

**Standards/Measurement Criteria**  
**Drafting and Design Technology**  
**MECHANICAL DRAFTING - OPTION C**  
**CIP No. 15.1300.40**

\*This indicates the “technical skill standards” for this program that will be assessed on the end-of-program Drafting and Design Technologies standards assessment.

**1.0 EXPLORE CAREER PATHWAYS IN DESIGN DRAFTING TECHNOLOGY**

- 1.1 Survey the fields of mechanical, civil, architectural and electrical/electronic drafting
- 1.2 Relate interests, skills and personal orientation to career choices
- 1.3 Use technology to research career path information
- 1.4 Survey salary ranges associated with different positions in design and drafting technology

**2.0 DEMONSTRATE JOB SEARCH SKILLS NEEDED TO OBTAIN A CAREER IN DESIGN DRAFTING TECHNOLOGIES**

- 2.1 Explain the steps in a job search
- 2.2 Identify employment opportunities in design drafting technologies utilizing on-line and off-line resources
- 2.3 Critique a job application

**3.0 DEMONSTRATE APPROPRIATE WORK HABITS FOR SUCCESSFUL EMPLOYMENT IN THE FIELD OF DESIGN DRAFTING**

- 3.1 Use design drafting technology vocabulary in context
- 3.2 Apply basic oral and written communication skills
- 3.3 Contribute to a team effort
- 3.4 Practice leadership skills in achieving a group goal
- 3.5 Plan, organize and implement design drafting activities

**4.0 PARTICIPATE IN LEADERSHIP ACTIVITIES SUCH AS THOSE SUPPORTED BY CAREER AND TECHNICAL STUDENT ORGANIZATION SkillsUSA**

- 4.1 Discuss the roles and responsibilities that leaders and members bring to an organization
- 4.2 Discuss characteristics and importance of an effective team member
- 4.3 Explain characteristics of effective workplace teams
- 4.4 Describe techniques to involve each member of the team

- 4.5 Participate in career development events
- 4.6 Develop and implement a personal and professional growth plan
- 4.7 Identify proper business etiquette
- 4.8 Define decision-making techniques and processes
- 4.9 Practice effective meeting management
- 4.10 Demonstrate business etiquette
- 4.11 Practice decision-making processes

## **5.0 EXPLORE PRINCIPLES OF INDUSTRIES RELYING ON DESIGN DRAFTING TECHNOLOGY**

- 5.1 Recognize relationship between trades/professions related to design drafting to facilitate smooth workflow
- 5.2 Discuss how quality of work affects profitability in design drafting
- 5.3 Explain the role and major functions of design drafting in different industries
- 5.4 Analyze current trends in design drafting
- 5.5 Identify needs and requirements of internal and external customers in design drafting

## **6.0 EXPLORE LEGAL AND ETHICAL ISSUES IN DESIGN/ENGINEERING INDUSTRIES**

- 6.1 Define ethics in the design drafting environment
- 6.2 Examine the relationship between ethics and the law as it related to design drafting
- 6.3 Explain ethical workplace behavior and how it applies to organizational policies and culture
- 6.4 Identify workers' rights regarding the workplace issues including safety, drug testing, harassment, discrimination, privacy, etc.

## **7.0 PRACTICE SAFE AND PRODUCTIVE WORKING PROCEDURES IN DESIGN DRAFTING ENVIRONMENTS**

- 7.1 Identify responsibilities of professionals in design drafting technology in creating and maintaining a safe work environment
- 7.2 Explain the importance of the OSHA (Occupational Safety and Health Administration) Standards and HazCom (Hazard Communication Standard)
- 7.3 Apply safety/environmental policies and procedures
- 7.4 Identify security issues related to computer hardware, software and data
- 7.5 Explain issues regarding software copyright, software licensing, and software copying
- 7.6 Practice ergonomically sound working procedures

## **8.0 APPLY PROBLEM SOLVING AND DECISION MAKING PROCESSES TO DESIGN DRAFTING RELATED SITUATIONS**

- 8.1 Apply problem-solving processes
- 8.2 Describe methods of establishing priorities
- 8.3 Solve problems individually and as part of a team

- 8.4 Generate creative ideas using critical thinking skills in solving design drafting related problems
- 8.5 Evaluate facts, use logic and reason in decision making

