

# Engineering CAD I

## Curriculum Content Frameworks

**Please note: All assessment questions will be taken from the knowledge portion of these frameworks.**

*Prepared by*

Hervey Galloway, Program Advisor  
Doris Soenke, Secretary

*Facilitated by*

Karen Chisholm, Program Manager  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

*Edited by*

Melba Shapley, TMe, Inc.  
Bruce Harkey, Drafting Instructor, Pulaski County  
Dick Burchett, Program Manager  
Hervey Galloway, Program Advisor

Office of Skilled and Technical Sciences / Technical and Professional Education  
Arkansas Department of Workforce Education

*Disseminated by*

Career and Technical Education  
Office of Assessment and Curriculum  
Arkansas Department of Workforce Education

# Curriculum Content Frameworks

## Engineering CAD I

Grade Levels: 10-12  
Course Code: 494740

Prerequisite: Drafting and Design 494700

Course Description: Emphasis is given to the development of competencies related to solving drafting and design problems that require the individual to understand and apply a wide range of technical knowledge and critical-thinking skill. The course is designed to allow the student to produce drawings as traditional drawings or as computer-aided drawings.

### Table of Contents

	Page
Unit 1: Practicing Safety	1
Unit 2: Prepare for a Career in Drafting	2
Unit 3: Using Mathematics in Drafting	4
Unit 4: Orientation to Engineering / CAD (CAD)	6
Unit 5: Performing CAD Operations	8
Unit 6: Perform Technical Drafting Operations	10
Unit 7: Dimensioning Technical Drawings	12
Unit 8: Drafting with Pictorial Views	14
Unit 9: Prepare Working Drawings	16
Unit 10: Prepare a Career Portfolio	18
Unit 11: Career and Technical Student Organizations (SkillUSA / HOSA)	20
Glossary	25

## Unit 1: Practicing Safety

### Hours: 2

Terminology: Glare, Hazard, Material Safety Data Sheet (MSDS)

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
1.1 Define terminology related to practicing safety	1.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
1.2 Outline general safety guidelines	1.2.1 Apply MSDS guidelines for safe handling of hazardous materials used in drafting	Foundation	Listening	Listens to follow directions [1.2.6]	
	1.2.2 Adhere to safety precautions regarding hazardous materials used in drafting	Thinking	Reading	Follows written directions [1.3.13]	
	1.2.3 Identify out drafting classroom hazardous materials		Decision	Accepts responsibility for decision [4.2.1]	
	1.2.4 Demonstrate school emergency exit plans		Evaluates information/data to make best decision [4.2.5]		

## Unit 2: Prepare for a Career in Drafting

### Hours: 3

Terminology: Mechanical engineer, Surveyor

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
2.1 Define terminology related to drafting careers	2.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
2.2 Describe career options in drafting	2.2.1 Research career options in technical drafting for a mechanical engineer, industrial designer, model maker, teacher, technical illustrator, and tool designer	Foundation	Speaking	Speaks effectively, using appropriate eye contact, gestures, and posture [1.5.11]	
		Personal Management	Career Awareness, Development, and Mobility	Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]	
2.3 Identify educational experience and personal traits that benefit a drafter	2.3.1 Revise a career action plan in drafting with several career actions	Foundation	Reading	Comprehends written information and applies it to a task [1.3.8]	
	2.3.2 Research requirements of a community college program in engineering and computer-aided engineering	Personal Management	Career Awareness, Development, and Mobility	Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]	
	2.3.3 Research requirements of a college major in engineering	Thinking	Reasoning	Comprehends ideas and concepts related to educational experience and personal traits that benefit a drafter [4.5.2]	
	2.3.4 Explore interest in various occupational areas utilizing technical drafters				
	2.3.5 Prepare a list of job responsibilities that apply to various drafting occupations				

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
2.4 Select potential barrier to career advancement	2.4.1	Depict potential barriers to career advancement	Foundation	Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]
	2.4.2	Explain common failures made by drafting employees to meet workplace expectations	Personal Management	Career Awareness, Development, and Mobility	Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]
	2.4.3	Estimate results of failure to keep current with technical knowledge and skills			
	2.4.4	Give examples of workplace discrimination (based upon such factors as gender, ethnicity, age, or physical disability)	Thinking	Creative Thinking	Finds new ways of dealing with existing problems/situations [4.1.5]
	2.4.5	Relate state and federal employment laws and company human resources policies			
2.5 List strategies for removing potential barriers to career advancement	2.5.1	Participate in professional development programs	Personal Management	Career Awareness, Development, and Mobility	Sets well-defined and realistic personal/career goals (short-term and long-term) [3.1.11]
	2.5.2	Show the benefits of constructive criticism			

