

**Module I**

Chapter 1 : Introduction to Engineering Graphics	1-1 to 1-36
1.1 Principles of Engineering Graphics	1-2
1.1.1 Significance of Engineering Drawing while designing a small object	1-2
1.2 Drawing Instruments	1-4
1.2.1 Drawing Board and Drawing Table	1-4
1.2.2 T-square	1-5
1.2.3 Set Squares	1-6
1.2.4 Protractor.....	1-7
1.2.5 Scale.....	1-7
1.2.6 Roll-N-draw	1-7
1.2.7 Mini-drafter	1-7
1.2.8 Drawing Instrument Box.....	1-8
1.2.9 Proportional Divider.....	1-10
1.2.10 French Curves	1-10
1.2.11 Drafting Templates.....	1-11
1.2.12 Drawing Paper.....	1-11
1.2.13 Drawing Pencils	1-12
1.2.14 Pencil Sharpener.....	1-13
1.2.15 Sand-paper Block	1-13
1.2.16 Eraser and Erasing Shield	1-13
1.2.17 Duster or Handkerchief	1-13
1.2.18 Drawing Pins, Clips or Adhesive Tapes.....	1-13
1.2.19 Paper Box.....	1-13
1.3 Drawing Sheet Layout.....	1-14
1.4 Standards and Conventions	1-14
1.5 Types of Lines and their Applications.....	1-15
1.6 Lettering	1-17
1.7 Dimensioning	1-24
1.7.1 Systems of Dimensioning.....	1-25
1.7.2 Practical Hints on Dimensioning.....	1-27
1.8 Scales	1-31
1.8.1 Sizes of Scale	1-32
1.8.2 Representative Fraction (R.F.)	1-32
1.8.3 Construction of Scale	1-33
1.8.4 Some of the Important Relations for Length Measurements	1-33
1.8.5 Classification of Scales	1-34

**Chapter 2 : Engineering Curves****2-1 to 2-20**

2.1	Introduction	2-2
2.2	Classification of Curves	2-2
2.3	Cycloids.....	2-2
2.4	Involute	2-11
2.4.1	Involute of a Polygon.....	2-11
2.4.2	Involute of a Circle.....	2-13
2.5	Helix	2-18
2.5.1	Helix on a Cylinder	2-19

Module II**Chapter 3 : Theory of Projections****3-1 to 3-18**

3.1	Introduction	3-2
3.2	Principle of Projection.....	3-2
3.3	Methods of Projection	3-3
3.3.1	Perspective Projections	3-4
3.3.2	Parallel Projections.....	3-5
3.4	System of Orthographic Projection	3-8
3.4.1	Position of the Views on a Plane Paper when Object is Lying in Four Quadrants.....	3-9
3.4.2	First-Angle Projection Method (with Three Principal Planes).....	3-11
3.4.3	Third-Angle Projection Method	3-14
3.5	Analysis of Reference Line in Principal Views.....	3-17
3.6	Symbols for Methods of Projection.....	3-18

Chapter 4 : Projection of Points and Lines**4-1 to 4-67**

4.1	Introduction	4-2
4.2	Location of a Point (Various Positions)	4-2
4.3	Conventional Representation.....	4-2
4.4	Projections of Points on Two Principal Planes.....	4-2
4.4.1	Projections of Point Situated Above the H.P. and Infront of the V.P.....	4-3
4.4.2	Projections of Point Situated on the H.P. and Infront of the V.P	4-3
4.4.3	Projections of Point Situated Above the H.P. and on the V.P.....	4-4
4.4.4	Projections of Point Situated on the H.P. and on the V.P.....	4-5
4.4.5	Projections of Point Situated Above the H.P. and Behind the V.P.	4-5
4.4.6	Projections of Point Situated on the H.P. and Behind the V.P.	4-6
4.4.7	Projections of Point Situated Below the H.P. and Behind the V.P.....	4-6
4.4.8	Projections of Point Situated Below the H.P. and on the V.P.	4-7
4.4.9	Projections of Point Situated Below the H.P. and Infront of the V.P.....	4-8
4.5	Projections of Point on Three Principal Planes	4-9
4.6	Auxiliary Planes	4-10



