Arkansas CTE

Engineering CAD I: Grades 10, 11, 12

Adopted 2006

Practicing Safety 1:

1.1 Define terminology related to practicing safety

1. Use terms appropriately in context 1.1.1

1.2 Outline general safety guidelines

1. Apply MSDS guidelines for safe handling of hazardous materials used in drafting 1.2.1
2. Adhere to safety precautions regarding hazardous materials used in drafting 1.2.2
3. Identify out drafting classroom hazardous materials 1.2.3
4. Demonstrate school emergency exit plans 1.2.4

Prepare for a Career in Drafting 2:

2.1 Define terminology related to drafting careers

1. Use terms appropriately in context 2.1.1

2.2 Describe career options in drafting

1. Research career options in technical drafting for a mechanical engineer, industrial designer, model maker, teacher, technical illustrator, and tool designer 2.2.1

2.3 Identify educational experience and personal traits that benefit a drafter

1. Revise a career action plan in drafting with several career actions 2.3.1
2. Research requirements of a community college program in engineering and computer-aided engineering 2.3.2
3. Research requirements of a college major in engineering 2.3.3
4. Explore interest in various occupational areas utilizing technical drafters 2.3.4
5. Prepare a list of job responsibilities that apply to various drafting occupations 2.3.5

2.4 Select potential barrier to career advancement

1. Depict potential barriers to career advancement 2.4.1
2. Explain common failures made by drafting employees to meet workplace expectations 2.4.2
3. Estimate results of failure to keep current with technical knowledge and skills 2.4.3
4. Give examples of workplace discrimination (based upon such factors as gender, ethnicity, age, or physical disability) 2.4.4
5. Relate state and federal employment laws and company human resources policies 2.4.5

2.5 List strategies for removing potential barriers to career advancement

1. Participate in professional development programs 2.5.1
2. Show the benefits of constructive criticism 2.5.2

Using Mathematics in Drafting 3:

3.1 Define terminology related to mathematics in drafting

1. Use terms appropriately in context 3.1.1

3.2 Outline mathematical conversions used in preparing technical drawings

1. Convert inches to feet and feet to inches 3.2.1
2. Convert centimeters to millimeters and millimeters to centimeters 3.2.2
3. Convert cubic feet to gallons and gallons to cubic feet 3.2.3

3.3 Identify basic mathematical skills used in drafting operations

1. Show how to use addition, subtraction, multiplication, and division involving whole numbers, fractions, mixed numbers and decimal fractions 3.3.1
2. Convert common fractions to decimal fractions and decimal fractions to common fractions 3.3.2

3.4 Describe mathematical calculations involving practical geometry and trigonometry

1. Apply practical geometry and trigonometry using the Pythagorean Theorem (3-4-5 triangle) 3.4.1
2. Solve mathematical formulas to calculate for area 3.4.2
3. Show mathematical formulas to calculate for volume 3.4.3
4. Demonstrate practical applications of the Pythagorean Theorem (3-4-5 triangle) 3.4.4

3.5 List methods to calculate material quantities used in manufacturing

1. Estimate the weight of various quantities of iron, steel, and aluminum; cubic yards of concrete for footing 3.5.1
2. Estimate quantities of paint to cover a tank 3.5.2
3. Calculate capacity of a tank 3.5.3

Orientation to Engineering / CAD (CAD) 4:

4.1 Define terminology related to engineering and CAD

1. Use terms appropriately in context 4.1.1

4.2 Identify various types of technical drawings used for manufacturing

1. Explain the purpose for components of technical drawings used in manufacturing 4.2.1
2. Give examples of various types of architectural and technical drawings 4.2.2

4.3 Describe techniques of drawing to scale

1. Draw objects to a scale of full-size, larger than full-size, and smaller than full-size 4.3.1
2. Demonstrate the use of the engineer's scale or metric scale to measure and layout drawings or sketches 4.3.2
3. Evaluate advantages and disadvantages of scales used on technical drawings 4.3.3

4.4 Name methods to prepare sketches used in industry

1. Use techniques for developing freehand sketches of simple manufactured parts 4.4.1
2. Show techniques for developing sketches using drawing instruments 4.4.2
3. Show techniques for developing sketches not using drawing instruments 4.4.3