## Unit 3: Using Mathematics in Drafting

### Hours: 5

Terminology: Concentric, Gallon, Mass, Volume

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
3.1 Define terminology related to mathematics in drafting	3.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and computer-aided drafting[1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
3.2 Outline mathematical conversions used in preparing technical drawings	3.2.1 Convert inches to feet and feet to inches	Foundation	Arithmetic / Mathematics	Converts different units of measurement [1.1.17]	
	3.2.2 Convert centimeters to millimeters and millimeters to centimeters				
	3.2.3 Convert cubic feet to gallons and gallons to cubic feet				
3.3 Identify basic mathematical skills used in drafting operations	3.3.1 Show how to use addition, subtraction, multiplication, and division involving whole numbers, fractions, mixed numbers and decimal fractions	Foundation	Arithmetic / Mathematics	Calculates different units of measurement [1.1.6]	
	3.3.2 Convert common fractions to decimal fractions and decimal fractions to common fractions				

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
3.4 Describe mathematical calculations involving practical geometry and trigonometry	3.4.1 Apply practical geometry and trigonometry using the Pythagorean Theorem (3-4-5 triangle)	Foundation	Arithmetic/ Mathematics	Computes using a formula [1.1.14]	
	3.4.2 Solve mathematical formulas to calculate for area			Uses basic algebraic symbols, terms, principles, and formulas [1.1.33]	
	3.4.3 Show mathematical formulas to calculate for volume			Uses basic geometric symbols, terms, principles, and formulas [1.1.34]	
	3.4.4 Demonstrate practical applications of the Pythagorean Theorem ( 3-4-5 triangle)				
3.5 List methods to calculate material quantities used in manufacturing	3.5.1 Estimate the weight of various quantities of iron, steel, and aluminum; cubic yards of concrete for footing	Foundation	Arithmetic/ Mathematics	Applies a mathematical formula to solve a problem [1.1.3]	
	3.5.2 Estimate quantities of paint to cover a tank			Estimates arithmetic results without a calculator [1.1.22]	
	3.5.3 Calculate capacity of a tank			Makes rough measurements [1.1.28]	

## Unit 4: Orientation to Engineering / CAD (CAD)

### Hours: 5

Terminology: Border, Title block

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
4.1 Define terminology related to engineering and CAD	4.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
4.2 Identify various types of technical drawings used for manufacturing	4.2.1 Explain the purpose for components of technical drawings used in manufacturing	Foundation	Writing	Presents answers/conclusions in a clear and understandable form [1.6.13]	
	4.2.2 Give examples of various types of architectural and technical drawings				
4.3 Describe techniques of drawing to scale	4.3.1 Draw objects to a scale of full-size, larger than full-size, and smaller than full-size	Foundation	Arithmetic/ Mathematics	Makes precision measurements using a scale [1.1.27]	
	4.3.2 Demonstrate the use of the engineer's scale or metric scale to measure and layout drawings or sketches	Thinking	Reasoning	Comprehends ideas and concepts related to engineering and CAD [4.5.2]	
	4.3.3 Evaluate advantages and disadvantages of scales used on technical drawings				

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
4.4 Name methods to prepare sketches used in industry	4.4.1 Use techniques for developing freehand sketches of simple manufactured parts 4.4.2 Show techniques for developing sketches using drawing instruments 4.4.3 Show techniques for developing sketches not using drawing instruments	Thinking	Seeing Things in the Mind's Eye	Organizes and processes images, symbols, pictures, graphs, objects, etc. [4.6.2]	
4.5 List freehand lettering techniques used in preparing technical drawings	4.5.1 Construct letters and numbers using the American National Standards Institute (ANSI) Single-Stroke Gothic Alphabet 4.5.2 Compose typical notes found on technical drawings using freehand lettering techniques	Foundation	Writing	Uses technical words and symbols [1.6.20] Writes/Prints legibly [1.6.24]	

## Unit 5: Performing CAD Operations

### Hours: 15

Terminology: Format, Grid, Snap

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS				
What the Student Should be Able to Do			What the Instruction Should Reinforce				
Knowledge	Application		Skill Group	Skill	Description		
5.1 Define terminology related to CAD	5.1.1	Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]		
				Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]		
5.2 Identify components of a CAD system used in industry	5.2.1	Give the purpose for components of a CAD drafting system to include a CPU, monitor, keyboard, mouse, digitizer, plotter, and software	Foundation	Speaking	Applies/Uses technical terms as appropriate to audience [1.5.2]  Communicates a thought, idea, or fact in spoken form [1.5.5]		
				Thinking	Reasoning	Determines which conclusions are correct when given a set of facts and a set of conclusions [4.5.3]	
						5.2.2 Depict common features of a CAD software program	
5.2.3	Show how to use CAD system command menus						
5.3 Outline fundamental computer skills	5.3.1	Show how to manage files (i.e., saving, backing up, organizing)	Foundation	Science	Applies a scientific principle to solve a problem [1.4.7]		
				Thinking	Decision Making	Writing	Produces neat, legible document from typewriter or computer [1.6.15]
						Perform word processing functions (compose, cut, copy, paste, print)	Comprehends ideas and concepts related to fundamental computer skills. [4.2.2]

