

## TABLE OF CONTENTS

<b>Introduction</b>	<b>I-1</b>
About the Cover	I-2
About the Author	I-2
Dedication	I-3
Contact the Author	I-4
Note to Instructors	I-4
Trademarks, Disclaimers, and Copyrighted Material	I-4
References	I-5
Table of Contents	I-6
Overview of Chapters	I-14
Chapter 1: History of Engineering Graphics	I-14
Chapter 2: Isometric Projection and Multi View Drawings	I-14
Chapter 3: Dimensioning Practices, Tolerancing and Fasteners	I-15
Chapter 4: Introduction to SolidWorks Part Modeling	I-16
Chapter 5: Revolved Boss/Base Features	I-16
Chapter 6: Swept Boss/Base and Loft Boss/Base Features	I-16
Chapter 7: Assembly Fundamentals: Bottom-up method	I-16
Chapter 8: Drawing Fundamentals	I-17
Chapter 9: Introduction to the (CSWA) exam	I-17
About the Book	I-18
Windows Terminology in SolidWorks	I-19
<b>Chapter 1 - History of Engineering Graphics</b>	<b>1-1</b>
Chapter Overview	1-3
History of Engineering Graphics	1-3
Global vs. Local Coordinate System	1-6
2D Cartesian Coordinate System	1-7
3D Cartesian Coordinate System	1-8
Absolute Coordinates	1-10
Relative Coordinates	1-10
Polar Coordinates	1-11
Cylindrical and Spherical Coordinates	1-11
Free Hand Sketching	1-12
General Sketching Techniques	1-13
Geometric Entities	1-14
Points	1-14
Lines	1-14
Planes	1-15
Circles	1-15
Arcs	1-16
Solid Primitives	1-16
Alphabet of Lines	1-17
Visible line	1-17
Hidden line	1-17
Dimension line	1-18
Extension line	1-18
Leader line	1-19

Break line	1-20
Centerline	1-20
Phantom line	1-21
Section line	1-21
Cutting Plane line	1-22
Precedence of Line Types	1-23
Alphabet of Lines - Exercises	1-25
Projections in General	1-27
Projection Types	1-29
Parallel Projection	1-29
Perspective Projection	1-29
Orthographic Projection	1-29
Oblique Projection	1-29
Multiview Projection	1-30
Orient and Select the Front View	1-30
Orthographic Project - Third Angle	1-31
Glass Box - Six Principal Views	1-32
Height, Width, and Depth Dimensions	1-35
Transferring Dimensions	1-35
Sheet Media	1-36
ANSI Standard Sheet sizes	1-36
Orthographic Projection - Exercises	1-37
Planes (Normal, Inclined and Oblique)	1-42
Plane - Exercises	1-43
Chapter Summary	1-49
Chapter Terminology	1-50
Questions/Exercises	1-53
<b>Chapter 2 - Isometric Projection and Multi View Drawings</b>	<b>2-1</b>
Chapter Overview	2-3
Isometric Projections	2-3
Isometric Sketching	2-5
Circles drawn in Axonometric Views	2-7
Additional Projections	2-9
Oblique Projections	2-9
Arrangement of Views	2-13
Two View drawing	2-14
One View drawing	2-16
Drawing - Exercises	2-19
Drawing views - Advanced	2-21
Section View	2-21
Detail View	2-23
Broken out View	2-24
Break or Broken View	2-25
Crop View	2-26
Auxiliary View	2-27
Exercises	2-27
History of Computer Aided Design (CAD)	2-28
Boolean operation	2-29
What is SolidWorks?	2-31
Design Intent	2-33

Design intent in the sketch	2-33
Design intent in the feature	2-34
Design intent in the part	2-34
Design intent in the assembly	2-35
Design intent in the drawing	2-35
Chapter Summary	2-36
Chapter Terminology	2-36
Questions/Exercises	2-38
<b>Chapter 3 - Dimensioning Practices, Scales, Tolerancing and Fasteners</b>	<b>3-1</b>
Chapter Overview	3-3
American National Standards Institute (ANSI)	3-3
Dimensioning	3-4
Location	3-4
Size	3-4
Measurement - units	3-5
Metric / SI	3-5
English	3-5
Dual	3-6
Scales	3-7
Architect's scale	3-7
Engineer's scale	3-7
Linear encoder	3-7
Vernier scale	3-7
Standards for Dimensioning	3-8
Linear dimension	3-8
Stagger dimension	3-8
Aligned dimension	3-9
Angular dimension	3-9
Chamfer dimension	3-10
Slot dimension	3-10
Radius dimension	3-11
Simple hole dimension	3-12
Fastener dimension	3-13
Cylindrical dimension	3-13
Equally spaced hole dimension	3-15
Hole dimension location	3-15
Point / Center of a circle dimension	3-16
Arc dimension	3-16
Order of Preference - linear dimension line	3-17
Precision	3-17
Size Dimension	3-18
Continuous Dimensions	3-19
Principles of good Dimensioning	3-20
Precision and Tolerance	3-26
Tolerance for a drawing	3-27
General Tolerance - Title Block	3-27
Local Tolerance - Dimension	3-28
Limit Tolerance	3-28
Unilateral Tolerance	3-29
Bilateral Tolerance	3-29

