SANTA CLARA COUNTY OFFICE OF EDUCATION
SANTA CLARA COUNTY REGIONAL OCCUPATIONAL PROGRAM
Serving Santa Clara and San Benito Counties

1. COURSE TITLE – CAREER TECHNICAL EDUCATION PATHWAY/SECTOR

Computer Aided Drafting/Design(Engineering Design) – Engineering and Design Industry

2. CBEDS TITLE

Computer Aided Drafting/Design

3. CBEDS NUMBER

5705

4. JOB TITLES

O*NET	TITLE
22514A	Architectural Drafter
22514B	Electronics Drafter
22514C	Civil Drafter
22514D	Mechanical Drafter
22517	Estimators and Drafters, Utilities, Structural Drafter

5. COURSE DESCRIPTION

Computer Aided Drafting ROP (CAD) is an introduction to the use, care and concepts of a typical CAD system. The students will use a "hands on" approach to develop skills in operating a CAD system. Knowledge of computers or programming is not required.

This course will consist of computer-aided drafting practice involving basic drawing techniques and plotting, the course will include: vocabulary development, hardware, terminology, software and system operation, input/output devices, line insertion, geometric shapes, text insertion, dimensioning, screen control, grids, coordinate systems, editing, hatching, layering, symbols libraries, and management of drawing files.

The student will use AutoCAD to draw basic 2-D technical drawings using an appropriate text as a guide. Text assignments will emphasize ANSI standards. A plotter or printer will produce hard copies of completed drawings. All assignments will include a description of drawing requirements.

The skills learned in this class will prepare students for entry level drafting positions or for advanced training at the post secondary level. A certificate will be awarded to all students upon successful completion of this course. Activities of this class depend largely upon specialized equipment; therefore, homework will be assigned only occasionally. Successful completion of this course satisfies five (5) credits of the computer science graduation requirements. Repeatable for credit.

6. HOURS

Classroom Theory/Applied	310
Community Classroom/Coop Voc Ed	105
TOTAL HOURS	415

7. RECOMMENDED PREREQUISITE

Required Must be 16 years of age or older, a junior or senior in high school, an out-of-school youth, or an adult.

Recommended

- Introductory drafting class
- Typing is highly recommended

8. DATE REVISED July 2005

UPDATED October 31, 2007

9. COURSE OUTLINE

A. Career Preparation Skills

Class Hours	CC/CVE Hours	GENERAL WORKPLACE SKILLS	Standards
30	Integrated throughout the course	• **Attitude and Work Habits** 1. Works both independently and collaboratively 2. Attends regularly and on time 3. Practices good safety procedures 4. Solves problems thinks critically and makes good decisions 5. Plans work and takes initiative 6. Demonstrates leadership and the willingness to help train others • **Job Employment Skills** 1. Develop a plan to achieve career goals 2. Complete a career portfolio 3. Use effective job search strategies 4. Perform employment research 5. Complete job application and resume 6. Develop effective interviewing and follow-up skills. 7. Demonstrate an awareness of importance of lifelong learning.	CPS: Personal Skills; Interpersonal Skills SCANS: Personal Qualities; Interpersonal Qualities CPS: Employment Literacy

Sources:
CPS - *Career Preparation Standards*. California Department of Education and WestEd
SCANS - *What Work Requires of Schools: A SCANS Report of America 2000*.
The Secretary's Commission on Achieving Necessary Skills, Publication of the US Dept. of Labor, June 1991.
Career Technical Education Model Curriculum Standards. California Department of Education. May 2005

B. Career Technical Skills

Class Hours	CC/CVE Hours	CONTENT AREA SKILLS	Foundation Standards	Mention - M Reinforced – R Taught – T	CTE Pathway Standards	Mention - M Reinforced – R Taught – T
5		**I. History**	* See attached pages that follow			
		A. The student will be able to describe the evolution, definition, and purpose of computer aided drafting and its relationship to current industrial technology and drafting practices. 1. Describe a brief history of computer drafting 2. Describe the advantages of computer drafting verses manual drafting. 3. Describe the terms CAD, CAM, and CAD/CAM. 4. Describe a CAD operator and a CAD technician.	USH 11.8.7 USH 11.5.7 USH 11.7.6	M	C1.0 C1.1 C1.2 C5.0 C5.3	M R T T R
15		**II. CAD Literacy**				
		B. The student will define and apply CAD vocabulary that is appropriate and pertinent to the development of CAD literacy. 1. Define and apply selected CAD terms and symbols to all exercises. 2. Define and apply selected CAD vocabulary as it relates to industry.	LS 2.5 1.8 LS 2.5 1.8	R T	C11.0 C11.1 C11.3	T
10		**III. Input/Output Devices**				
		C. The student will be able to select operate and care for the basic CAD input and output devices (hardware and software, and select materials used in computer aided drafting. 1. Define and demonstrate the proper use of basic input devices such as the CPU, floppy diskettes, network, keyboards and mice. 2. Define and demonstrate the proper use of basic output devices such as the monitor, printer or plotter. 3. Define and demonstrate the proper use of media, materials and supplies.	10.0 10.1 10.3 10.4 10.1 10.3 10.1	R T R T	C2.0 C2.1 C2.2 C2.3	T R T T