## **9.0 DEMONSTRATE TECHNOLOGICAL LITERACY FOR DESIGN DRAFTING OPERATIONS**

- 9.1 Examine the uses of technology in the design drafting fields
- 9.2 Demonstrate basic usage of computers (input, storage, output)
- 9.3 Access information electronically (i.e. Internet, CD-ROM, memory stick)
- 9.4 Apply file and disk management techniques
- 9.5 Import text and graphics from other software programs
- 9.6 Export text and graphic information in different formats to other software programs

## **10.0 USE MATHEMATICAL PROCESSES TO SOLVE PROBLEMS IN DESIGN DRAFTING TECHNOLOGY**

- 10.1 Identify and use common measurement tools used in drafting and design technology and their functions
- 10.2 Select appropriate measurement techniques for the specific needs of different design drafting fields
- 10.3 Perform mathematical calculations in the context of design drafting related problems
- 10.4 Recognize and use metric units of length, weight, volume and/or temperature in mathematical problems
- 10.5 Recognize and use imperial units of length, weight, volume and/or temperature in mathematical problems
- 10.6 Use technology in the solution of math-related problems

## **11.0 INTERPRET SCHEMATICS, BLUEPRINTS, AND TECHNICAL DRAWINGS**

- 11.1 Interpret dimensions, symbols, legends, scales and directions/orientations
- 11.2 Analyze how content and information are communicated in schematics, blueprints and technical drawings
- 11.3 Analyze schematics, blueprints, and technical drawings for clarity, completeness and accuracy
- 11.4 Recognize cross referencing on technical drawings

## **12.0 PRACTICE SKETCHING, DRAWING AND VISUALIZATION SKILLS FOR DESIGN DRAFTING**

- 12.1 Identify and analyze composition elements
- 12.2 Employ common types of drafting media and surfaces in traditional or digital form
- 12.3 Illustrate the basic elements and principles of drafting and design using traditional or digital media
- 12.4 Identify basic design methods like Golden Mean, Cheng or Greek Styles

### **13.0 DEMONSTRATE BASIC OPERATION OF COMPUTER HARDWARE AND SOFTWARE UTILIZED IN DESIGN DRAFTING TECHNOLOGY**

- 13.1 Identify computer hardware associated with design drafting technology
- 13.2 Apply basic commands of CAD software
- 13.3 Store and retrieve data for CAD software
- 13.4 Demonstrate the operation of hardware items that support data output from CAD application software (e.g., printer, projector, etc.)
- 13.5 Output 2D plotted drawings

### **14.0 DEVELOP A PLAN FOR A CAREER IN DESIGN DRAFTING**

- 14.1 Investigate the variety of design drafting career options in design, engineering and manufacturing
- 14.2 Develop career goals based on interests, aptitudes and research
- 14.3 Manage personal and career goals
- 14.4 Describe factors that contribute to job satisfaction and success

### **15.0 PREPARE FOR EMPLOYMENT IN DESIGN DRAFTING**

- 15.1 Develop a resume
- 15.2 Develop an electronic/scannable format resume
- 15.3 Create a drafting/design portfolio with industry-specific work samples
- 15.4 Complete job application process, including electronic applications
- 15.5 Demonstrate interviewing skills, including pre-interview preparation and post-interview follow-up
- 15.6 Research a design drafting organization as a potential employee

### **16.0 PARTICIPATE IN WORK-BASED LEARNING EXPERIENCES IN DESIGN DRAFTING**

- 16.1 Use technology appropriate for the job
- 16.2 Demonstrate positive work behaviors
- 16.3 Demonstrate safe and healthy work behaviors
- 16.4 Recognize and adapt to changes in the workplace
- 16.5 Participate in a variety of work-based experiences, paid or non-paid, in design drafting

### **17.0 DEMONSTRATE ORAL COMMUNICATION SKILLS FOR DESIGN DRAFTING**

- 17.1 Conduct formal/informal research to collect appropriate topical information and data
- 17.2 Use questioning techniques to obtain needed information from audience
- 17.3 Interpret oral and nonverbal communications of audience
- 17.4 Demonstrate active listening during communications
- 17.5 Demonstrate appropriate technologies for a formal presentation