Formatting inch Tolerance	3-29
Metric Dimension Specifications	3-30
Toleranced Parts and Important Terms	3-30
Fit - Hole Tolerance	3-31
Fit Types between Mating Parts	3-31
Clearance Fit	3-32
Interference Fit	3-32
Transition Fit	3-32
Fasteners in General	3-34
Representing External (Male) Threads	3-34
Cutting External (Male) Threads	3-35
Die	3-35
Lathe	3-35
Representing Internal (Female) Threads	3-36
Cutting Internal (Female) Threads	3-36
Taper	3-37
Plug	3-37
Bottoming	3-37
American National Standard and Unified Screw Threads	3-38
Single vs. Double or Triple Threads	3-38
Pitch and Major Diameter	3-39
Thread Class of Fit	3-39
Class 1	3-39
Class 2	3-39
Class 3	3-39
General Thread Notes	3-40
Dimensioning a CounterBore Hole	3-41
Dimensioning a CounterSink Hole	3-41
Chapter Summary	3-42
Chapter Terminology	3-42
Questions/Exercises	3-44
<b>Chapter 4 - Introduction to SolidWorks Part Modeling</b>	<b>4-1</b>
Chapter Overview	4-3
File Management	4-4
Start a SolidWorks 2014 Session	4-5
SolidWorks UI and CommandManager	4-6
Menu bar toolbar	4-6
Menu bar menu	4-6
Drop-down menu	4-7
Right-click Context toolbar	4-7
Fly-out tool buttons/Consolidated menu	4-8
System feedback icons	4-8
Confirmation Corner	4-8
Heads-up View toolbar	4-9
CommandManager	4-12
Part (default tab)	4-12
Drawing (default tab)	4-13
Assembly (default tab)	4-14
FeatureManager Design Tree	4-16
Fly-out FeatureManager	4-18

Task Pane	4-19
SolidWorks Resources	4-20
Design Library	4-20
File Explorer	4-21
Search	4-21
View Palette	4-21
Appearances, Scenes, and Decals	4-22
Custom Properties	4-22
Document Recovery	4-22
Motion Study tab	4-23
Create a New Part	4-24
Part Template	4-29
BATTERY Part	4-34
BATTERY Part-Extruded Boss/Base Feature	4-36
BATTERY Part-Fillet Feature	4-40
BATTERY Part-Extruded Cut Feature	4-42
BATTERY Part-Second Fillet Feature	4-44
BATTERY Part Extruded Boss/Base Feature	4-45
BATTERYPLATE Part	4-51
Save As, Delete, Modify, and Edit Feature	4-52
BATTERYPLATE Part-Extruded Boss/Base Feature	4-54
BATTERYPLATE Part-Fillet Features: Full Round, Multiple Radius Options	4-55
Multi-body Parts and Extruded Boss Feature	4-58
Chapter Summary	4-59
Chapter Terminology	4-62
Questions / Exercises	4-65
<b>Chapter 5 - Revolved Features</b>	<b>5-1</b>
Chapter Overview	5-3
LENS Part	5-4
LENS Part Revolved Boss/Base Feature	5-5
LENS Part-Shell Feature	5-8
LENS Part-Extruded Boss/Base Feature and Convert Entities Sketch tool	5-9
LENS Part-Extruded Boss/Base Feature	5-9
LENS Part-Hole Wizard Feature	5-10
LENS Part-Revolved Boss Thin Feature	5-12
LENS Part-Extruded Boss/Base Feature and Offset Entities	5-14
LENS Part-Extruded Boss/Base Feature and Transparent Optical Property	5-16
LENS Part-Transparent Optical Property	5-16
BULB Part	5-18
BULB Part-Revolved Base Feature	5-19
BULB Part-Revolved Boss Feature and Spline Sketch tool	5-21
BULB Part-Revolved Cut Thin Feature	5-23
BULB Part-Dome Feature	5-25
BULB Part-Circular Pattern Feature	5-26
BULB Part-Seed Cut Feature	5-28
BULB Part-Extruded Cut Feature	5-28
BULB Part-Circular Pattern Feature	5-29
Customizing Toolbars and Short Cut Keys	5-30
Chapter Summary	5-32
Chapter Terminology	5-33