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
5.4 Describe procedures for CAD drawing setup commands	5.4.1 Use CAD drawing setup commands to include drawing limits, units of measurement, text styles and size, dimension variables		Interpersonal	Arithmetic/ Mathematics	Uses computer in mathematical applications, information processing, problem solving [1.1.38]
	5.4.2 Modify settings for various drawing aids (i.e., snap, grid, and polar)		Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]
	5.4.3 Modify settings for various layers for a CAD drawing				
5.5 List CAD drawing commands for preparing technical drawings	5.5.1 Use CAD drawing commands to construct lines, circles, arcs, polylines, polygons, ellipses, rectangles, and text		Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	5.5.2 Construct blocks or symbols using CAD commands				
	5.5.3 Insert various blocks and symbols in CAD				
5.6 Explain CAD editing and modifying commands on technical drawings	5.6.1 Use CAD modifying commands to include move, copy, mirror, break, offset, stretch, scale, rotate, trim, extend, erase, grips, and array		Thinking	Creative Thinking	Creates new design by applying specified criteria [4.1.3]
	5.6.2 Use CAD commands to change or modify lines and features of a multiview drawing of simple manufacturing parts			Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]  Interprets drawings to solve design problems [4.4.7]
5.7 Distinguish between historical methods to reproduce technical drawings and current reproduction technology	5.7.1 Give examples of historical methods to reproduce technical drawings		Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	5.7.2 Prepare all or part of a technical drawing using current reproduction technology			Writing	Organizes information into an appropriate format [1.6.10]
5.8 Describe how to plot CAD drawings	5.8.1 Demonstrate techniques for scaling drawings using a CAD system		Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]
	5.8.2 Plot CAD drawings to various scales				Revises plan of action indicated by findings [4.4.9]
	5.8.3 Demonstrate how to plot CAD drawings having single and multiple view ports				

## Unit 6: Perform Technical Drafting Operations

### Hours: 15

Terminology: American National Standards Institute (ANSI), International Standards Organization (ISO), Section view

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do			What the Instruction Should Reinforce			
Knowledge	Application		Skill Group	Skill	Description	
6.1 Define terminology related to technical drafting operations	6.1.1 Use terms appropriately in context		Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]	
				Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
6.2 Identify reference materials used for preparing technical drawings	6.2.1 Demonstrate use of a table of contents, glossary, indexes, and cross-references in technical reference materials		Thinking	Knowing How to Learn	Locates appropriate learning resources to acquire or improve knowledge and skills [4.3.3]	
	6.2.2 Reference information in textbooks, and catalogs				Uses available resources to acquire new skills or improve skills [4.3.4]	
	6.2.3 Reference information for technical drawings using internet resources				Uses available resources to apply new skills [4.3.6]	
6.3 Describe line conventions for technical drawings	6.3.1 Prepare a list of common line symbols used on technical drawings		Foundation	Reading	Applies information to job performance [1.3.4]	
	6.3.2 Apply common line symbols to technical drawings of simple parts		Thinking	Reasoning	Applies rules and principles to a new situation [4.5.1]	
	6.3.3 Relate uses for special line symbols on technical drawings					Comprehends ideas and concepts related to the use of line conventions on technical drawings [4.5.2]
	6.3.4 Apply various special line symbols to technical drawings of simple parts					

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
6.4 Select the appropriate types of projections to represent objects	6.4.1	Demonstrate the ability to select projections which best communicate the features of objects	Foundation	Arithmetic/ Mathematics	Makes precision measurements using a scale [1.1.27]
	6.4.2	Construct orthographic views necessary to show features of objects	Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]
	6.4.3	Determine reasons for section views on technical drawings			Interprets drawings to solve design problems [4.4.7]
	6.4.4	Distinguish between characteristics of various types of section views			
	6.4.5	Use section views necessary to best show interior features of an object			
6.5 List general drafting standards applied to technical drawings	6.5.1	Relate the purpose for drawing standards	Foundation	Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]
	6.5.2	Distinguish between ANSI and ISO standards in preparing technical drawings	Thinking	Reasoning	Extracts rules or principles from written information [4.5.4]
	6.5.3	Research ANSI and ISO standards for preparing a technical drawing			See relationship between two or more ideas, objects, or situations [4.5.5]