Career Technical Skills						
Class Hours	**CC/CVE Hours**	**CONTENT AREA SKILLS**	**Foundation Standards**	**Mention - M Reinforced – R Taught - T**	**CTE Pathway Standards**	**Mention - M Reinforced – R Taught – T**
15	20	**IV. Drafting and Geometry**				
		A. The student will be able to identify, select, and draw geometric shapes using coordinates. 1. Identify, select, and draw geometric shapes using absolute coordinates. 2. Identify, select, and draw geometric shapes using relative coordinates. 3. The student will be able to identify, select, and draw geometric shapes using polar coordinates	NS 1.1 MR 2.5 MR 2.3 G 19.0	R	C4.0 C.4.1 C.4.2 C4.4	T
25	10	**V. AutoCAD Commands**				
		A. The student will be able to identify and demonstrate a working knowledge of the AutoCAD command structure, screen and template menus, drawing aides and symbols library necessary to create two dimension and three dimension geometry. 1. Identify and demonstrate the use of the AutoCAD main menu structure. 2. Identify and demonstrate the use of AutoCAD's drawing editor menu structure. 3. Identify and demonstrate the use of AutoCAD's drawing aides such as: SNAP, GRID, ORTHO, COORD, and FLIP SCREEN. 4. Identify and demonstrate the use of AutoCAD's command structure. 5. Identify and demonstrate the use of AutoCAD's function keys on the keyboard.	NS 1.1 R 2.1 R 2.6	R	C5.0 C5.1 C5.2 C5.3 C5.4 C5.5	T

Career Technical Skills						
Class Hours	**CC/CVE Hours**	**CONTENT AREA SKILLS**	**Foundation Standards**	**Mention - M Reinforced – R Taught – T**	**CTE Pathway Standards**	**Mention - M Reinforced – R Taught – T**
30	10	**VI. Basic Geometric Shapes**				
		A. The student will be able to create basic geometric shapes and text on the computer. 1. Apply techniques and proper setup to generate basic CAD primitives and text essential in creating geometric shapes on the computer. 2. Use commands such as: toggle grid, snap, coords, flip screen and ortho on/off. 3. Insert lines and entities with the keyboard, 4. Create geometric shapes using Cartesian coordinates. 5. Create geometric shapes using relative coordinates. 6. Change default settings. 7. Use screen control menus such as zoom and pan to enlarge small areas. 8. Use edit commands such as break and mirror to edit a basic shape.	NS 1.1 G 8.0 G 8.0	R	C2.0 C2.1 C5.2 C5.4	T
5		**VII. DOS Commands**				
		A. The student will be able to apply basic DOS commands and routines for efficient use of system and file management. 1. Define and briefly describe DOS. 2. Create a directory. 3. Remove a directory. 4. Delete files. 5. Copy files. 6. Save files to a subdirectory. 7. Rename files.	10.2	T	C2.0 C5.1 C10.2	T
30	10	**VIII. Two Dimensional CAD Drafting Geometry**				
		1. Define entities and primitives basic to CAD. 2. Define and create layers, linetypes, and colors. 3. Create lines, circles, arcs and basic entities. 4. Create fillets, chamfers and hatch boundaries. 5. Insert text using left, right, center, and middle justifications.	NS 1.1 G 10.0 G 11.0	R	C3.0 C5.0 C5.1	T