Questions / Exercises	5-35
<b>Chapter 6 - Swept, Lofted, and Additional Features</b>	<b>6-1</b>
Chapter Overview	6-3
O-RING Part	6-4
O-RING Part-Swept Base Feature	6-4
SWITCH Part	6-8
SWITCH Part-Lofted Base Feature	6-8
SWITCH Part-Shape Feature	6-12
Four Major Categories of Solid Features	6-14
LENSCAP Part	6-15
LENSCAP Part-Extruded Boss/Base Feature	6-16
LENSCAP Part-Extruded Cut Feature	6-16
LENSCAP Part-Shell Feature	6-16
LENSCAP Part-Revolved Cut Thin Feature	6-19
LENSCAP Part-Thread Path Feature	6-20
LENSCAP Part-Helix/Spiral Curve Feature	6-20
LENSCAP Part-Swept Boss Feature	6-20
HOUSING Part	6-26
HOUSING Part-Extruded Boss/Base Feature	6-27
HOUSING Part-Lofted Boss Feature	6-29
HOUSING Part-Second Extruded Boss/Base Feature	6-33
HOUSING Part-Shell Feature	6-34
HOUSING Part-Third Extruded Boss/Base Feature	6-35
HOUSING Part-Draft Feature	6-36
HOUSING Part-Thread Feature	6-38
HOUSING Part-Swept Boss Feature	6-38
HOUSING Part-Handle Swept Boss Feature	6-43
HOUSING Part-Extruded Cut Feature with UpToSurface Option	6-48
HOUSING Part-First Rib Feature	6-50
HOUSING Part-Linear Pattern Feature	6-50
HOUSING Part-Second Rib Feature	6-53
HOUSING Part-Mirror Feature	6-57
Chapter Summary	6-59
Chapter Terminology	6-61
Questions / Exercises	6-62
<b>Chapter 7 - Assembly Modeling</b>	<b>7-1</b>
Chapter Overview	7-3
Assembly Modeling Overview	7-4
FLASHLIGHT Assembly	7-6
Assembly Techniques	7-7
Assembly Template	7-8
Assembly Templates-ASM-IN-ANSI	7-8
Assembly Templates-ASM-MM-ISO	7-9
LENSANDBULB Sub-assembly	7-10
BATTERYANDPLATE Sub-assembly	7-14
CAPANDLENS Sub-assembly	7-16
FLASHLIGHT Assembly	7-20
FLASHLIGHT Assembly-Interference Issues	7-27
FLASHLIGHT Assembly-Exploded View	7-28

FLASHLIGHT Assembly-Export Files and eDrawings	7-31
Chapter Summary	7-34
Chapter Terminology	7-34
Questions / Exercises	7-36
<b>Chapter 8 - Fundamentals of Drawing</b>	<b>8-1</b>
Chapter Overview	8-3
New Drawing and the Drawing Template	8-4
Title Block	8-7
Company Logo and Save Sheet Format	8-11
BATTERY Drawing	8-15
BATTERY Drawing - Insert a View	8-16
BATTERY Drawing - Detail View	8-19
BATTERY Drawing - View Display	8-20
BATTERY Drawing - Insert Model Items and Move Dimensions	8-21
BATTERY Drawing - Insert a Note	8-23
New Assembly Drawing and Exploded View	8-25
FLASHLIGHT Drawing - Bill of Materials	8-27
FLASHLIGHT Drawing-Balloons	8-28
Part Numbers	8-29
FLASHLIGHT Drawing - ConfigurationManager	8-30
FLASHLIGHT Drawing - Update the Bill of Materials	8-30
O-RING Part - Design Table	8-32
O-RING Drawing	8-34
O-RING Drawing - Design Table	8-34
Center of Mass point	8-36
Chapter Summary	8-37
Chapter Terminology	8-38
Questions / Exercises	8-39
<b>Chapter 9 - Introduction to the Certified Associate - Mechanical Design (CSWA)</b>	
<b>Exam</b>	<b>9-1</b>
Chapter Objective	9-3
Introduction	9-3
Intended Audience	9-3
CSWA Exam Content	9-5
About the Exam	9-9
Exam day	9-9
Drafting Competencies	9-13
Basic and Intermediate Part Creation and Modification	9-15
Advanced Part Creation and Modification	9-21
Assembly Creation and Modification	9-27
<b>Appendix</b>	
ECO Form	A-1
Types of Decimal Dimensions (ASME Y14.5)	A-2
SolidWorks Keyboard Shortcuts	A-3
Windows Shortcuts	A-4
Helpful On-Line information	A-5
SolidWorks Document types	A-6

Index

I-1

View the video instruction for additional help. Supplementary projects are included in the exercise section of Chapter 7. Copy the components from the Chapter 7 Homework folder. Create an ANSI Assembly document. Create and insert all needed components and mates to assemble the assembly and to simulate proper movement per the provided avi file located in the folders.

Name
Bench Vice Assembly Project
Butterfly Valve Assembly Project
Drill Guide Assembly Project
Pulley Assembly Project
Quick Acting Clamp Assembly Project
Radial Engine Assembly Project
Shock Assembly Project
Welder Arm Assembly Project

