Lab Manual

of

ENGINEERING GRAPHICS - I

Paper Code: ES157

First Semester

B.Tech - All branches

Department of MAE &ME

Maharaja Agrasen Institute of Technology
PSP Area, Sector-22, Rohini,
Delhi-110085

Course Objectives

1. Students will learn the utility of Engineering graphics, various equipment used, various scales, dimensions and BIS codes used while making drawings for various streams of engineering disciplines.
2. Students will learn theory of projections and projection of points.
3. Students will learn projection of lines and projection of planes.
4. Students will learn the projection of solid and development of surfaces.

Course Outcomes (CO)

CO1: To understand the theory of projections and projection of points.

CO2: Ability to do line projections.

CO3: Ability to do plane projections.

CO4: Ability to do solid projections and development of surfaces

CO-PO Mapping

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High												
CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	2	1	2
CO2	3	3	3	3	2	-	-	-	1	2	1	2
CO3	3	3	3	3	2	-	-	-	1	2	1	2
CO4	3	3	3	3	2	-	-	-	1	2	1	2

Syllabus

Unit I

Introduction: Engineering Graphics/Technical Drawing, Introduction to drawing equipments and use of instruments, Conventions in drawing practice. Types of lines and their uses, BIS codes for lines, technical lettering as per BIS codes, Introduction to dimensioning, Types, Concepts of scale drawing, Types of scales

Theory of Projections: Theory of projections, Perspective, Orthographic, System of orthographic projection: in reference to quadrants, Projection of Points, Projection in different quadrants, Projection of point on auxiliary planes. Distance between two points, Illustration through simple Problems.

Unit II

Projection of Lines: Line Parallel to both H.P. and V.P., Parallel to one and inclined to other, Other typical cases: three view projection of straight lines, true length and angle orientation of straight line: rotation method, Trapezoidal method and auxiliary plane method, traces of line.

Unit III

Projection of Planes: Projection of Planes Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, Plane oblique to reference planes, traces of planes.

Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

Unit IV

Projection of Solids: Projection of solids in first or third quadrant, Axis parallel to one and perpendicular to other, Axis parallel to one inclined to other, Axis inclined to both the principal plane, Axis perpendicular to profile plane and parallel to both H.P. and V.P., Visible and invisible details in the projection, Use of rotation and auxiliary plane method.

Development of Surface: Purpose of development, Parallel line, radial line and triangulation method, Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, Development of surface.

Textbooks:

1. Engineering Drawing by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

References:

1. Engineering Drawing by P.S. Gill, S.K Kataria & Sons, New Delhi, 2013.
2. Technical Drawing with Engineering Graphics by Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, and Cindy M. Johnson, 15th Ed., Prentice Hall, USA, 2016
3. Engineering Drawing by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, New Delhi, 2009.

List of Drawing Sheets

Unit 1	Sheet no.1	Alphabets, Dimensioning and Scales: Engineering Graphics/Technical Drawing, Introduction to drawing equipment and use of instruments, Conventions in drawing practice. Types of lines and their uses, BIS codes for lines, technical lettering as per BIS codes, Introduction to dimensioning, Types, Concepts of scale drawing, Types of scales
	Sheet no.2	Projection of Points: Theory of projections, Perspective, Orthographic, System of orthographic projection: in reference to quadrants, Projection of Points, Projection in different quadrants, Projection of point on auxiliary planes. Distance between two points, Illustration through simple problems.
Unit 2	Sheet no.3	Projection of Lines-I: Line Parallel to both H.P. and V.P., Parallel to one and inclined to other, Other typical cases: three view projection of straight lines, true length
	Sheet no.4	Projection of Lines-II: angle orientation of straight line: rotation method, Trapezoidal method and auxiliary plane method, traces of line.
Unit 3	Sheet no.5	Projection of Planes-I: Projection of Planes Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, Plane oblique to reference planes, traces of planes.
	Sheet no.6	Projection of Planes-II: Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.
Unit 4	Sheet no.7	Projection of Solids-I: Projection of solids in first or third quadrant, Axis parallel to one and perpendicular to other, Axis parallel to one inclined to other, Axis inclined to both the principal plane, Axis perpendicular to profile plane and parallel to both H.P. and V.P., Visible and invisible details in the projection, Use of rotation and auxiliary plane method.
	Sheet no.8	Projection of Solids-II Development of Surface: Purpose of development, Parallel line, radial line and triangulation method, Development of prism, cylinder, cone and pyramid surface for both right-angled and oblique solids, Development of surface.
	Sheet no.9	Projection of actual solids