Career Technical Skills						
Class Hours	**CC/CVE Hours**	**CONTENT AREA SKILLS**	**Foundation Standards**	**Mention - M Reinforced – R Taught – T**	**CTE Pathway Standards**	**Mention - M Reinforced – R Taught – T**
		6. Insert Cartesian and polar coordinates using the keyboard and pointing devices. 7. Select appropriate editing commands such as erase, break, trim, copy, etc. to complete and control geometry on the screen. 8. Select appropriate screen control commands such as zoom, pan, layers, etc. to view geometry in detail.	AI 8.0 10.2	M	C4.4 C4.5 C5.1	T
30		**IX. CAD Dimensioning**				
		A. The student will be able to apply AutoCAD to generate and edit basic dimensions and tolerances and dimension to orthographic drawings. 1. Select, insert, and generate linear dimensions horizontal and vertical. 2. Select, insert, and generate diameter, radii, and angular dimensions. 3. Select, insert, and generate override symbols and editing features. 4. Select, insert, and generate a dimension variable to change default parameters. 5. Select, insert, and generate tolerance and limit dimensioning. 6. Select, insert, and generate continuous and base line type dimensioning. 7. Select, insert, and generate a unidirectional and aligned system of dimensioning, geometric tolerancing symbols and datum features.	AI 10.0 G 20.0	R	C6.0 C6.1 C6.2 C6.3 C6.1 C6.2 C6.3	T T
30	10	**X. CAD Drafting Geometry**				
		A. The student will be able to create libraries (blocks) and change attributes of symbols, linetypes and 2D drafting geometry. 1. Create and save a prototype ANSI standard border and title block. 2. Create layers necessary for prototypes. 3. Create block entities and save in symbols library. 4. Create and insert balloons and leaders. 5. Insert blocks.	10.0 10.2 10.3 10.4	R R T R	C5.0 C5.1 C5.2 C5.3 C5.4 C5.5	T

Career Technical Skills						
Class Hours	**CC/CVE Hours**	**CONTENT AREA SKILLS**	**Foundation Standards**	**Mention - M Reinforced – R Taught – T**	**CTE Pathway Standards**	**Mention - M Reinforced – R Taught – T**
25		**XI. Drafting Standards**				
		A. The student will be able to generate appropriate screen limits and plotted scales for standard sheet sizes. 1. Determine and apply horizontal and vertical working space. 2. Determine and apply 85% rule of limits for a drawing. 3. Determine and apply units, sheet size, and plotting scale for mechanical and architectural drawings.	10.0 10.1 10.4	R T R	C3.0 C3.1 C3.2	M T T
45	20	**XII. Orthographic (2D) Views**				
		A. The student will be able to synthesize orthographic (2D) views with freehand sketching and CAD. 1. Use AutoCAD to determine parameters for working drawings on planner sheets. 2. Setup working drawings appropriately on prepared border and title block. 3. Use AutoCAD to determine: units, grids, and other drawing aides. 4. Use AutoCAD to edit primitives and geometry as necessary to control images. 5. Use AutoCAD to generate dimensions, dimension tolerances, limits and geometric dimensioning symbols necessary from Y14 menus. 6. Use AutoCAD to generate finish marks, notes, and text in title blocks. 7. Use AutoCAD to plot screen images on plotters at desired scale. 8. Use AutoCAD to save, rename and copy DWG files to floppy diskette, directory or network.	R 2.6 W 1.8 G 10.0 G 11.0	R	C4.0 C4.1 C4.4 C6.0 C9.1	T

Career Technical Skills						
Class Hours	**CC/CVE Hours**	**CONTENT AREA SKILLS**	**Foundation Standards**	**Mention - M Reinforced – R Taught – T**	**CTE Pathway Standards**	**Mention - M Reinforced – R Taught – T**
45	25	**XIII. Three Dimensional Drafting Geometry**				
		A. The student will be able to generate, 3D wire frame models from prepared 2D views. 1. Use AutoCAD to define and describe elevation, thickness, extrusion, hide and viewpoints as it relates to 3 D generation. 2. Use AutoCAD to generate elevations and thickness in a 2D environment and extrude a 3D wireframe utilizing viewpoint and hide commands. 3. Use AutoCAD to define and describe commands WCS, VCS, viewpoints, setvar and 3D face as it relates to three dimensional generation and manipulation. 4. Generate and manipulate the above commands that will produce 3D wire frames and 3D faces	4.0 4.2 5.0 G 8.0	R	C5.0 C4.3 C5.3 C5.4 C5.5	T
310	**105**	**Total Hours**				

C. Expected Student Proficiencies

ATTITUDE AND WORK HABITS
- Attendance
- Punctuality/Reliability
- Utilizes Time effectively
- Cooperates/Works Effectively With Others

COMPUTER GRAPHICS OPERATION
- CAD Fundamentals/Command Structure
- Symbols and Characters
- Keyboard and Screen Menu Usage
- Utility Routines/File Mgmt/MS-DOS
- Computer Terms, Vocabulary and Definitions
- Identification, Use, and Care-Hardware/Software
- Input Devices/Output Devices

