representation, Dimensional and Geometrical tolerances and surface finish symbols. (Part VII)		
32	Draw detailed drawings from given assembly drawing showing conventional representation, Dimensional and Geometrical tolerances and surface finish symbols. (Part VIII)	VI	02
	Total		64

Note:

- i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, all practicals are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1.	Interpretation of given problem	20
2.	Draw sheet using different drafting instrument	35
3.	Follow line work for neat and accurate drafting	10
4.	Dimensioning the given drawing and writing text	10
5.	Answers to sheet related questions	10
6.	Submit the assigned sheet on time	5
7.	Follow cleanliness and housekeeping in Drawing Hall	5
8.	Attendance and punctuality	5
	TOTAL	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Use drawing instruments safely.
- b. Practice cleanliness and neatness.
- c. Follow ethics and standards.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.



	<p>given Mechanical working Drawing.</p> <p>3c. Use standard conventions in practice.</p>	<p>common features like slotted head, radial rib, knurling, serrated shaft, splined shaft, ratchet and pinion, repeated parts, square on shafts, holes on circular pitch, internal and external thread.</p> <p>3.3 Conventional representation of standard parts like ball and roller bearing, gears, springs.</p> <p>3.4 Pipe joints and valves.</p> <p>3.5 Counter sunk and Counter bored holes.</p> <p>3.6 Tapers (As per standard conventions using IS SP – 46 (1988)</p>
<p>Unit– IV Production Drawings</p>	<p>4a. Calculate tolerances on the given machine components.</p> <p>4b. Identify fit required between mating parts of machine components based on the given tolerance values.</p> <p>4c. Interpret welding symbols in the given working drawing.</p> <p>4d. Interpret surface roughness characteristics from the values the given on component drawing.</p> <p>4e. Draw above conventional representations for the given situation.</p>	<p>4.1 Limits, Fits and Tolerances:</p> <p>a) Definitions, introductions to ISO system of Tolerance.</p> <p>b) Dimensional tolerances:-Terminology, selection and representation of dimensional tolerance- number and grade method. Definitions concerning Tolerancing and Limits system, unilateral and bilateral tolerance, Hole and shaft base systems, Types of fits- Clearance, transition and Interference, Selection of fit for engineering applications. Calculation of limit sizes and identification of type of fit from the given sizes like $\text{Ø}50\text{ H}7/\text{s}6$, $\text{Ø}30\text{ H}7/\text{d}9$ etc.</p> <p>4.2 Geometrical Tolerances: Types of geometrical tolerances, terminology for deviation, representation of geometrical tolerance on drawing.</p> <p>4.3 General welding symbols, length and size of weld, surface contour and finish of weld, all round and site weld, symbolic representation in Engineering practices and its interpretation.</p> <p>4.4 Machining symbol and surface texture: Indication of machining symbol showing direction of lay, sampling length, roughness grades, machining allowances, manufacturing methods. Representation of surface roughness on drawing.</p>



distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Student should maintain a separate A3 size sketch book which will be the part of term work and submit it along with drawing sheets. Following assignment should be drawn in the sketch book
 - i. Minimum 5 problems each on Unit No I and II.
 - ii. Minimum 2 problems each on Unit No III to VI.

Note- Problems on sheet and in the sketch book should be different.
- b. Students should collect Production drawings from nearby workshops/industries and try to visualize the part from the given views.
- c. Prepare paper models of development of lateral surfaces of solids
- d. Visit any sheet metal workshop and prepare a report related to type of components, dimensions, material, area of application, raw material required, name of operations performed.
- e. Prepare clay/ paper models of solids showing curves of intersection

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- a. Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b. '**L**' in **section No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects
- f. Demonstrate students thoroughly before they start doing the practice.
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students during practice.
- i. Arrange visit to nearby industries and workshops for understanding various production drawings.
- j. Show video, animation films, solid modeling software to explain intersection of solid, Assembly and details
- k. Prepare wall charts for Dimensional and Geometrical Tolerances.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in



- i. http://www.youtube.com/watch?v=_M5eYB6056M
- j. <http://www.youtube.com/watch?v=UyROI-bAMu4>
- k. <http://www.youtube.com/watch?v=eix8xbqb93s>
- l. <http://www.youtube.com/watch?v=kWOl6ttDTBc>
- m. <http://www.youtube.com/watch?v=gJbrO2jtoa8&feature=related>
- n. <http://www.youtube.com/watch?v=PXgkBadGHEE>
- o. Engineering Graphics & Drawing v 1.0 from Cognifront
- p. <http://npkauto.com/assignments>