- 17.6 Deliver presentation incorporating both appropriate verbal and nonverbal communication techniques

## **18.0 DEMONSTRATE WRITTEN COMMUNICATION SKILLS FOR DESIGN DRAFTING**

- 18.1 Conduct formal/informal research to collect appropriate topical information and data
- 18.2 Organize information and develop an outline
- 18.3 Write business communication documents using appropriate format for the situation
- 18.4 Using appropriate technology, prepare draft document using established rules for grammar, spelling and sentence construction

## **19.0 EVALUATE BUSINESS AND FINANCIAL MANAGEMENT PRACTICES NEEDED IN DESIGN DRAFTING INDUSTRIES**

- 19.1 Review bidding and billing structures used by design drafting firms
- 19.2 Review a budget for a design project
- 19.3 Develop time and production schedules for a project
- 19.4 Describe the impact of rework, excessive labor costs, scope creep and lack of teamwork on a project budget

## **20.0 PARTICIPATE IN LEADERSHIP ACTIVITIES SUCH AS THOSE SUPPORTED BY CAREER AND TECHNICAL STUDENT ORGANIZATION SkillsUSA**

- 20.1 Determine the roles and responsibilities that leaders and members bring to an organization
- 20.2 Describe how personal characteristics affect leadership ability
- 20.3 Compare/contrast leadership and management styles
- 20.4 Evaluate characteristics of effective teams
- 20.5 Describe how cultural/ethnic differences affect interpersonal interactions/communications within a group
- 20.6 Evaluate characteristics of an effective team player
- 20.7 Practice techniques to involve each member of the team
- 20.8 Demonstrate team work
- 20.9 Practice effective meeting management
- 20.10 Demonstrate business etiquette
- 20.11 Practice decision-making processes

## **21.0 APPLY MATHEMATICAL CONCEPTS TO PROBLEMS IN DESIGN DRAFTING**

- 21.1 Apply basic mathematical skills to design drafting operations
- 21.2 Apply mathematical calculations involving practical geometry and trigonometry
- 21.3 Calculate and evaluate geometric figures
- 21.4 Create geometric constructions utilizing technical sketching techniques
- 21.5 Determine/select appropriate dimensioning systems (e.g., decimal, metric)

## **\*22.0 APPLY MEASUREMENT AND SCALE CONCEPTS IN DESIGN DRAFTING**

- 22.1 Identify types of measurement used in design drafting
- 22.2 Select proper measurement tools
- 22.3 Perform measurements with hand held instruments
- 22.4 Determine and apply appropriate scale
- 22.5 Transcribe illustrations accurately

## **\*23.0 INTERPRET ENGINEERING DOCUMENTS AND CONTROL DOCUMENTS**

- 23.1 Interpret dimensions, symbols, legends, scales, and directions/orientations
- 23.2 Analyze how content and information are communicated in schematics, blueprints, and technical drawings
- 23.3 Analyze schematics, blueprints, and technical drawings for clarity, completeness, and accuracy
- 23.4 Recognize cross-referencing on technical drawings
- 23.5 Identify and describe basic types of drawings by trade
- 23.6 Locate and interpret information on specific documents
- 23.7 Check prints for dimensional accuracy, completeness and note detail
- 23.8 Compare schematics to dimensional drawings
- 23.9 Verify drawing elements
- 23.10 Identify conflicting data

## **\*24.0 CREATE TECHNICAL DRAWINGS**

- 24.1 Identify, select, and use fundamental drafting techniques for drawings
- 24.2 Demonstrate freehand lettering technique
- 24.3 Identify "Alphabet of Lines" by name, line type variation, order of usage and application on technical drawings
- 24.4 Create title blocks
- 24.5 Format borders
- 24.6 Apply notes and dimensions
- 24.7 Plot or print drawings using correct layout
- 24.8 Organize and maintain drawings and supporting documents

## **\*25.0 UTILIZE BASIC COMPUTER CONCEPTS, OPERATIONS AND INFORMATION TECHNOLOGY APPLICATIONS**

- 25.1 Use computer hardware and input/output devices for designing drafting problems
- 25.2 Apply basic commands of operating system software
- 25.3 Apply file and disk management techniques
- 25.4 Import and export data files using different formats (dxf, dxb, Tiff, gif, pcx, eps, spd, or other formats as required)
- 25.5 Prepare files for electronic transfer
- 25.6 Access and use the Internet for file transfer
- 25.7 Access and use a computer network for file management and transfer