SHEET NO. 1

ALPHABETS, DIMENSIONING AND SCALES

1. Write free hand, in single stroke, vertical capital letters A, C, G, I, K, M, N and W, as provided in table below:

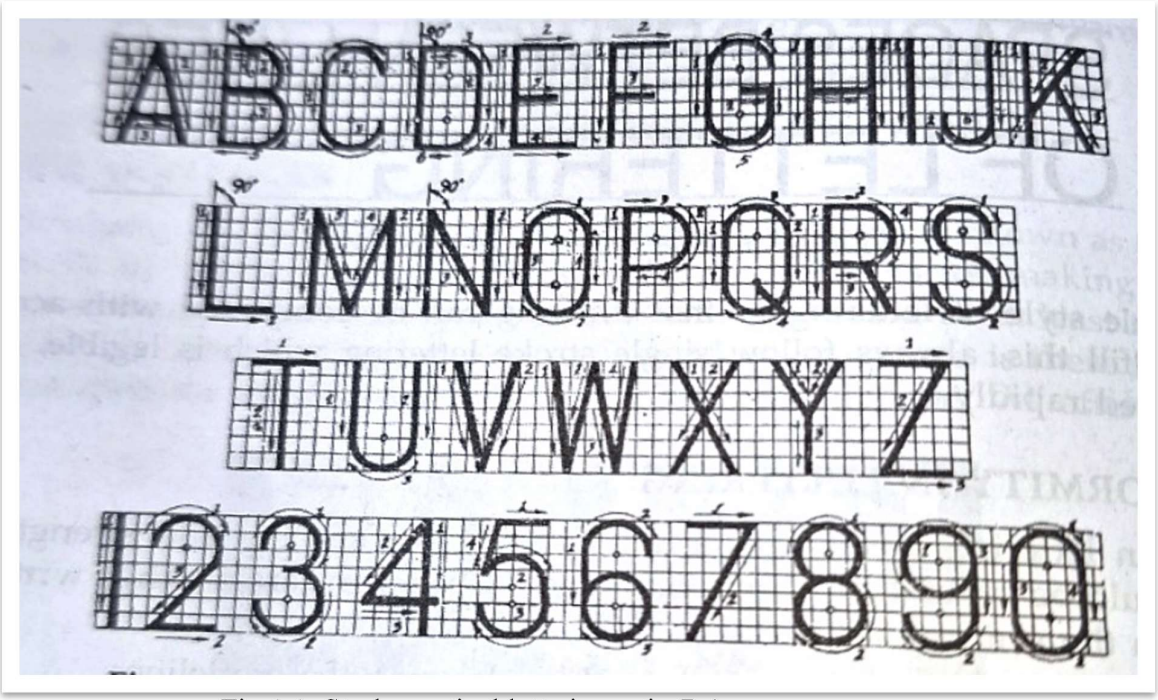
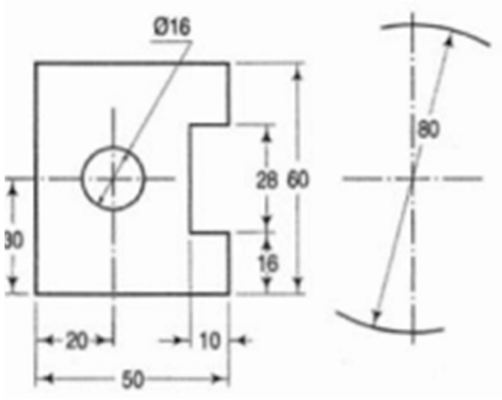
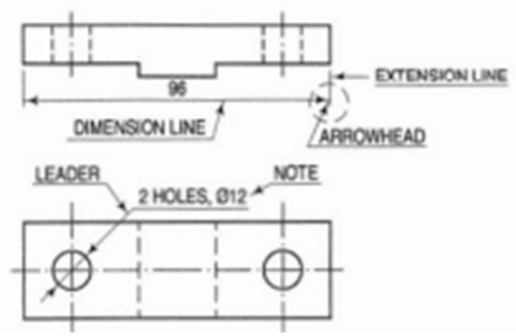


