

CONTENTS

<i>Preface</i>	<i>xv</i>
<i>Abbreviations, Notations and Symbols</i>	<i>xxi</i>
1. Drawing Instruments and Sheet Layout	1.1–1.26
1.1 Introduction <i>1.1</i>	
1.2 International and National Codes <i>1.1</i>	
1.3 Drawing Instruments <i>1.2</i>	
1.4 Drawing Board <i>1.2</i>	
1.5 Mini Drafter <i>1.3</i>	
1.6 Drawing Sheet <i>1.4</i>	
1.7 Drawing Pencil <i>1.6</i>	
1.8 Compass <i>1.7</i>	
1.9 Divider <i>1.8</i>	
1.10 Protractor <i>1.9</i>	
1.11 Ruler (Scale) <i>1.10</i>	
1.12 French Curves <i>1.11</i>	
1.13 Set Squares <i>1.12</i>	
1.14 Eraser <i>1.12</i>	
1.15 Sheet Fasteners <i>1.13</i>	
1.16 Templates <i>1.13</i>	
1.17 Pencil Cutters <i>1.14</i>	
1.18 Sand Paper Pad <i>1.14</i>	
1.19 Brush or Towel <i>1.14</i>	
1.20 General Preparation for Drawing <i>1.14</i>	
1.21 Planning and Layout of Sheet <i>1.15</i>	
1.22 Frames and Borders <i>1.15</i>	
1.23 Title Block <i>1.17</i>	
1.24 Space for Text <i>1.19</i>	
1.25 Item References on Drawing and Item Lists <i>1.20</i>	
1.26 Folding of Drawing Sheets <i>1.21</i>	
1.27 Conclusion <i>1.23</i>	
<i>Exercise 1A 1.23</i>	
<i>Viva-Voce Questions 1.25</i>	
<i>Multiple-Choice Questions 1.25</i>	

2.	Lines, Lettering and Dimensioning	2.1–2.26
2.1	Introduction 2.1	
2.2	Lines 2.1	
2.3	Lettering 2.5	
2.4	Dimensioning 2.7	
2.5	Placement of Dimensions 2.9	
2.6	Arrangement of Dimensions 2.10	
2.7	Symbols and Notes for Dimensioning 2.12	
2.8	Rules of Dimensioning 2.19	
	<i>Exercise 2A</i> 2.24	
	<i>Viva-Voce Questions</i> 2.25	
	<i>Multiple-Choice Questions</i> 2.25	
3.	Geometrical Constructions	3.1–3.31
3.1	Introduction 3.1	
3.2	Bisect a Line and an Arc 3.1	
3.3	Perpendicular to a Line 3.2	
3.4	Parallel Lines 3.4	
3.5	Divide a Line 3.4	
3.6	Angle Bisector 3.6	
3.7	Centre of an Arc or Circle 3.6	
3.8	Circle through Three Points 3.7	
3.9	Divide a Circle 3.7	
3.10	Tangent to a Circle 3.7	
3.11	Tangent to Two Circles 3.9	
3.12	Arc to Connect Lines and Circles Tangentially 3.10	
3.13	Arc to Connect Line and Point 3.12	
3.14	Circle to Connect Another Circle and a Point 3.13	
3.15	Polygons 3.13	
3.16	Construction of a Triangle 3.15	
3.17	Rectangle and Square 3.17	
3.18	Construction of a Regular Pentagon 3.18	
3.19	Construction of a Regular Hexagon 3.19	
3.20	Inscribe Polygon in a Circle 3.19	
3.21	Inscribe an Octagon in a Square 3.22	
3.22	Circumscribe Polygon to a Circle 3.22	
3.23	Inscribe a Circle in a Polygon 3.22	
3.24	Engineering Applications 3.27	
	<i>Exercise 3A</i> 3.28	
	<i>Viva-Voce Questions</i> 3.31	
	<i>Multiple-Choice Questions</i> 3.31	
4.	Scales	4.1–4.36
4.1	Introduction 4.1	
4.2	Representation of Scale 4.1	
4.3	Units of Measurements 4.2	

- 4.4 Types of Scales 4.2
- 4.5 Representative Fraction (RF) 4.2
- 4.6 Requirements of a Scale 4.4
- 4.7 Plain Scale 4.4
- 4.8 Diagonal Scale 4.10
- 4.9 Comparative Scale 4.19
- 4.10 Vernier Scale 4.24
- 4.11 Scale of Chords 4.31
- Exercise 4A* 4.34
- Viva-Voce Questions* 4.36
- Multiple-Choice Questions* 4.36