4.5 List freehand lettering techniques used in preparing technical drawings

1. Construct letters and numbers using the American National Standards Institute (ANSI) Single-Stroke Gothic Alphabet 4.5.1
2. Compose typical notes found on technical drawings using freehand lettering techniques 4.5.2

Performing CAD Operations 5:

5.1 Define terminology related to CAD

1. Use terms appropriately in context 5.1.1

5.2 Identify components of a CAD system used in industry

1. Give the purpose for components of a CAD drafting system to include a CPU, monitor, keyboard, mouse, digitizer, plotter, and software 5.2.1
2. Depict common features of a CAD software program 5.2.2
3. Show how to use CAD system command menus 5.2.3

5.3 Outline fundamental computer skills

1. Show how to manage files (i.e., saving, backing up, organizing) 5.3.1
2. Set up a CAD drafting system 5.3.2
3. Perform word processing functions (compose, cut, copy, paste, print) 5.3.3

5.4 Describe procedures for CAD drawing setup commands

1. Use CAD drawing setup commands to include drawing limits, units of measurement, text styles and size, dimension variables 5.4.1
2. Modify settings for various drawing aids (i.e., snap, grid, and polar) 5.4.2
3. Modify settings for various layers for a CAD drawing 5.4.3

5.5 List CAD drawing commands for preparing technical drawings

1. Use CAD drawing commands to construct lines, circles, arcs, polylines, polygons, ellipses, rectangles, and text 5.5.1
2. Construct blocks or symbols using CAD commands 5.5.2
3. Insert various blocks and symbols in CAD 5.5.3

5.6 Explain CAD editing and modifying commands on technical drawings

1. Use CAD modifying commands to include move, copy, mirror, break, offset, stretch, scale, rotate, trim, extend, erase, grips, and array 5.6.1
2. Use CAD commands to change or modify lines and features of a multiview drawing of simple manufacturing parts 5.6.2

5.7 Distinguish between historical methods to reproduce technical drawings and current reproduction technology

1. Give examples of historical methods to reproduce technical drawings 5.7.1
2. Prepare all or part of a technical drawing using current reproduction technology 5.7.2

5.8 Describe how to plot CAD drawings

1. Demonstrate techniques for scaling drawings using a CAD system 5.8.1
2. Plot CAD drawings to various scales 5.8.2
3. Demonstrate how to plot CAD drawings having single and multiple view ports 5.8.3

Perform Technical Drafting Operations 6:

6.1 Define terminology related to technical drafting operations

1. Use terms appropriately in context 6.1

6.2 Identify reference materials used for preparing technical drawings

1. Demonstrate use of a table of contents, glossary, indexes, and cross-references in technical reference materials 6.2.1
2. Reference information in textbooks, and catalogs 6.2.2
3. Reference information for technical drawings using internet resources 6.2.3

6.3 Describe line conventions for technical drawings

1. Prepare a list of common line symbols used on technical drawings 6.3.1
2. Apply common line symbols to technical drawings of simple parts 6.3.2
3. Relate uses for special line symbols on technical drawings 6.3.3
4. Apply various special line symbols to technical drawings of simple parts 6.3.4

6.4 Select the appropriate types of projections to represent objects

1. Demonstrate the ability to select projections which best communicate the features of objects 6.4.1
2. Construct orthographic views necessary to show features of objects 6.4.2
3. Determine reasons for section views on technical drawings 6.4.3
4. Distinguish between characteristics of various types of section views 6.4.4
5. Use section views necessary to best show interior features of an object 6.4.5

6.5 List general drafting standards applied to technical drawings

1. Relate the purpose for drawing standards 6.5.1
2. Distinguish between ANSI and ISO standards in preparing technical drawings 6.5.2
3. Research ANSI and ISO standards for preparing a technical drawing 6.5.3

Dimensioning Technical Drawings 7:

7.1 Define terminology related to dimensioning technical drawing

1. Use terms appropriately in context 7.1.1

7.2 Discuss dimensioning practices used on technical drawings

1. Demonstrate an understanding of methods for the placement of dimensions using the unidirectional and aligned dimensioning systems on multiview drawings 7.2.1
2. Demonstrate techniques for applying dimensions to various features of technical drawings 7.2.2
3. Apply dimensions and notes to technical drawings, including units of measurement, arrowheads and leaders 7.2.3
4. Prepare dimension technical drawings using appropriate positioning of views, line precedence, circles, and arcs 7.2.4
5. Demonstrate an understanding of standards for applying datumline dimensioning to various features of a technical drawing 7.2.5