BASIC ENTITY CREATION
- Lines, Circles, Arcs, and Text
- Cartesian Coordinates-Absolute/Relative
- Popular Coordinate Input
- Oblique and Hatching Insertions

ENTITY MODIFICATION AND EDITING
- Erase, Remove, Undo, Add, and Change
- Array, Copy, Move, Rotate and Mirror
- Break, Divide, Trim, Extend and Stretch
- Fillets and Chamfers

SCREEN CONTROL COMMANDS
- Zoom, Pan, Windows and Views
- Layers, Color, Limetypes and Related Functions
- Limits, Grids, Snaps Object Snap
- Multi-Viewports

CAD DIMENSIONING TECHINQUES

Horizontal and Vertical Insertion
Diameters, Raddi, Leaders and Angular Insertion
Override and Special Techniques
Use of Dimensioning Variable
Tolerancing and Limit Dimension Generation
Baseline and continuous Generation

SYMBOLS LIBRARIES
- Work Groups
- Block and Wblock Creation
- Block Insertion Procedure

THREE-DIMENTIONAL CAD
- Elevation and Thickness
- Using the X, Y, Z axes
- Rotating and Coordinate Input
- 3D Extrusion Drafting
- 3D Drafting in the User Coordinate System (UCS)
- 3D Wireframe Creation
- 3D Solid Modeling

UTILITY MENUS-SAVE AND PLOTTING
- Using Quit, Save and End
- Scaling and Positioning
- Pen Selection and Speeds
- Determining Sheet Sizes and Scale
- Use of Laser Printers
- Use of care of Plotters

CAD/CAM EXPERIENCE
- 2D Geometry Generation
- Pocket and Island

10. ADDITIONAL RECOMMENDED/OPTIONAL ITEMS

A. **Academic credit:** One year or 10 elective credits

B. **Other – n/a**

	ARTICULATION	None
	UC APPROVAL	None
X	**INDUSTRY CERTIFICATION**	NOCTI

C. **Instructional Strategies:**

- Lecture
- Demonstration
- Design problems and vocabulary
- Critical comparison
- Readings
- Project-based learning
- Work-based learning
- Guest presentations
- Group projects
- Computer programs
- Videos
- Internet research
- Peer learning

D. **Instructional Materials:**

AutoCAD Instructor, by James A. Leach, McGraw Hill, New York, NY published 2000.
Mechanical Drawing Board and CAD Techniques, by Thomas E. French, McGraw Hill, New York, NY published 2003
Autodesk.com various AutoCAD tutorials

11. FOUNDATION STANDARDS ALIGNED

*** CAHSEE Test Item**

1.0 Academics

Students understand the academic content required for entry into postsecondary education and employment in the Engineering and Design sector. *(The standards listed below retain in parentheses the numbering as specified in the mathematics, science, history–social science, and visual and performing arts content standards adopted by the State Board of Education.)*

Math

* 1.2 Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.

* 1.3 Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.

* 2.1 Use estimation to verify the reasonableness of calculated results.

Algebra I

* 8.0 Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.

Geometry

10.0 Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids.

11.0 Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.

16.0 Students perform basic constructions with a straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line.

History/Social Science

1.Students compare the present with the past, evaluating the consequences of past events and decisions and determining the lessons that were learned.

4. Students relate current events to the physical and human characteristics of places and regions.

4. Students construct and test hypotheses; collect, evaluate, and employ information from multiple primary and secondary sources; and apply it in oral and written presentations.

5. Students analyze human modifications of landscapes and examine the resulting environmental policy issues.

6. Students conduct cost-benefit analyses and apply basic economic indicators to analyze the aggregate economic behavior of the U.S. economy.

2.0 Communications

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts. *(The standards listed below retain in parentheses the numbering as specified in the English–language arts content standards adopted by the State Board of Education.)*

Reading

1.0 Word Analysis, Fluency, and Systematic Vocabulary Development
Students use their knowledge of word origins and word relationships, as well as historical and literary context clues, to determine the meaning of specialized vocabulary and to understand the precise meaning of grade-level-appropriate words.

* 2.1 Compare and contrast the features and elements of consumer materials to gain meaning from documents (e.g., warranties, contracts, product information, instruction manuals).

2.2 Analyze the way in which clarity of meaning is affected by the patterns of organization, hierarchical structures, repetition of the main ideas, syntax, and word choice in the text.

2.3 Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

2.4 Make warranted and reasonable assertions about the author's arguments by using elements of the text to defend and clarify interpretations.