5. Conic Sections

5.1–5.39

- 5.1 Introduction 5.1
- 5.2 Cone 5.1
- 5.3 Conic Sections 5.1
- 5.4 Construction of Ellipse 5.6
- 5.5 Locate Centre, Major Axis and Minor Axis 5.12
- 5.6 Tangents and Normal to the Ellipse 5.13
- 5.7 Construction of Parabola 5.14
- 5.8 Locate Axis, Focus and Directrix 5.18
- 5.9 Tangent and Normal to the Parabola 5.19
- 5.10 Construction of Hyperbola 5.20
- 5.11 Locate Asymptotes and Directrix 5.26
- 5.12 Tangent and Normal to the Hyperbola 5.27
- 5.13 Miscellaneous Problems 5.28
- Exercise 5A* 5.36
- Viva-Voce Questions* 5.38
- Multiple-Choice Questions* 5.39

6. Engineering Curves and Loci of Points

6.1–6.38

- 6.1 Introduction 6.1
- 6.2 Roulettes 6.1
- 6.3 Cycloidal Curves 6.1
- 6.4 Trochoid, Epitrochoid and Hypotrochoid 6.6
- 6.5 Involute 6.12
- 6.6 Spiral 6.14
- 6.7 Helix 6.19
- 6.8 Miscellaneous Problems 6.20
- Exercise 6A* 6.28
- 6.9 Loci of Points 6.30
- Exercise 6B* 6.36
- Viva-Voce Questions* 6.37
- Multiple-Choice Questions* 6.38

7. Orthographic Projections

7.1–7.50

- 7.1 Projection 7.1

7.2	Pictorial View and Multi-View	7.1
7.3	Orthographic Projection	7.2
7.4	Multi-View Drawing	7.3
7.5	Terminology	7.4
7.6	First Angle Projection	7.4
7.7	Features of First Angle Projection	7.6
7.8	Third Angle Projection	7.6
7.9	Features of Third Angle Projection	7.8
7.10	Second and Fourth Angle Projections	7.8
7.11	Symbols	7.9
7.12	Reference Arrows Method	7.9
7.13	Assumptions	7.10
7.14	General Preparation for Multi-View Drawings	7.11
7.15	Conversion of Pictorial View into Orthographic Views	7.11
7.16	Miscellaneous Problems	7.22
<i>Exercise 7A</i> 7.23		
7.17	Sectional Views	7.29
7.18	Representation of a Cutting Plane	7.30
7.19	Section Lines or Hatching	7.30
7.20	Features Left Uncut	7.31
7.21	Simplified Representation of Intersections	7.32
7.22	Section Line Conventions	7.33
7.23	Types of Sectional Views	7.33
7.24	Conventional Breaks	7.38
7.25	Problems on Sectional Views	7.38
<i>Exercises 7B</i> 7.40		
7.26	Auxiliary Views	7.42
7.27	Full and Partial Auxiliary Views	7.43
7.28	Primary Auxiliary Views	7.43
7.29	Secondary Auxiliary Views	7.45
<i>Exercise 7C</i> 7.46		
<i>Viva-Voice Questions</i> 7.48		
<i>Multiple-Choice Questions</i> 7.48		

8. Projections of Points

8.1–8.11

8.1	Introduction	8.1
8.2	Location of a Point	8.1
8.3	Conventional Representation	8.1
8.4	Point above the H.P. and in Front of the V.P.	8.2
8.5	Point above the H.P. and behind the V.P.	8.3
8.6	Point below the H.P. and behind the V.P.	8.3
8.7	Point below the H.P. and in Front of the V.P.	8.4
8.8	Point on the H.P. and in Front of the V.P.	8.5
8.9	Point above the H.P. and on the V.P.	8.6
8.10	Point on the H.P. and behind the V.P.	8.6
8.11	Point below the H.P. and on V.P.	8.7