## Unit 7: Dimensioning Technical Drawings

### Hours: 15

Terminology: Angular dimension, Datum feature, Dimension, Finish mark, Limit tolerance, Tolerance

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
7.1 Define terminology related to dimensioning technical drawing	7.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to CAD [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
7.2 Discuss dimensioning practices used on technical drawings	7.2.1 Demonstrate an understanding of methods for the placement of dimensions using the unidirectional and aligned dimensioning systems on multiview drawings	Foundation  Thinking	Arithmetic / Mathematics	Uses common measuring devices/tools to measure engineering and CAD [1.1.37]	
			Problem Solving	Comprehends ideas and concepts related to dimensioning multiview drawings [4.4.1]  Interprets drawings to solve design problems [4.4.7]	
			Reasoning	Applies rules and principles to a new situation [4.5.1]	
				Extracts rules or principles from written information [4.5.4]	
				7.2.2 Demonstrate techniques for applying dimensions to various features of technical drawings	
7.2.3 Apply dimensions and notes to technical drawings, including units of measurement, arrowheads and leaders					
7.2.4 Prepare dimension technical drawings using appropriate positioning of views, line precedence, circles, and arcs					
7.2.5 Demonstrate an understanding of standards for applying datumline dimensioning to various features of a technical drawing					

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
7.3 Identify types of general notes found on a technical drawing	7.3.1 Relate the types of notes used on technical drawings 7.3.2 Apply general notes to technical drawings 7.3.3 Compose general notes used on working drawings	Thinking	Seeing Things in the Mind's Eye	Organizes and processes images, symbols, pictures, graphs, objects, etc. [4.6.2]	
7.4 Describe machining notes and special symbols applied to a technical drawing	7.4.1 Identify locations for machining notes and symbols on technical drawings (e.g., chamfer, radius, counter bore, countersink, depth, diameter, finish)	Foundation  Thinking	Arithmetic/ Mathematics  Speaking  Problem Solving	Comprehends mathematical ideas and concepts related to engineering and CAD [1.1.13]  Demonstrates mathematical calculation [1.1.19]  Communicates a thought, idea, or fact in spoken form [1.5.5]  Interprets drawings to solve design problems [4.4.7]	
7.5 Label tolerance dimensions applied to technical drawings	7.5.1 Relate the need for tolerance in dimensions for machine parts 7.5.2 Demonstrate the use of limit dimensions on working drawings 7.5.3 Demonstrate the use of +/- tolerance dimensions on working drawings 7.5.4 Compute maximum and minimum dimensions based on tolerance dimensioning for machine parts 7.5.5 Apply limit dimensions to technical drawings of machine parts 7.5.6 Apply +/- tolerance dimensions to drawings of machine parts	Foundation	Reading  Writing	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]  Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	

## Unit 8: Drafting with Pictorial Views

### Hours: 15

Terminology: Axonometric

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
8.1 Define terminology related to pictorial views	8.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
8.2 Describe special characteristics of pictorial drawings	8.2.1 Distinguish between pictorial (axonometric) and multiview drawings	Foundation	Science	Uses equipment and techniques to develop isometric, oblique, and perspective drawings [1.4.23]	
	8.2.2 Explain the characteristics unique to isometric drawings	Thinking	Problem Solving	Interprets drawings to solve design problems [4.4.7]	
	8.2.3 Explain the characteristics unique to oblique drawings		Seeing Things in the Mind's Eye	Organizes and processes images, symbols, pictures, graphs, objects, etc. [4.6.2]	
	8.2.4 Explain the characteristics unique to perspective drawings				
8.3 List techniques for developing isometric drawings	8.3.1 Demonstrate techniques to develop isometric drawings of simple parts	Foundation	Science	Uses equipment and techniques to develop isometric, oblique, and perspective drawings [1.4.23]	
	8.3.2 Prepare isometric drawings of simple objects with cubic and cylindrical features	Thinking	Problem Solving	Interprets drawings to solve design problems [4.4.7]	
	8.3.3 Use CAD commands to change or modify lines and features of an isometric drawing				

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
8.4 List techniques for developing oblique drawings	8.4.1	Demonstrate techniques to develop general oblique drawings of simple objects	Thinking	Problem Solving	Interprets drawings to solve design problems [4.4.7]
	8.4.2	Identify characteristics of cavalier oblique drawings		Reasoning	Applies rules and principles to a new situation [4.5.1]
	8.4.3	Identify characteristics of cabinet oblique drawings			
8.5 Identify practices to dimension isometric views on working drawings	8.5.1	Demonstrate methods for the placement of dimensions using the unidirectional dimensioning system on isometric views	Foundation	Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]
	8.5.2	Apply dimensions and notes to isometric views, including units of measurement, arrowheads and leaders		Writing	Analyzes data, summarizes results, and makes conclusions [1.6.2]
	8.5.3	Prepare and dimension isometric views of objects using appropriate positioning of view, line precedence, circles, and arcs			Uses technical words and symbols [1.6.20]
	8.5.4	Demonstrate methods for applying datumline dimensioning to various features of an isometric drawing			