## **\*26.0 USE A CADD/VDCM (VIRTUAL DESIGN AND CONSTRUCTION MODELING) SYSTEMS AND PROCEDURES**

- 26.1 Explore and determine applicability of CADD/VDCM systems to the project
- 26.2 Analyze drawings using CADD/VDCM software functions/commands
- 26.3 Use CADD/VDCM software commands to set up drawing scale, format, dimensioning, etc.
- 26.4 Apply layers/visible items, colors, line types, editing commands and grouping techniques
- 26.5 Control entity properties
- 26.6 Incorporate standard parts, symbol libraries and/or templates
- 26.7 Control viewing commands
- 26.8 Create and manipulate views by modifying coordinate system settings
- 26.9 Minimize a drawing file for storage and transmission

## **\*27.c DETAIL PROJECTION VIEWS/COMPONENTS**

- 27.1c Determine the appropriate views for projection (i.e. plan, top, front, etc.)
- 27.2c Identify, create and place appropriate views for orthographic projections
- 27.3c Identify, create and place appropriate auxiliary views to determine true size, shape, and location of non-orthogonal features
- 27.4c Identify, create and place appropriate section views
- 27.5c Construct full, half and offset section of an object
- 27.6c Utilize various material hatch patterns in section views

## **\*28.c EXPLORE AND DRAFT MECHANICAL DRAFTING/DESIGN CONCEPTS AND PROBLEMS**

- 28.1c Use manufacturing and machining terminology in context
- 28.2c Use precision measuring equipment
- 28.3c Solve drafting/design problems in trigonometry
- 28.4c Use industry standards, codes and regulations software for mechanical drafting to solve a problem
- 28.5c Apply mechanical symbols to a drawing
- 28.6c Prepare detail and assembly working drawings
- 28.7c Prepare an engineering change order and revise the applicable drawings

## **\*29.c DEMONSTRATE DRAFTING/DESIGN CONCEPTS AS RELATED TO BASIC MANUFACTURING PROCESSES**

- 29.1c Design and detail a foundry produced product
- 29.2c Design and detail a machine tooled product
- 29.3c Design and detail a welded product
- 29.4c Design and detail a sheet metal part
- 29.5c Prepare models for computer numerical control (CNC) processes
- 29.6c Identify types of parts to be detailed (cast, machined, forged, sheet metal, welded)
- 29.7c Incorporate piping, welding and instrumentation symbols in mechanical drawings
- 29.8c Draft, locate and label fasteners on production, assembly drawings and parts lists

- 29.9.c Draft, locate and label spring assemblies
- 29.10c Draft, identify and label characteristics and requirements of jig and fixture tooling
- 29.11c Denote manufacturing treatments of materials in drawings
- 29.12c Denote shop processes to be used
- 29.13c Prepare bill of materials for drawings

### **\*30.c INCORPORATE GEOMETRIC DIMENSIONING AND TOLERANCING (GDT) STANDARDS**

- 30.1c Determine appropriate datum features
- 30.2c Use standard fit tables to determine tolerances and fits
- 30.3c Calculate tolerance stackups
- 30.4c Interpret tolerance dimensions
- 30.5c Dimension fit tolerances
- 30.6c Apply dimensioning rules correctly and in compliance with ASME Y14 standards
- 30.7c Apply metric and/or dual dimensions to drawing in compliance with ASME Y14 standards
- 30.8c Select/set/draw appropriate dimension features (i.e., arrowhead, text sizes, extension lines)
- 30.9c Draw/select appropriate dimensioning practices (e.g., conventional, tabular, datum, ordinate, aligned, rectangular coordinate, polar systems)
- 30.10c Apply geometric tolerances (e.g., true position, form, material conditions, datum points)

### **\*31.c DRAFT ASSEMBLIES OF COMPONENTS**

- 31.1c Construct an aligned section
- 31.2c Construct an assembly section
- 31.3c Construct a cross section
- 31.4c Prepare intersections
- 31.5c Prepare developments
- 31.6c Prepare revolution drawings
- 31.7c Develop patterns, including radial and parallel line patterns