8.12 Point on both H.P. and V.P. 8.8

8.13 Summary 8.8

8.14 Miscellaneous Problems 8.8

Exercise 8A 8.10

Viva-Voce Questions 8.10

Multiple-Choice Questions 8.11

9. Projections of Straight Lines

9.1–9.60

9.1 Introduction 9.1

9.2 Orientation of a Straight Line 9.1

9.3 Trace of a Straight Line 9.1

9.4 Line Parallel to Both H.P. and V.P. 9.2

9.5 Line Perpendicular to H.P. 9.3

9.6 Line Perpendicular to V.P. 9.4

9.7 Line Inclined to H.P. and Parallel to V.P. 9.4

9.8 Line Inclined to V.P. and Parallel to H.P. 9.5

9.9 Line Situated on H.P. 9.6

9.10 Line Situated in the V.P. 9.7

9.11 Line Situated Both in H.P. and V.P. 9.8

9.12 Summary 9.9

9.13 Miscellaneous Problems 9.10

Exercise 9A 9.12

9.14 Line in First Angle and Inclined to Both the Reference Planes 9.14

9.15 Miscellaneous Problems 9.23

Exercise 9B 9.44

9.16 Projections of a Line in Different Angles 9.46

9.17 Miscellaneous Problems 9.48

Exercise 9C 9.57

Viva-Voce Questions 9.58

Multiple-Choice Questions 9.59

10. Projections of Planes

10.1–10.56

10.1 Introduction 10.1

10.2 Orientation of Planes 10.1

10.3 Plane Parallel to H.P. 10.2

10.4 Plane Parallel to V.P. 10.3

10.5 Plane Parallel to Profile Plane 10.4

10.6 Plane Inclined to H.P. and Perpendicular to V.P. 10.4

10.7 Plane Inclined to V.P. and Perpendicular to H.P. 10.10

10.8 Trace of a Plane 10.14

10.9 Summary 10.17

Exercise 10A 10.18

10.10 Plane Inclined to Both the Reference Planes 10.20

Exercise 10B 10.36

10.11 Auxiliary Plane Method 10.38

10.12 Alternative Auxiliary Plane Method 10.41

- 10.13 True Shape of Plane 10.46
- 10.14 Distance of a Point from the Plane 10.49
- 10.15 Locate a Point 10.50
- 10.16 Angle between Two Intersecting Planes 10.52
- Exercise 10C* 10.53
- Viva-Voce Questions* 10.55
- Multiple-Choice Questions* 10.55

11. Projections of Solids

11.1–11.68

- 11.1 Introduction 11.1
- 11.2 Classification of Solids 11.1
- 11.3 Recommended Method of Labelling 11.4
- 11.4 Orientation of Solid 11.5
- 11.5 Axis Perpendicular to H.P. 11.5
- 11.6 Axis Perpendicular to V.P. 11.7
- 11.7 Axis Parallel to Both H.P. and V.P. 11.8
- 11.8 Miscellaneous Problems 11.9
- Exercise 11A* 11.11
- 11.9 Initial Position of the Solid 11.13
- 11.10 Identify Visible and Hidden Lines 11.13
- 11.11 Axis Inclined to H.P. and Parallel to V.P. 11.14
- 11.12 Axis Inclined to V.P. and Parallel to H.P. 11.21
- 11.13 Miscellaneous Problems 11.25
- Exercise 11B* 11.27
- 11.14 Axis Inclined to Both H.P. and V.P. 11.28
- Exercise 11C* 11.51
- 11.15 Auxiliary Plane Method 11.53
- 11.16 Projections of Spheres 11.61
- Exercise 11D* 11.66
- Viva-Voce Questions* 11.67
- Multiple-Choice Questions* 11.67

12. Sections of Solids

12.1–12.60

- 12.1 Introduction 12.1
- 12.2 Terminology 12.1
- 12.3 Type of Section Planes 12.2
- 12.4 Section by a Plane Perpendicular to V.P. 12.5
- 12.5 Section by a Plane Perpendicular to H.P. 12.21
- 12.6 Section by a Plane Perpendicular to Both H.P. and V.P. 12.31
- 12.7 Miscellaneous Problems 12.32
- Exercise 12A* 12.38
- 12.8 Anti-Section 12.40
- Exercise 12B* 12.57
- Viva-Voce Questions* 12.59
- Multiple-Choice Questions* 12.59