Fig 1.1: Stroke vertical lettering ratio **7:4**

2. In the figure given below, a unidirectional system of dimensioning is used. Draw the figure using a unidirectional and aligned system of dimensioning separately.



3. Draw the following figure to understand the Dimensioning terms and notations



4. Construct a scale (Plain) of 1: 4 to show centimetres and long enough to measure up to 5 decimetres.
5. To construct a diagonal scale of RF=1/5000 to show 1 metre and long enough to measure up to 600 metres. On the scale, show a distance of 457 metres.

SHEET NO. 2

PROJECTION OF POINTS

1. Draw the projections of the following points taking a common reference line, keeping the distance between any two consecutive points as 20 mm.

   (i) Point A 35 mm in front of VP and 35 mm above HP

   (ii) Point B is in HP and 30 mm in front of VP

   (iii) Point C is 30 mm above HP and 45 mm behind VP

   (iv) Point D is in VP and 45 mm above HP

   (v) Point E is 35 mm below HP and 55 mm behind VP

   (vi) Point F is in VP and 45 mm below HP

   (vii) Point G is in both HP and VP

2. A point E is 20 mm below HP and 20 mm behind VP. Another point F is 30 mm above HP and 40 mm in front of VP. Draw the projections of E and F, keeping the distance between their projectors 50 mm, draw straight lines joining their (i) Top views (ii) Front views.

3. Two points A and B are in HP. Point A is 30 mm in front of VP, while B is behind the VP. The distance between their projectors is 75 mm and the line joining their top views makes an angle of 45˚ with XY. Find the distance of point B from the VP.

4. A point P is 40 mm below HP and its shortest distance from XY (reference line) is 55 mm. The point P lies in the third quadrant. Draw its projection.

SHEET NO. 3

PROJECTION OF LINES-I

1. Draw the projections of a line AB 75 mm long, in the following positions:

   (i) Parallel to and 30 mm above the H.P. and in the V.P.

   (ii) Parallel to and 30 mm below the H.P. and in the V.P.

   (iii) Perpendicular to the H.P., 20 mm in front of the V.P. and its one end 15 mm above the H.P.

   (iv) Perpendicular to the H.P., 20 mm behind the V.P. and its one end 15 mm below the H.P.

   (v) Inclined at 30° to the H.P. and its one end 20 mm above it; parallel to and 30 mm in front of the V.P.

2. The top view of a line CD, 75 mm long, measures 55 mm. The line is in the V.P., its end C being 25 mm above the H.P. Draw its projections (Front View, Top View and Side View).

3. The front view of a line, EF, is inclined at 30° to the V.P and 65 mm long. Draw the projections of the line, when it is parallel to and 40 mm above the H.P., its end E being 30 mm in front of the V.P. Draw its projections (Front View, Top View and Side View).

4. The length of the top view of a line GH is parallel to the V.P. and inclined at 45° to the H.P. The line is 50 mm. End G of the line is 12 mm above the H.P. and 25 mm in front of the V.P. Draw the projections of the line and determine its true length.

SHEET NO. 4

PROJECTION OF LINES-II

1. A line AB, 50 mm long, has its end A in both the H.P. and the V.P. It is inclined at 30° to the H.P. and at 45° to the V.P. Draw its projections.

2. The top view of a 75 mm long line AB measures 65 mm, while the length of its front view is 50 mm. It's one end A is in the H.P. and 12 mm in front of the V.P. Draw the projections of AB and determine its inclinations with the H.P. and the V.P.

