Technical Drawing 101 with AutoCAD® 2018

A Multidisciplinary Guide to Drafting Theory and Practice with Video Instruction

Douglas Smith
Antonio Ramirez
Ashleigh Fuller

SDC PUBLICATIONS
Better Textbooks. Lower Prices.
www.SDCpublications.com
ACCESS CODE
UNIQUE CODE INSIDE

Visit the following websites to learn more about this book:

CONTENTS

CHAPTER ONE

TECHNICAL DRAWING 2

OBJECTIVES 2

OVERVIEW 3

1.1 The Origins of Technical Drawing **4**

1.2 The Role of Technical Drawing in the Design Process **4**

1.3 Training for Careers in Technical Drawing **6**

Career Paths in Technical Drawing **7**

Qualities that Employers Look for in Drafters **11**

Salary Information for Drafters, Architects, and Engineers **11**

Job Prospects for Drafters **12**

KEY WORDS 12

CHAPTER SUMMARY 12

REVIEW QUESTIONS 13

CHAPTER EXERCISES 14

CHAPTER TWO

MULTIVIEW DRAWING 16

OBJECTIVES 16

OVERVIEW 17

2.1 The Terminology of Multiview Drawing **18**

2.2 Points, Planes, Coordinate Systems, Lines, and Angles **18**

2.3 Terminology of Geometric Shapes **22**

Circles **22**

Polygons **23**

Cylinders **24**

2.4 Multiview Drawings **25**

2.5 View Selection and Alignment of Multiview Drawings **26**

2.6 Using Projection Planes to Visualize Multiviews **26**

2.7 Projection Planes **28**

Visualizing the Front View **28**

Visualizing the Top View **29**

Visualizing the Side View **30**

2.8 Normal, Inclined, and Oblique Surfaces **30**

Normal Surfaces **30**

Inclined Surfaces **32**

Oblique Surfaces **33**

2.9 Linetypes and Lineweights in Multiview Drawings **40**

2.10 Hidden Features and Centerlines in Multiview Drawings **41**

2.11 Use Your Imagination! **42**

2.12 Visualizing the Multiviews of Basic Geometric Shapes **46**

2.13 Orthographic Projection **49**

2.14 Drawing Objects to Scale **52**

Full Scale **52**

Half Scale **52**

Quarter Scale **52**

Double Scale **52**

2.15 Drawing Architectural Plans to Scale **52**

Quarter Inch Equals One Foot **52**

Eighth Inch Equals One Foot **52**

2.16 Drawing Sheet Sizes **53**

2.17 Third-Angle Projection Versus First-Angle Projection **54**

KEY WORDS 56

CHAPTER SUMMARY 56

REVIEW QUESTIONS 56

CHAPTER EXERCISES 58

CHAPTER THREE

TRADITIONAL DRAFTING TOOLS AND TECHNIQUES 70

OBJECTIVES 70

OVERVIEW 71

3.1 Traditional Drafting Tools and Techniques **72**

3.2 Technical Pencils and Pens **72**

3.3 Beginning a Traditional Drafting Project **73**

3.4 Drafting Triangles **73**

3.5 Drawing Lines with Triangles and Parallel Straightedges **74**

3.6 Making Measurements with the Engineer's, Architect's, and Metric Scales **76**

Reading the Engineer's Scale **77**

Reading the Metric Scale **77**

Reading the Architect's Scale **78**

3.7 Converting Units of Measurement **79**

3.8 Reading the Protractor **79**

3.9 Circle Template **81**

3.10 Isometric Ellipse Template **81**

3.11 Adding Text to Drawings and Sketches **89**

Developing a Technical Lettering Style **90**

KEY WORDS 90

CHAPTER SUMMARY 90

REVIEW QUESTIONS 90

CHAPTER EXERCISE 91

CHAPTER PROJECTS 92

CHAPTER FOUR

COMPUTER-AIDED DESIGN BASICS 98

OBJECTIVES 98

OVERVIEW 99

4.1 Beginning an AutoCAD Drawing **100**

4.2 Adding Toolbars to the Ribbon Interface **102**

4.3 Creating, Opening, and Saving AutoCAD Drawing Files **104**

Beginning a New Drawing from the Application Menu **105**

Opening an Existing Drawing **105**

Saving a Drawing **105**

Performing a Save As **105**