7.3 Identify types of general notes found on a technical drawing

1. Relate the types of notes used on technical drawings 7.3.1
2. Apply general notes to technical drawings 7.3.2
3. Compose general notes used on working drawings 7.3.3

7.4 Describe machining notes and special symbols applied to a technical drawing

1. Identify locations for machining notes and symbols on technical drawings (e.g., chamfer, radius, counter bore, countersink, depth, diameter, finish) 7.4.1

7.5 Label tolerance dimensions applied to technical drawings

1. Relate the need for tolerance in dimensions for machine parts 7.5.1
2. Demonstrate the use of limit dimensions on working drawings 7.5.2
3. Demonstrate the use of +/- tolerance dimensions on working drawings 7.5.3
4. Compute maximum and minimum dimensions based on tolerance dimensioning for machine parts 7.5.4
5. Apply limit dimensions to technical drawings of machine parts 7.5.5
6. Apply +/- tolerance dimensions to drawings of machine parts 7.5.6

Drafting with Pictorial Views 8:

8.1 Define terminology related to pictorial views

1. Use terms appropriately in context 8.1.1

8.2 Describe special characteristics of pictorial drawings

1. Distinguish between pictorial (axonometric) and multiview drawings 8.2.1
2. Explain the characteristics unique to isometric drawings 8.2.2
3. Explain the characteristics unique to oblique drawings 8.2.3
4. Explain the characteristics unique to perspective drawings 8.2.4

8.3 List techniques for developing isometric drawings

1. Demonstrate techniques to develop isometric drawings of simple parts 8.3.1
2. Prepare isometric drawings of simple objects with cubic and cylindrical features 8.3.2
3. Use CAD commands to change or modify lines and features of an isometric drawing 8.3.3

8.4 List techniques for developing oblique drawings

1. Demonstrate techniques to develop general oblique drawings of simple objects 8.4.1
2. Identify characteristics of cavalier oblique drawings 8.4.2
3. Identify characteristics of cabinet oblique drawings 8.4.3

8.5 Identify practices to dimension isometric views on working drawings

1. Demonstrate methods for the placement of dimensions using the unidirectional dimensioning system on isometric views 8.5.1
2. Apply dimensions and notes to isometric views, including units of measurement, arrowheads and leaders 8.5.2
3. Prepare and dimension isometric views of objects using appropriate positioning of view, line precedence, circles, and arcs 8.5.3
4. Demonstrate methods for applying datumline dimensioning to various features of an isometric drawing 8.5.4

Prepare Working Drawings 9:

9.1 Define terminology related to working drawings

1. Use terms appropriately in context 9.1.1

9.2 Identify characteristics of threads and fasteners shown on working drawings

1. Explain the meaning of thread notes (metric and U.S. system) used on working drawings 9.2.1
2. Distinguish between different types of thread representation (detailed, schematic, and simplified) 9.2.2
3. Prepare schematic, and simplified thread representation on a working drawing 9.2.3

9.3 Describe detail working drawings

1. Prepare detail drawings of mechanical parts 9.3.1

9.4 Identify section views on working drawings

1. Determine characteristics of typical section views used for working drawings 9.4.1
2. Demonstrate techniques for indicating iron, aluminum, and steel on section views 9.4.2
3. Apply drawing conventions used for various section views 9.4.3
4. Prepare working drawings of simple mechanical parts requiring the use of section views to show internal detail 9.4.4

9.5 Explain features of dimensioning commands for technical drawings

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 9.5.1
2. Use CAD dimensioning commands to place aligned and unidirectional dimensioning on features of multiview and isometric drawings 9.5.2
3. Use CAD commands to place notes and leaders on a technical drawing 9.5.3
4. Setup and change CAD dimensioning styles for a technical drawing 9.5.4

Prepare a Career Portfolio 10:

10.1 Define terminology related to preparing a career portfolio

1. Use terms appropriately in context 10.1.1

10.2 Outline a career portfolio

1. Evaluate options for displaying drafting work in a professional manner 10.2.1
2. Use a variety of media display materials giving consideration to several portfolio display methods 10.2.2
3. Demonstrate the role a portfolio can play in the hiring process for employment 10.2.3