## Unit 9: Prepare Working Drawings

### Hours: 30

Terminology: Casting, Counterbore, Countersink, Drill, Fillet, Round, Runout

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
9.1 Define terminology related to working drawings	9.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and computer-aided drafting [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
9.2 Identify characteristics of threads and fasteners shown on working drawings	9.2.1 Explain the meaning of thread notes (metric and U.S. system) used on working drawings	Foundation	Writing	Organizes information into an appropriate format [1.6.10]	
	9.2.2 Distinguish between different types of thread representation (detailed, schematic, and simplified)	Thinking	Problem Solving	Interprets drawings to solve design problems [4.4.7]	
	9.2.3 Prepare schematic, and simplified thread representation on a working drawing				
9.3 Describe detail working drawings	9.3.1 Prepare detail drawings of mechanical parts	Foundation	Writing	Organizes information into an appropriate format [1.6.10]	
		Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]  Interprets drawings to solve design problems [4.4.7]	
			Seeing Things in the Mind's Eye	Organizes and processes images, symbols, pictures, graphs, objects, etc. [4.6.2]	

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
9.4 Identify section views on working drawings	9.4.1 Determine characteristics of typical section views used for working drawings	Thinking	Decision Making	Comprehends ideas and concepts related to section drawings [4.2.2]	
	9.4.2 Demonstrate techniques for indicating iron, aluminum, and steel on section views			Evaluates information/data to make best decision [4.2.5]	
	9.4.3 Apply drawing conventions used for various section views		Problem Solving	Interprets drawings to solve design problems [4.4.7]	
	9.4.4 Prepare working drawings of simple mechanical parts requiring the use of section views to show internal detail				
9.5 Explain features of dimensioning commands for technical drawings	9.5.1 Use CAD dimensioning commands to include linear, aligned, angular, baseline, continuous, radius and diameter, and associative dimensioning on features of multiview and isometric drawings	Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]	
	9.5.2 Use CAD dimensioning commands to place aligned and unidirectional dimensioning on features of multiview and isometric drawings				
	9.5.3 Use CAD commands to place notes and leaders on a technical drawing				
	9.5.4 Setup and change CAD dimensioning styles for a technical drawing				

## Unit 10: Prepare a Career Portfolio

### Hours: 3

Terminology: Media, Technical writer

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
10.1 Define terminology related to preparing a career portfolio	10.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to engineering and CAD [1.3.6]
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]
10.2 Outline a career portfolio	10.2.1 Evaluate options for displaying drafting work in a professional manner	Thinking	Creative Thinking	Develops visual aids to create audience interest [4.1.4]
	10.2.2 Use a variety of media display materials giving consideration to several portfolio display methods			Prepares presentation based on subject research, interviews, surveys [4.1.10]
	10.2.3 Demonstrate the role a portfolio can play in the hiring process for employment			Organizes and processes images, symbols, pictures, graphs, objects, etc. [4.6.2]
			Seeing Things in the Mind's Eye	

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
10.3 Select and organize material for a career portfolio	10.3.1 Prepare a resume' and cover letter for a career portfolio, including references and letters of recommendation to be included with a career portfolio	Personal Management Skills	Career Awareness, Development, and Mobility	Establishes and implements a plan of action [3.1.5]
	10.3.2 Show examples of work for a career portfolio representing a variety of projects and demonstrating the range of talent (e.g., drawings, pictures of models)		Organizational Effectiveness	Presents personal skills as benefits for company objective [3.3.7]
	10.3.3 Show examples of work for a career portfolio that demonstrates ability and versatility	Thinking	Self-Esteem	Develops self-confidence by creating a resume' which promotes personal strengths/abilities [3.5.5]
	10.3.4 Prepare a career portfolio with sections labeled by subject areas		Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]
	10.3.5 Prepare an index for a career portfolio including such items as mechanical drawings, manual drawings, projects, awards, and recognitions (SkillsUSA, academic, and others)			
	10.3.6 Organize materials for a career portfolio in a logical manner for presentation			
10.4 Outline guidelines for a career portfolio	10.4.1 Demonstrate professional dress for a portfolio presentation	Personal Management	Self-Esteem	Creates self-confidence and positive self-image through proper grooming [3.5.3]
	10.4.2 Relate an understanding of oral communication skills necessary for presenting a portfolio	Thinking	Decision Making	Comprehends ideas and concepts related to professional dress and oral communication [4.2.2]