4.4 Locating Points on the Cartesian Coordinate System **108**

The User Coordinate System (UCS) Icon **109**

Absolute Coordinates **109**

4.5 Drawing Lines Using Absolute Coordinates **109**

4.6 Drawing Horizontal and Vertical Lines **111**
Drawing Lines with Direct Entry **111**
4.7 Drawing Lines with Relative Coordinates **112**
4.8 Drawing Lines with Polar Coordinates **113**
4.9 Setting the Environment for AutoCAD Drawings **116**
Drawing Units **116**
Drawing Limits **121**
Layers **122**
4.10 Zoom and Pan Commands **129**
4.11 AutoCAD Commands **130**
Draw Commands **131**
Modify Commands **147**
Placing and Editing Text **169**
Controlling Text Style **172**
4.12 Drafting Settings Dialog Box **174**
Snap and Grid Tab **174**
Polar Tracking Tab **177**
Dynamic Input Tab **179**
Object Snap Tab **181**
4.13 Object Snap Tools **182**
4.14 Properties Command **189**
4.15 Inquiry Toolbar **191**
4.16 Preparing to Plot **192**
4.17 Plotting with AutoCAD **195**
4.18 Creating a Page Setup for Plotting **197**
KEY WORDS 200
CHAPTER SUMMARY 200
REVIEW QUESTIONS 200
CHAPTER PROJECTS 201

CHAPTER FIVE

DIMENSIONING MECHANICAL DRAWINGS 232

OBJECTIVES 232

OVERVIEW 233

5.1 Dimensioning Fundamentals **234**

Dimensioning Terminology **235**

5.2 Dimension Standards for Mechanical Drawings **236**

Recommended Size and Spacing of Dimension Features **237**

Text Height and Style **238**

Notating Holes and Arcs **239**

Dimensioning Angles **240**

Ordinate Dimensioning **240**

Notes for Drilling and Machining Operations **241**

5.3 Do's and Don'ts of Mechanical Dimensioning (ASME Y14.5-2009) **242**

5.4 Role of Drafters in the Preparation of Dimensioned Mechanical Drawings **243**

5.5 Checking Dimensions on the Finished Drawing **244**

5.6 Design Basics: How Designers Calculate Dimensions **244**

5.7 Tolerances **245**

Displaying Tolerances on Mechanical Drawings **245**

Interpreting Tolerances on Technical Drawings **246**

Tolerancing Terminology **249**

Interpreting Design Sketch 1 **249**

Interpreting Design Sketch 2 **250**

Calculating the Fit between the Parts in Design Sketches 1 and 2 **251**

Reference Dimensions **252**

Confirming the Tolerances of Manufactured Parts **252**

Tolerance Costs **253**

5.8 Dimensioning with AutoCAD **253**

Linear Dimension Command **255**

Aligned Dimension Command **256**

Arc Length Command **256**

Ordinate Dimension Command **257**

Radius Dimension Command **257**

Jogged Dimension Command **258**
Diameter Dimension Command **258**
Angular Dimension Command **259**
Quick Dimension Command **259**
Baseline Dimension Command **260**
Continue Dimension Command **260**
Dimension Space Command **261**
Dimension Break Command **262**
Tolerance Command **262**
Center Mark Command **263**
Inspection Command **263**
Jogged Linear Command **264**
Dimension Edit Command **264**
Dimension Text Edit Command **265**
Dimension Update Command **266**
Dimension Style Command **266**
5.9 Defining Dimension Settings with the Dimension Style Manager **267**
5.10 Overriding a Dimension Setting **276**
Updating a Dimension **277**
5.11 Adding a Leader to a Drawing **277**
KEY WORDS 280
CHAPTER SUMMARY 280
REVIEW QUESTIONS 280
CHAPTER PROJECTS 282

CHAPTER SIX

DIMENSIONING ARCHITECTURAL DRAWINGS 292
OBJECTIVES 292
OVERVIEW 293
6.1 Dimensioning Architectural Drawings **294**
6.2 Determining Dimensions on Architectural Drawings **294**
6.3 Architectural Drafting Conventions **295**
6.4 Alignment of Dimension Text **296**