3. A line AB, 50 mm long makes an angle of 30^{o} to the HP and $45^{0}$to the VP. The end A is 10mm above HP and 10 mm in front of the VP. Draw the projections of the line AB and determine its traces.

4. The end point A of a straight-line AB is 40 mm long is 20mm away from the HP and 30mm away from the VP. Other end B is 50mm away from HP and 10mm away from VP. Draw the projection of line AB and determine its Θ, ǿ, HT,VT,TL **(Trapezoidal Method).**

SHEET NO. 5

PROJECTION OF PLANES-I

1. An equilateral triangle of 50 mm side has its V.T. parallel to and 25 mm above xy. It has no H.T. Draw its projections when one of its sides is inclined at 45° to the V.P.
2. Draw the projections of a circle of 50 mm diameter, having its plane vertical and inclined at 30° to the V.P. Its centre is 30 mm above the H.P. and 20 mm in front of the V.P. Show also its traces.
3. A rectangular plane surface of size 50 x 30 is positioned in the first quadrant and is inclined at an angle of 60° with the H.P. and 30° with the V.P. Draw its projections.
4. Draw the projections of a regular hexagon of 25 mm side, having one of its sides in the H.P. and inclined at 60° to the V.P., and its surface making an angle of 45° with the H.P.

SHEET NO. 6

PROJECTION OF PLANES-II

1. Show by means of traces, each of the following planes

   (a) Perpendicular to the H.P. and the V.P.

   (b) Perpendicular to the H.P. and inclined at 30˚ to the V.P.

   (c) Parallel to and 40 mm away from the V.P.

   (d) Inclined at 45° to the H.P. and perpendicular to the V.P.

   (e) Parallel to the H.P. and 25 mm away from it.

2. Draw the projections of a regular pentagon of 25 mm side, having one of its sides in the H.P. and inclined at 60° to the V.P. and its surface making an angle of 45° with the H.P. (Use Auxiliary Plane Method to solve the same.) .

3. A semi-circular disc of 60 mm diameter has its straight edge in the VP and inclined to HP at 45˚. The surface of the plate makes an angle of 30˚ with the VP. Draw the projections. (Use Auxiliary plane method).

SHEET NO. 7

PROJECTION OF SOLIDS-I

1. Draw the projections of a cone, base 75 mm diameter and axis 100 mm long, lying on the H.P. on one of its generators with the axis parallel to the V.P.
2. Draw the projections of a cylinder 75 mm diameter and 100 mm long, lying on the ground with its axis inclined at 30" to the V.P. and parallel to the ground.
3. A pentagonal pyramid, base 25 mm side and axis 50 mm long has one of its triangular faces in the V.P. and the edge of the base contained by that face makes an angle of 30° with the H.P. Draw its projections.
4. A hexagonal prism, base 25 mm side and axis 50 mm long, has an edge of its base on the ground. Its axis is inclined at 30° to the ground and parallel to the V.P. Draw its projections.

SHEET NO. 8

PROJECTION OF SOLIDS-II

1. Draw the projections of a triangular prism, base 40 mm side and axis 50 mm long, resting on one of its bases on the H.P. with a vertical face perpendicular to the V.P.

2. Draw the projections of a pentagonal pyramid, base 30 mm edge and axis 50 mm long, having its base on the H.P. and an edge of the base parallel to the V.P. Also draw its side view.

3. Draw the projections of a pentagonal prism, base 25 mm side and axis 50 mm long, resting on one of its rectangular faces on the H.P. with the axis inclined at 45˚ to the V.P.

4. A hexagonal pyramid, base 25 mm side and axis 50 mm long, has an edge of its base on the ground. Its axis is inclined at 30° to the ground and parallel to the V.P. Draw its projections.

5. Draw the projections of a cone, base 45 mm diameter and axis 50 mm long, when it is resting on the ground on a point on its base circle with (a) the axis making an angle of 30° with the H.P. and 45° with the V.P.; (b) the axis making an angle of 30° with the H.P. and its top view making 45° with the V.P.