10.3 Select and organize material for a career portfolio

1. Prepare a résumé and cover letter for a career portfolio, including references and letters of recommendation to be included with a career portfolio `10.3.1`
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) `10.3.2`
3. Show examples of work for a career portfolio that demonstrates ability and versatility `10.3.3`
4. Prepare a career portfolio with sections labeled by subject areas `10.3.4`
5. Prepare an index for a career portfolio including such items as mechanical drawings, manual drawings, projects, awards, and recognitions (SkillsUSA, academic, and others) `10.3.5`
6. Organize materials for a career portfolio in a logical manner for presentation `10.3.6`

10.4 Outline guidelines for a career portfolio

1. Demonstrate professional dress for a portfolio presentation `10.4.1`
2. Relate an understanding of oral communication skills necessary for presenting a portfolio `10.4.2`

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

11.1 Define terminology related to student organizations

1. Use terms appropriately in context `11.1.1`

11.2 Outline a self-assessment and identify individual learning styles

1. Show individual strengths `11.2.1`
2. Show areas in need of improvement `11.2.2`

11.3 Describe self-motivation techniques and establish short-term goals

1. Prepare a list of short-term goals `11.3.1`
2. Discuss ways to change or improve lifestyle appearance and behavior `11.3.2`

11.4 Give examples of individual time-management skills

1. Prepare and maintain a time journal `11.4.1`
2. Outline ways to improve time management skills `11.4.2`

11.5 Predict future occupations

1. Research the Internet to explore for career opportunities within specified fields of study `11.5.1`
2. Prepare a presentation on a specified career area `11.5.2`

11.6 Identify the customer

1. Differentiate between External and Internal customers `11.6.1`
2. Identify factors which contribute to poor customer relationships `11.6.2`

11.7 Identify the benefits of doing a community service project

1. Outline ways to become involved in the community `11.7.1`
2. Develop a community service project `11.7.2`

11.8 Describe effective communication with others

1. Note personal barriers to listening `11.8.1`
2. Relate a personal plan to overcome barriers to listening `11.8.2`

11.9 Give locations for a shadowing activity

1. Summarize and relate an experience of job shadowing activity `11.9.1`

11.10 Identify the components of an employment portfolio

1. Present parts of a portfolio `11.10.1`
2. Compile a personal employment portfolio for an interview `11.10.2`

11.11 List proficiency in program competencies

1. Construct an interpersonal competency assessment `11.11.1`

11.12 Describe how to measure/modify short-term goals

1. Discuss how to pursue short-term goal(s) `11.12.1`

11.13 Identify stress sources

1. Prepare a list of personal sources of stress `11.13.1`
2. Outline techniques to cope with individual sources of stress `11.13.2`

11.14 Identify characteristics of a positive image

1. List behaviors and traits that lead to a positive image `11.14.1`
2. Note behaviors and traits that lead to a negative image `11.14.2`

11.15 Describe how team skills can be applied to a group project

1. Form a team to develop a class project `11.15.1`

11.16 Outline how to observe and critique a meeting

1. Attend a formal meeting held with in the community `11.16.1`
2. Prepare a critique of the meeting attended `11.16.2`

11.17 List business meeting skills

1. Relate the basic rules required to ensure an orderly and business-like meeting 11.17.1
2. Demonstrate with role-playing to illustrate appropriate meeting skills 11.17.2

11.18 Outline a survey for employment opportunities

1. Compile information on a particular employment opportunity of interest 11.18.1
2. Perform an internet search of a specific career area 11.18.2

11.19 Select a professional journal for review and develop a three to five minute presentation

1. Prepare a presentation on the content, purpose, and distribution of a particular professional journal 11.19.1

11.20 Identify customer expectations

1. List customer expectations 11.20.1
2. Discover the consequences of unmet customer expectations 11.20.2

11.21 List parts of a job application

1. Prepare a job application from various businesses in the community 11.21.1
2. Demonstrate a mock job interview 11.21.2

11.22 Outline your employment portfolio

1. Construct a personal employment portfolio 11.22.1

11.23 Identify supervisory and management roles in an organization

1. Prepare an organizational chart 11.23.1
2. Outline the responsibilities of managers and supervisors 11.23.2

11.24 Outline safety issues

1. Research safety issues within a given career area 11.24.1