# Unit 11: Career and Technical Student Organizations (SkillUSA / HOSA)

Hours: 12

Terminology: Assess, Assessment, Behavior, Business Meeting, Career, Competency, Critique, Cultural diversity, Customers, Equity issues, Expectation, Government, Image, Interview, Job application, Journal, Management, Mentor, Organizational chart, Parliamentary procedure, Portfolio, Presentation, Professional organizations, Résumé, Self-motivation, Short-term goals, Social etiquette, Stress, Task, Trade unions

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
11.1 Define terminology related to student organizations	11.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to student organizations [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
11.2 Outline a self-assessment and identify individual learning styles	11.2.1 Show individual strengths	Interpersonal	Leadership	Conveys attitudes and values of group to others [2.4.3]	
	11.2.2 Show areas in need of improvement	Thinking	Problem Solving	Identifies possible reasons for problem [4.4.6]	
11.3 Describe self-motivation techniques and establish short-term goals	11.3.1 Prepare a list of short-term goals	Personal Management	Self-Esteem	Develops/Initiates a plan for self-improvement [3.5.4]	
	11.3.2 Discuss ways to change or improve lifestyle appearance and behavior	Thinking	Creative Thinking	Identifies new goals and objectives [4.1.8]	
11.4 Give examples of individual time management skills	11.4.1 Prepare and maintain a time journal	Foundation	Writing	Prepares a complex document in a concise manner [1.6.12]	
	11.4.2 Outline ways to improve time management skills	Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]  Recognizes/Defines problem [4.4.8]	
11.5 Predict future occupations	11.5.1 Research the Internet to explore for career opportunities within specified fields of study	Foundation	Reading	Draws conclusions from what is read [1.3.12]	
			Writing	Summarizes written information [1.6.17]	
	11.5.2 Prepare a presentation on a specified career area	Personal Management	Career Awareness, Development, and Mobility	Explores career opportunities [3.1.6]	
		Thinking	Creative Thinking	Prepares presentation based on subject research, interviews, surveys [4.1.10]	

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
11.6 Identify the customer	11.6.1 Differentiate between External and Internal customers	Interpersonal	Customer Service	Recognizes effects of positive/negative attitudes on customers [2.3.7]
	11.6.2 Identify factors which contribute to poor customer relationships	Thinking	Decision Making	Shows initiative and courtesy in meeting and working with customers [2.3.8] Evaluates information/data to make best decision
11.7 Identify the benefits of doing a community service project	11.7.1 Outline ways to become involved in the community	Foundation	Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]
	11.7.2 Develop a community service project	Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]
11.8 Describe effective communication with others	11.8.1 Note personal barriers to listening	Thinking	Problem Solving	Recognizes/Defines problem [4.4.8]
	11.8.2 Relate a personal plan to overcome barriers to listening			Revises plan of action indicated by findings [4.4.9]
11.9 Give locations for a shadowing activity	11.9.1 Summarize and relate an experience of job shadowing activity	Interpersonal	Leadership	Encourages/Motivates members of a group or team [2.4.6]
11.10 Identify the components of an employment portfolio	11.10.1 Present parts of a portfolio	Foundation	Writing	Completes form accurately [1.6.7]
	11.10.2 Compile a personal employment portfolio for an interview			Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]
11.11 List proficiency in program competencies	11.11.1 Construct an interpersonal competency assessment	Foundation	Writing	Analyzes data, summarizes results, and makes conclusions [1.6.2]
11.12 Describe how to measure / modify short-term goals	11.12.1 Discuss how to pursue short-term goal(s)	Thinking	Creative Thinking	Identifies new goals and objectives [4.1.8]
11.13 Identify stress sources	11.13.1 Prepare a list of personal sources of stress	Foundation	Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6]
	11.13.2 Outline techniques to cope with individual sources of stress	Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
11.14 Identify characteristics of a positive image	11.14.1 List behaviors and traits that lead to a positive image	Foundation	Reading	Determines what information is needed [1.3.10]
	11.14.2 Note behaviors and traits that lead to a negative image	Personal Management	Self-Esteem	Comprehends the importance of a positive self-concept [3.5.1]  Develops/Initiates a plan for self-improvement [3.5.4]
		Thinking	Decision Making	Identifies pros and cons to assist in decision-making process [4.2.7]
			Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]
11.15 Describe how team skills can be applied to a group project	11.15.1 Form a team to develop a class project	Interpersonal	Teamwork	Works effectively with others to reach a common goal [2.6.6]
11.16 Outline how to observe and critique a meeting	11.16.1 Attend a formal meeting held with in the community	Foundation	Writing	Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]
	11.16.2 Prepare a critique of the meeting attended	Interpersonal	Customer Service	Shows initiative and courtesy in meeting and working with customers [2.3.8]
11.17 List business meeting skills	11.17.1 Relate the basic rules required to ensure an orderly and business-like meeting	Foundation	Speaking	Organizes ideas and communicates oral messages to listeners [1.5.7]
	11.17.2 Demonstrate with role-playing to illustrate appropriate meeting skills	Interpersonal	Leadership	Conveys attitudes and values of group to others [2.4.3]  Influences group behavior [2.4.8]
11.18 Outline a survey for employment opportunities	11.18.1 Compile information on a particular employment opportunity of interest	Foundation	Writing	Presents own opinion in written form in a clear, concise manner [1.6.14]
	11.18.2 Perform an internet search of a specific career area	Personal Management	Career Awareness, Development, and Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4]
11.19 Select a professional journal for review and develop a three to five minute presentation	11.19.1 Prepare a presentation on the content, purpose, and distribution of a particular professional journal	Foundation	Writing	Prepares a complex document in a concise manner [1.6.12]