- 13. Development of Surfaces** **13.1–13.52**
- 13.1 Introduction 13.1
 - 13.2 Classification of Surfaces 13.1
 - 13.3 Methods of Development 13.1
 - 13.4 Development of Prisms 13.2
 - 13.5 Development of Cylinders 13.7
 - 13.6 Development of Cones 13.12
 - 13.7 Development of Pyramids 13.18
 - 13.8 Development of Spheres 13.24
 - 13.9 Development of Transition Pieces 13.26
 - 13.10 Development of Tray 13.29
 - 13.11 Development of Oblique Objects 13.31
 - 13.12 Applications 13.34
 - Exercise 13A* 13.37
 - 13.13 Anti-Development 13.40
 - Exercise 13B* 13.51
 - Viva-Voce Questions* 13.52
 - Multiple-Choice Questions* 13.52
- 14. Intersection of Surfaces** **14.1–14.34**
- 14.1 Introduction 14.1
 - 14.2 Engineering Applications 14.1
 - 14.3 Methods of Determining the Curves of Intersection 14.1
 - 14.4 Types of Interpenetrating Solids 14.2
 - 14.5 Intersection of Prism by Another Solid 14.2
 - 14.6 Intersection of Cylinder by Another Solid 14.8
 - 14.7 Intersection of Pyramid by Another Solid 14.14
 - 14.8 Intersection of Cone by Another Solid 14.18
 - 14.9 When Axes Intersect at an Angle other than Right Angle 14.24
 - 14.10 Intersection of Sphere by Another Solid 14.26
 - 14.11 Miscellaneous Problems 14.27
 - Exercises* 14.30
 - Viva-Voce Questions* 14.33
 - Multiple-Choice Questions* 14.33
- 15. Isometric Projections** **15.1–15.52**
- 15.1 Introduction 15.1
 - 15.2 Axonometric Projection 15.1
 - 15.3 Principle of Isometric Projection 15.2
 - 15.4 Terminology 15.3
 - 15.5 Construction of an Isometric Scale 15.4
 - 15.6 Characteristics of Principal Lines in Isometric Projection 15.5
 - 15.7 Isometric Projection and Isometric View 15.5
 - 15.8 Dimensioning on Isometric Projection 15.6
 - 15.9 Isometric View of Planes 15.6
 - 15.10 Four Centre Method to Draw Ellipse and Elliptical Arcs 15.9

15.11	Isometric View of Right Solids	15.11	
15.12	Isometric View of Solid Containing Non-Isometric Lines	15.12	
15.13	Isometric View of Truncated Solid	15.17	
15.14	Isometric View of Composite Solids	15.20	
	<i>Exercise 15A</i>	15.27	
15.15	Conversion of Orthographic Views into Isometric Views	15.28	
15.16	Miscellaneous Problems	15.37	
	<i>Exercise 15B</i>	15.46	
15.17	Free Hand Sketching of Isometric Views	15.48	
15.18	Missing Views	15.49	
	<i>Exercise 15C</i>	15.50	
	<i>Viva-Voce Questions</i>	15.50	
	<i>Multiple-Choice Questions</i>	15.50	
16.	Oblique Projections		16.1–16.16
16.1	Introduction	16.1	
16.2	Terminology	16.1	
16.3	Direction of Projectors	16.2	
16.4	Rules for The Choice of Position of an Object	16.3	
16.5	Dimensioning Oblique Drawings	16.3	
16.6	Advantages of Oblique Drawing	16.4	
16.7	Oblique Projections	16.4	
	<i>Exercise 16</i>	16.14	
	<i>Viva-Voce Questions</i>	16.15	
	<i>Multiple-Choice Questions</i>	16.15	
17.	Perspective Projections		17.1–17.26
17.1	Introduction	17.1	
17.2	Applications of Perspective	17.1	
17.3	Types of Perspective	17.1	
17.4	Characteristic Features of Perspective Projections	17.3	
17.5	Terminology	17.3	
17.6	The Myth of Perspectives	17.4	
17.7	Methods of Drawing Perspective Views	17.4	
17.8	Miscellaneous Problems	17.16	
	<i>Exercise 17</i>	17.24	
	<i>Viva-Voce Questions</i>	17.25	
	<i>Multiple-Choice Questions</i>	17.25	
18.	Computer Aided Design (CAD)		18.1–18.67
18.1	Introduction	18.1	
18.2	CAD Application	18.1	
18.3	Software Providers	18.1	
18.4	Hardware and Operating System Technologies	18.2	
18.5	Basic Components of a Computer	18.2	
18.6	Introduction to Autocad	18.4	
18.7	Starting with AutoCAD 2013	18.5	

18.8	Application Windows	18.5
18.9	Ribbon Tabs, Panel and Tools	18.7
18.10	Display Menu Bar and Toolbars	18.9
18.11	Status Bar	18.10
18.12	Setting up a Drawing Space	18.12
18.13	Specifying Coordinates	18.15
18.14	Draw Panel	18.16
18.15	Modify Panel	18.29
18.16	Construction Panel	18.37
18.17	Adding Text	18.38
18.18	Adding Dimensions	18.40
18.19	Adding Different Types of Line	18.43
18.20	Applications of Autocad in Elementary Drawing	18.44
18.21	Applications of Autocad in Engineering Drawing	18.48
	<i>Exercise 18A</i>	18.63
	<i>Viva-Voce Questions</i>	18.65
	<i>Multiple-Choice Questions</i>	18.66