4.6.1	Types of Auxiliary Planes	4-10
4.7	Projections of Point on Auxiliary Planes.....	4-12
4.7.1	Projections of Point on an AVP	4-12
4.7.2	Projections of Point on an AIP.....	4-13
4.8	Definition of a Straight Line.....	4-14
4.9	Location of a Line	4-14
4.10	Projections of Line	4-14
4.11	Projections of Line Parallel to Two Principal Planes and Perpendicular to the Third.....	4-14
4.11.1	Projections of Line Parallel to H.P. and V.P. and Perpendicular to P.P.....	4-14
4.11.2	Projections of Line Parallel to H.P. and P.P. and Perpendicular to V.P.....	4-15
4.11.3	Projections of Line Parallel to V.P. and P.P. and Perpendicular to H.P.....	4-16
4.12	Projections of Line Parallel to One Reference Plane and Inclined to the Other Two.....	4-17
4.12.1(a)	Projections of Line Parallel to V.P. and Inclined to H.P. and P.P.	4-17
4.12.1(b)	Projections of Line in V.P. and Inclined to H.P. and P.P.	4-18
4.12.2(a)	Projections of Line Parallel to H.P. and Inclined to V.P. and P.P.	4-19
4.12.2(b)	Projections of Line in H.P. and Inclined to V.P. and P.P.	4-20
4.12.3(a)	Projections of Line Parallel to P.P. and Inclined to H.P. and V.P.	4-21
4.12.3(b)	Projections of Line on PP and Inclined to HP and VP	4-22
4.13	Line Inclined to Both H.P. and V.P. (Oblique Line)	4-23
4.14	Projections of Oblique Lines	4-25
4.14.1	To Draw the Projections of a Line when its T.L., θ , ϕ and Location of One of its Ends are Known	4-26
4.14.2	Notations Used	4-29
4.14.3	Conventions for Line Thickness.....	4-30
4.15	To Find TL, θ and ϕ of a Line when its Projections are Given	4-30
4.16	Solved Problems on Oblique Lines	4-31
4.17	Problems on Applications of Lines	4-56

Chapter 5 : Projection of Planes

5-1 to 5-24

5.1	Introduction	5-2
5.2	Various Types of Planes.....	5-2
5.3	Various Positions of Planes	5-3
5.4	Surface of Planes Parallel to One Principal Plane and Perpendicular to the Other Two	5-3
5.4.1	Surface of Planes Parallel to H.P. and Perpendicular to V.P. and P.P.....	5-3
5.4.2	Surface of Planes Parallel to V.P. and Perpendicular to H.P. and P.P.....	5-4
5.4.3	Surface of Planes Parallel to P.P. and Perpendicular to H.P. and V.P.....	5-4
5.5	Surface of Planes Perpendicular to One Principal Plane & Inclined to Other Two.....	5-8
5.5.1	Surface of a Plane Perpendicular to V.P., Inclined to H.P. with One of the Sides of the Plane on H.P.	5-8
5.5.2	Surface of a Plane Perpendicular to V.P., Inclined to H.P. with One of the Corners of the Plane on H.P.	5-10



5.5.3	Surface of a Plane Perpendicular to H.P., Inclined to V.P. with One of the Sides of the Plane on V.P.	5-11
5.5.4	Surface of a Plane Perpendicular to H.P., Inclined to V.P. with One of the Corners of the Plane on V.P.	5-12

Module III

Chapter 6 : Projection of Solids**6-1 to 6-102**

6.1	Introduction	6-2
6.2	Classification of Solids.....	6-2
6.2.1	Polyhedra and Solids of Revolution.....	6-2
6.2.2	Regular and Irregular Solids	6-6
6.2.3	Right and Oblique Solids	6-7
6.2.4	Full Solid, Frustum of a Solid and Truncated Solid.....	6-8
6.3	Various Positions of Solids	6-9
6.4	Projections of Solids When its Axis is Parallel to Two of the Principal Planes and Perpendicular to the Third Principal Plane	6-9
6.4.1	Projections of solids when its axis is parallel to V.P. and P.P. and perpendicular to H.P.	6-10
6.4.2	Projections of solids when its axis is parallel to H.P. and P.P. and perpendicular to V.P.	6-14
6.4.3	Projections of solids when its axis is parallel to H.P. and V.P. and perpendicular to P.P.	6-18
6.5	Projections of Solids when its Axis is Parallel to One of the Principal Planes and Inclined to Other Two.....	6-22
6.5.1	Projections of Solids when its Axis is Inclined to H.P. and Parallel to V.P. with an Edge of the Base on H.P.....	6-22
6.5.2	Projections of Solids when its Axis is Inclined to H.P. and Parallel to V.P. with a Corner of Base on H.P.....	6-27
6.5.3	Projections of Solids when its Axis is Inclined to V.P. and Parallel to H.P. with an Edge of the Base on V.P.	6-30
6.5.4	Projections of Solids when its Axis is Inclined to V.P. and Parallel to H.P. with a Corner of Base on V.P.	6-34
6.6	Projections of Solids when its Axis is Inclined to all the Three Principal Planes	6-37
6.6.1	Projections of Prisms.....	6-38
6.6.2	Projections of Pyramids	6-60
6.6.3	Projections of Cylinder	6-94
6.6.4	Projections of Cone	6-96

