MACHINE DRAWING

ENME 152

Lecture : 2 **Year : I**
Tutorial : 4 **Part : II**
Practical : 0

Course Objectives:
To enable to prepare working drawings and use computer aided drafting software for producing two dimensional and three-dimensional drawings.

1 Limit Dimensioning and Machining Symbols (2 hours)

- 1.1 Limit-fit system
  - 1.1.1 Basic terminologies of limit-fit system
  - 1.1.2 Tolerances, methods of placing tolerances on a drawing
  - 1.1.3 Fit, types of fit, systems of fit
  - 1.1.4 ISO system of limits and fits
  - 1.1.5 Selection and calculation of limits, fits and tolerances
- 1.2 Geometrical tolerances
  - 1.2.1 Basic terminologies of geometrical tolerances
  - 1.2.2 Symbols of geometric tolerances and placement on a drawing
- 1.3 Surface roughness and machining symbols
  - 1.3.1 Basic terminologies associated with surface quality and surface roughness profile
  - 1.3.2 Surface roughness number, surface roughness and machining symbols
  - 1.3.3 Roughness grade number and grade symbols
  - 1.3.4 Symbols for direction of lay

2 Threads, Bolts Studs and Nuts (2 hours)

- 2.1 Thread terms and nomenclature, forms of screw threads
- 2.2 Detailed and simplified representation of internal and external threads
- 2.3 Thread dimensioning
- 2.4 Standard bolts and nuts: Hexagonal head and square head
- 2.5 Studs
- 2.6 Locking devices
- 2.7 Screws
- 2.8 Washers
- 2.9 Bolts and nuts for special applications

3 Welding and Riveting (2 hours)

3.1 Riveted joints
- 3.1.1 Rivet and riveting
- 3.1.2 Forms of rivet heads
- 3.1.3 Types of riveted joints
- 3.1.4 Terms associated with riveted joint

3.2 Welded joints
- 3.2.1 Welding and types of welded joints
- 3.2.2 Welded joints symbols
- 3.2.3 Specification of welded joints on drawing

4 Pipe Joints (2 hours)

4.1 Pipe and pipe materials
4.2 Pipe designation
4.3 Pipe threads
4.4 Types of pipe joints
4.5 Valves
4.6 Piping symbols
4.7 Piping layouts: Single line and double line layouts

5 Detail and Assembly Drawings (4 hours)

5.1 Introduction to working drawing
5.2 Components of working drawing: Drawing layout, bill of materials, drawing numbers
5.3 Detail drawing
5.4 Assembly drawing
5.5 Practices of detail and assembly drawing: V-block clamp, centering cone, couplings, bearings, antivibration mounts, stuffing boxes, screw jacks, tool post, expansion joint, turn buckle, coupling puller, vice, C-clamp, tail stock

6 Basic Drawing Commands (2 hours)

6.1 Loading software, screen organization
6.2 Entering commands: Menus, command line, function keys
6.3 Commands and system variables
6.4 Coordinate system: Entering distances and angles
6.5 Basic drawing commands: Creating point, creating straight line and construction line, creating circle, arc and ellipse, creating polygons, creating splines

7 Modifying Commands (2 hours)

7.1 Erasing the object
7.2 Creating multiple objects

7.3 Scaling the object
7.4 Creating chamfer and fillet
7.5 Trimming and extending of the object
7.6 Breaking and dividing
7.7 Modifying colors, styles, etc. of the object

8 Drawing Aids and Tools (2 hours)

8.1 Setting up units and limits
8.2 Using ortho, grids and snap
8.3 Help and undo commands
8.4 Display commands
8.5 Creating isometric drawing

9 Fine Tuning Drawings and Grouping (2 hours)

9.1 Hatching command
9.2 Working with layers
9.3 Creating and inserting blocks

10 Annotations and Dimensions (2 hours)

10.1 Inserting text on drawing
10.2 Dimension styles, dimensioning commands, tolerance, limits, dimension setup, dimension variables, dimension scale

11 Three Dimensional Drawing (6 hours)

11.1 Wireframe, surface and solid modeling
11.2 Creating 3D drawing using thickness and elevation commands
11.3 Solid modeling, standard
11.4 Creating 3D drawing using extrude command
11.5 Standard solid editing commands
11.6 3D Modifying commands: Move, rotate, mirror, array
11.7 Shading and rendering and their options, motion path animations

12 Plotting Drawings (2 hours)

12.1 Layout management
12.2 Plotting 2D and 3D drawings
12.3 Creating multiple views for a 3D drawing

Tutorial (60 hours)

1. Limit, fit, tolerances and surface roughness and machining symbols
2. Threaded joints
3. Welded and riveted joints
4. Pipe joints
5. Detail drawing

6. Assembly drawing
7. 2D Drawing consisting straight lines, circle and arc
8. 2D Drawing consisting ellipse and polygon
9. 2D Drawing using modifying commands
10. Creating isometric, creating hatch, working with layers and blocks
11. Inserting text and dimensions of 2D drawing
12. 3D Drawing: Wireframe, surface and solid modeling
13. 3D Drawing: Solid editing and 3D operations
14. Plotting 2D and 3D drawings
15. Project 1: Drawing of standard mechanical components (Spring, nut bolt, gear, cam profile, etc.)
16. Project 2: Detail drawing
17. Project 3: Assembly drawing

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hour	Mark distribution*
1	2	6
2	2	6
3	2	6
4	2	6
5	4	16
6-12	18	Covered only during Internal evaluation
Total	**30**	**40**

* There may be minor deviation in marks distribution.

References

1. Luzadder, W.J., Duff, J.M. (1989). Fundamentals of engineering drawing (Latest Edition). Prentice-Hall.
2. French, T.E., Vierck, C.J., Foster, R.J. (1993). Engineering drawing and graphic technology (Latest Edition). McGraw-Hill.
3. Luintel, M.C. (2023). Engineering Drawing II. Heritage Publishers & Distributors.
4. Giesecke, F.E., Mitchell, A., Spencer, H.C., Dygdon, J.T. (2021). Technical drawing with engineering graphics. Peachpit Press.
5. Bhatt, N.D. (2022). Machine drawing. Charotar Publishing House.
6. Gill, P.S. (2013). A textbook of machine drawing. S.K. Kataria & Sons.
7. Dhawan, R.K. (2015). A textbook of machine drawing. S. Chand & Co.
8. Kulkarni, D.M., Rastogi, A.P., Sarkar, A.K. (2009). Engineering graphics with AutoCAD. PHI Learning / Prentice Hall.
9. Graham, R., Holland, L. (2011). Mastering AutoCAD Civil 3D: Autodesk Official Training Guide. John Wiley & Sons.