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
11.20 Identify customer expectations	11.20.1 List customer expectations  11.20.2 Discover the consequences of unmet customer expectations	Interpersonal	Customer Service	Applies human relations skills in real-life situations [2.3.1]  Recognizes effects of positive/negative attitudes on customers [2.3.7]  Works with customers to satisfy their expectations [2.3.9]
11.21 List parts of a job application	11.21.1 Prepare a job application from various businesses in the community  11.21.2 Demonstrate a mock job interview	Foundation	Reading  Speaking  Writing	Determines what information is needed [1.3.10]  Communicates a thought, idea, or fact in spoken form [1.5.5]  Uses verbal language and other cues such as body language appropriate in style, tone, and level of complexity to the audience and the occasion [1.5.14]  Completes form accurately [1.6.7]
11.22 Outline your employment portfolio	11.22.1 Construct a personal employment portfolio	Foundation	Writing	Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]  Produces neat, legible document from typewriter or computer [1.6.15]  Summarizes written information [1.6.17]  Uses language, style, organization, and format appropriate to subject matter, purpose, and audience [1.6.19]
11.23 Identify supervisory and management roles in an organization	11.23.1 Prepare an organizational chart  11.23.2 Outline the responsibilities of managers and supervisors	Foundation  Interpersonal  Thinking	Writing  Leadership  Creative Thinking	Produces neat, legible document from typewriter or computer [1.6.15]  Helps an individual or group challenge existing procedures, policies, or authority [2.4.7]  Develops visual aids to create audience interest [4.1.4]

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
11.24 Outline safety issues	11.24.1 Research safety issues within a given career area	Foundation	Reading	Identifies relevant details, facts and specifications [1.3.16]
			Science	Follows safety guidelines [1.4.15]
		Personal Management	Integrity/Honesty/ Work Ethic	Follows established rules, regulations, and policies [3.2.5]

# Glossary

## Unit 1: Practicing Safety

1. Glare — an intense blinding light
2. Hazard — a possible source of danger; to expose to danger or harm
3. Material Safety Data Sheet (MSDS) — an information sheet that details procedures and methods for using, storing, and disposing of most solvents and chemicals required for all materials that could be hazardous to personnel or equipment; these sheets contain information on the material, such as the manufacturer and chemical makeup

## Unit 2: Prepare for a Career in Drafting

1. Mechanical engineer — one who is trained or professionally engaged in mechanical engineering (the branch of engineering that encompasses the generation and application of heat and mechanical power and the design, production, and use of machines and tools)
2. Surveyor — a person who determines the boundaries, area, or elevations of land or structures; gathers representative data samples

## Unit 3: Using Mathematics in Drafting

1. Concentric — having a common center, axis, or origin
2. Gallon — a unit of volume in the United States Customary System; used for in liquid measurement; equal to four quarts
3. Mass — a unified body of matter with no specific shape; the physical volume or bulk of a solid body
4. Volume — the amount of space occupied by a three-dimensional object or region of space; expressed in cubic units

## Unit 4: Orientation to Engineering / CAD (CAD)

1. Border — heavy lines used to form a boundary for the drawing
2. Title block — a section of the drawing that gives important information about the product and progress of the project; it can include: part name, drawing number, scale of the drawing, material specifications and special treatment, company name and address, date of completion, revision dates, general tolerances, names of drafter, checker, and persons responsible for engineering, materials, and production approvals