6.5 Architectural Dimensioning Guidelines **296**

6.6 Architectural Dimension Spacing **297**

6.7 Adding a Leader to a Drawing **297**

KEY WORDS 298

CHAPTER SUMMARY 298

REVIEW QUESTIONS 298

CHAPTER PROJECT 299

CHAPTER SEVEN

ISOMETRIC DRAWINGS 304

OBJECTIVES 304

OVERVIEW 305

7.1 Orientation of Lines in Isometric Drawings **306**

7.2 Orientation of Ellipses in Isometric Drawings **306**

7.3 Creating Isometric Drawings with AutoCAD **309**

KEY WORDS 315

CHAPTER SUMMARY 315

REVIEW QUESTIONS 315

CHAPTER PROJECTS 317

CHAPTER EIGHT

SECTIONS 326

OBJECTIVES 326

OVERVIEW 327

8.1 Sections in Mechanical Drawings **328**

8.2 Sections in Architectural Drawings **329**

8.3 Types of Sections **330**

Full Sections **330**

Half Sections **331**

Broken-Out Sections **333**

Revolved Sections **334**

Removed Sections **334**

Offset Sections **335**

KEY WORDS 340
CHAPTER SUMMARY 340
REVIEW QUESTIONS 340
CHAPTER PROJECTS 341

CHAPTER NINE

AUXILIARY VIEWS 352
OBJECTIVES 352
OVERVIEW 353
9.1 Visualizing an Auxiliary View **354**
9.2 Constructing an Auxiliary View with the Offset Command **362**
KEY WORDS 367
CHAPTER SUMMARY 367
REVIEW QUESTIONS 368
CHAPTER PROJECTS 369

CHAPTER TEN

BLOCKS 370
OBJECTIVES 370
OVERVIEW 371
10.1 Considerations for Creating Blocks **372**
KEY WORDS 377
CHAPTER SUMMARY 377
REVIEW QUESTIONS 377
CHAPTER PROJECTS 378

CHAPTER ELEVEN

MECHANICAL WORKING DRAWINGS 388
OBJECTIVES 388
OVERVIEW 389
11.1 Preparing Mechanical Working Drawings **390**
Assembly Drawings **390**
Detail Drawings **394**

KEY WORDS 396
CHAPTER SUMMARY 396
REVIEW QUESTIONS 396
CHAPTER PROJECTS 397

CHAPTER TWELVE

ARCHITECTURAL WORKING DRAWINGS 412
OBJECTIVES 412
OVERVIEW 413
12.1 Floor Plans **414**
12.2 Electrical Plans **415**
12.3 Elevations **416**
Creating Elevations Using Multiview Drawing Techniques **416**
Architectural Wall Sections **417**
Roof Profiles on Architectural Elevations **417**
Using the Floor Plan to Locate Features on Elevations **418**
KEY WORDS 419
CHAPTER SUMMARY 419
REVIEW QUESTIONS 419
CHAPTER PROJECT 420

CHAPTER THIRTEEN

3D MODELING BASICS 448
OBJECTIVES 448
OVERVIEW 449
13.1 2D versus 3D **450**
13.2 Changing the Point of View of an AutoCAD Drawing **450**
13.3 AutoCAD's 3D Modeling Environment **451**
13.4 3D Modeling Tools **453**
Extruding 2D Entities to Create 3D Solid Objects **454**
Unioning 3D Objects **455**
Subtracting 3D Objects **455**
Using the Subtract Command **456**

13.5 Rotating 3D Objects **456**

13.6 Viewing 3D Objects **457**

Using the Free Orbit Tool **457**

13.7 Representing 3D Objects as Shaded or Wireframe Models **457**

KEY WORDS 458

CHAPTER SUMMARY 458

REVIEW QUESTIONS 458

CHAPTER PROJECTS 459

APPENDIX A ANSI/ASME STANDARDS 475

APPENDIX B ISO STANDARDS 477

APPENDIX C UNITED STATES NATIONAL CAD STANDARD 479

APPENDIX D GEOMETRIC DIMENSIONING AND TOLERANCING BASICS 481

GLOSSARY 485

INDEX 491