Module IV

Chapter 7 : Sections of Solids**7-1 to 7-55**

7.1	Introduction	7-2
7.2	Section Planes and its Representation	7-2
7.3	Types of Section Planes	7-2
7.3.1	Section Plane Perpendicular to V.P. and Parallel to H.P.....	7-2
7.3.2	Section Plane Perpendicular to V.P. and Inclined to H.P.....	7-3



7.3.3	Section Plane Perpendicular to H.P. and Parallel to V.P.....	7-3
7.3.4	Section Plane Perpendicular to H.P. and Inclined to V.P.....	7-4
7.3.5	Section Plane Perpendicular to Both H.P. and V.P.	7-4
7.4	Sections	7-5
7.4.1	Line View of Section	7-5
7.4.2	Apparent Section.....	7-5
7.4.3	True Shape of Section	7-5
7.5	Section Lines and Hatching	7-8
7.6	Sections of Prisms	7-8
7.7	Sections of Pyramid.....	7-28
7.8	Sections of Cones	7-38

Module V

Chapter 8 : Orthographic Projections**8-1 to 8-52**

8.1	Orthographic projections.....	8-2
8.2	Multi-view Orthographic Projections and Reference Planes.....	8-2
8.3	System of Orthographic Projection	8-3
8.3.1	Position of the Views on a Plane Paper when Object is Lying in Four Quadrants.....	8-4
8.3.2	First-Angle Projection Method (with Three Principal Planes).....	8-6
8.3.3	Third-Angle Projection Method	8-9
8.4	Analysis of Reference Line in Principal Views.....	8-12
8.5	Symbols for Methods of Projection.....	8-13
8.6	Precedence of Lines.....	8-13
8.7	Method of Drawing Hidden Lines.....	8-14
8.8	Methods of Drawing Centre Lines	8-14
8.9	Identification of Surfaces	8-14
8.10	Fillet, Rounds and Runouts.....	8-15
8.11	Procedure of Preparing Orthographic Views by using First-Angle Projection Method	8-17
8.12	Orthographic Views of Elementary Objects.....	8-19
8.13	Solved Problems.....	8-23

Chapter 9 : Sectional Orthographic Projections**9-1 to 9-41**

9.1	Introduction	9-2
9.2	Hatching	9-3
9.3	Types of Sections	9-4
9.3.1	Full Sections.....	9-4
9.3.2	Half Sections	9-5
9.3.3	Offset Sections	9-5
9.3.4	Revolved Section	9-6
9.3.5	Removed Section	9-7
9.3.6	Partial or Local or Broken Out Section	9-7
9.3.7	Aligned Section	9-8



9.3.8	Guidelines for Sectioning Ribs	9-8
9.3.9	Ribs in Section	9-8
9.4	Different Types of Holes	9-11
9.5	Solved Examples	9-13

Module VI

Chapter 10 : Missing Views 10-1 to 10-33

10.1	Introduction	10-2
10.2	Guidelines to Read Orthographic Views and to Draw the Missing View	10-2
10.3	Some Elementary Problems to Develop Imagination for Missing Views	10-3
10.4	Reading a Drawing	10-5
10.4.1	Objects having T.V. Same, F.V. Different	10-5
10.4.2	Objects having F.V. Same, T.V. Different	10-8
10.4.3	Possibility or More than One Solution for Given Two Views	10-10
10.5	Solved Problems	10-13

Module VII

Chapter 11 : Isometric Views 11-1 to 11-68

11.1	Introduction	11-2
11.2	Types of Pictorial Projections	11-2
11.3	Types of Axonometric Projections	11-2
11.3.1	Isometric Projection	11-2
11.3.2	Diametric Projection	11-3
11.3.3	Trimetric Projection	11-3
11.4	Isometric Projection of a Cube	11-3
11.5	Key Terms	11-3
11.6	Isometric View or Drawing and Isometric Projection	11-6
11.7	Construction of Isometric Point	11-7
11.8	Construction of Isometric Planes	11-7
11.8.1	Polygon	11-7
11.8.2	Circle and Semi-circle	11-9
11.9	Construction of Isometric Solid	11-12
11.9.1	Isometric Construction of Prism	11-13
11.9.2	Isometric Construction of Pyramid and its Frustum	11-14
11.9.3	Isometric Construction of Cylinder and Semi-Cylinder	11-15
11.9.4	Isometric Construction of Cone and its Frustum	11-17
11.9.5	Construction of Isometric Spheres	11-18
11.10	Construction of Isometric Solid Having Irregular Curve	11-20
11.11	Solved Problems	11-21
11.12	Exercise	11-65