## Unit 5: Performing CAD Operations

1. Format — a systematic, organized manner of preparing a computer disk to receive data by dividing the surface of the disk into sections that are used as storage areas for the data
2. Grid — in CAD, a nonprinting set of equally spaced dots that provide a visual reference for the computer-assisted drafting operator; the dots can be set at any convenient interval
3. Snap — a tool in CAD that allows the cursor to automatically move to and stop on a pre-determined and precise location on an object or entity as the cursor moves near

## Unit 6: Perform Technical Drafting Operations

1. American National Standards Institute (ANSI) — an organization that defines building standard, includes accessible routes, general site and building elements, plumbing elements and fixtures, communication elements and fixtures, special rooms and spaces
2. International Standards Organization (ISO) — an organization that sets standards in many businesses and technologies, including computing and communications
3. Section view — shows a view as if a cut were made through a section of a part in order to show internal details of the part

## Unit 7: Dimensioning Technical Drawings

1. Angular dimension — the measure of the angle between two nonparallel lines
2. Dimension — a measure of spatial extent, especially width, height, or length
3. Finish mark — a symbol that shows that a surface is to be machined or finished
4. Limit tolerance — a dimension showing the largest and smallest size allowed
5. Tolerance — the amount a manufactured part can vary from the specified dimension; a tolerance can be shown as a plus/minus tolerance
6. Datum feature — the line, surface, plane, or axis used as the reference feature for dimensions of an object

## Unit 8: Drafting with Pictorial Views

1. Axonometric — of or relating to a projection in which an object is drawn with its horizontal and vertical axes to scale but with its curved lines and diagonals distorted

## Unit 9: Prepare Working Drawings

1. Casting — the pouring of molten metal into a hollow or waxed filled mold, made in the shape of the desired object; molten metal is poured into the hollow cavity and allowed to cool
2. Counterbore — enlarging the end(s) of a machined hole to a specified diameter and depth
3. Countersink — creating an enlargement having sloping sides at the top of a hole so that the head of a screw can lie flush with or below the surface
4. Drill — an implement with cutting edges or a pointed end for boring holes in hard materials
5. Fillet — external curve
6. Round — internal curve
7. Runout — the area where one curved surface merges with another

## Unit 10: Prepare a Career Portfolio

1. Media — the paper, film or electronic file used to store drawings
2. Technical writer — one whose occupation is writing about a special skill or practical knowledge in a mechanical or scientific field

## Unit 11: Career and Technical Student Organizations (SkillUSA / HOSA)

1. Assess — to determine the value, significance, or extent; to judge
2. Assessment — a tool used to determine value, significance, or extent
3. Behavior — the actions one takes, how one conducts oneself
4. Business meeting — planned gathering of individuals (occupational, work, trade, or organizational) that is methodical, and systematic; the meeting is for a common purpose
5. Career — a chosen pursuit, the general course of progression of one's working life
6. Competency — the knowledge that enable one to comprehend and complete a task
7. Critique — a critical review or commentary
8. Cultural diversity — integrated existence of ethnic groups based on their values, beliefs, behavior patterns (social, educational, economic, religious, artistic values)
9. Customers — one who buys goods or services
10. Equity issues — a point of matter affecting the justice and fairness for all concerned
11. Expectation — eager anticipation; to look forward to the probable occurrence or appearance of something
12. Government — the agency or apparatus through which a governing individual or body functions and exercises authority
13. Image — the public's opinion or concept of something
14. Interview — a formal, in person meeting in which the assessment of the qualifications of an applicant are demonstrated/determined
15. Job application — a form or document used by an employer when hiring prospective employees
16. Journal — a personal record of occurrences, experiences, reflections kept on a regular basis
17. Management — the person or persons who control or direct a business or other enterprise
18. Mentor — a wise or trusted counselor or teacher
19. Organizational chart — a chart that reflects the structure through which individuals cooperate systematically to conduct business
20. Parliamentary procedure — a body of rules governing a meeting

21. Portfolio — a portable case for holding materials, such as photographs, drawings, or other materials that represent a person's work
22. Presentation — a performance; a formal introduction; the process of offering for consideration or display
23. Professional organization — a service provider utilizing a business relationship that allows outsourcing of human resources tasks, mainly for small to mid-sized business that do not have the need or resources for a dedicated human resources department; the concept is virtually unknown outside of the United States
24. Résumé — a brief account of one's professional or work experience and qualifications often submitted with a job application
25. Self-motivation — to take action, move forward of one's own volition
26. Short-term goals — goals or targets that are reachable with a short or brief period of time
27. Stress — an extreme pressure, strain, or difficulty
28. Task — a function to be performed
29. Trade unions — a labor union, especially one limited in membership to people in the same trade