2.6 Use information from a variety of consumer, workplace, and public documents to explain a situation or decision and to solve a problem.

2.6 Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Writing

1.1 Demonstrate an understanding of the elements of discourse (e.g., purpose, speaker, audience, form) when completing narrative, expository, persuasive, or descriptive writing assignments.

* 1.2 Use precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.

1.2 Use point of view, characterization, style (e.g., use of irony), and related elements for specific rhetorical and aesthetic purposes.

1.4 Enhance meaning by employing rhetorical devices, including the extended use of parallelism, repetition, and analogy; the incorporation of visual aids (e.g., graphs, tables, pictures); and the issuance of a call for action.

1.5 Use language in natural, fresh, and vivid ways to establish a specific tone.

1.5 Use correct punctuation and capitalization.

1.6 Revise writing for word choice; appropriate organization; consistent point of view; and transitions between paragraphs, passages, and ideas.

2.3 Write reflective compositions:

a. Explore the significance of personal experiences, events, conditions, or concerns by using rhetorical strategies (e.g., narration, description, exposition, persuasion).

b. Draw comparisons between specific incidents and broader themes that illustrate the writer's important beliefs or generalizations about life.

c. Maintain a balance in describing individual incidents and relate those incidents to more general and abstract ideas.

2.5 Write job applications and resumes:

a. Provide clear and purposeful information and address the intended audience appropriately.

b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.

c. Modify the tone to fit the purpose and audience.

d. Follow the conventional style for that type of document (e.g., resume, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.

2.6 Deliver multimedia presentations:

a. Combine text, images, and sound and draw information from many sources (e.g., television broadcasts, videos, films, newspapers, magazines, CD-ROMs, the Internet, electronic media-generated images).

b. Select an appropriate medium for each element of the presentation.

c. Use the selected media skillfully, editing appropriately and monitoring for quality.

d. Test the audience's response and revise the presentation accordingly.

Written & Oral English Language Conventions

1.0 Written and Oral English Language Conventions
Students write and speak with a command of standard English conventions.

1.1 Demonstrate control of grammar, diction, and paragraph and sentence structure and an understanding of English usage.

1.2 Produce legible work that shows accurate spelling and correct punctuation and capitalization.

Listening & Speaking

1.1 Recognize strategies used by the media to inform, persuade, entertain, and transmit culture (e.g., advertisements; perpetuation of stereotypes; use of visual representations, special effects, language).

1.3 Interpret and evaluate the various ways in which events are presented and information is communicated by visual image makers (e.g., graphic artists, documentary filmmakers, illustrators, news photographers).

1.4 Use rhetorical questions, parallel structure, concrete images, figurative language, characterization, irony, and dialogue to achieve clarity, force, and aesthetic effect.

1.6 Use logical, ethical, and emotional appeals that enhance a specific tone and purpose.

1.7 Use appropriate rehearsal strategies to pay attention to performance details, achieve command of the text, and create skillful artistic staging.

1.10 Evaluate when to use different kinds of effects (e.g., visual, music, sound, graphics) to create effective productions.

2.2 Deliver oral reports on historical investigations:

a. Use exposition, narration, description, persuasion, or some combination of those to support the thesis.

b. Analyze several historical records of a single event, examining critical relationships between elements of the research topic.

c. Explain the perceived reason or reasons for the similarities and differences by using information derived from primary and secondary sources to support or enhance the presentation.
d. Include information on all relevant perspectives and consider the validity and reliability of sources.
2.4 Deliver multimedia presentations:
a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.
b. Select an appropriate medium for each element of the presentation.
c. Use the selected media skillfully, editing appropriately and monitoring for quality.
d. Test the audience's response and revise the presentation accordingly.

2.5 MULTIMEDIA

Understand the importance of technical and computer-aided design and drawing technologies essential to the language of the engineering and design industry, including reading, writing, interpreting, and creating drawings, sketches, and schematics using engineering and design industry conventions and standards; interpreting and understanding detailed information provided from available technical documents, both print and electronic, and from experienced people; and using computers, calculators, multimedia equipment, and other devices in a variety of applications.

3.0 CAREER PLANNING & MANAGEMENT

Students understand how to make effective decisions, use career information, and manage personal career plans:

3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in a career.
3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options.
3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.
3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning.
3.6 Know important strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and preparation of a portfolio.
3.7 Understand the nature of entrepreneurial activities.

4.0 TECHNOLOGY

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.
4.2 Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.
4.3 Understand the influence of current and emerging technology on selected segments of the economy.

5.0 PROBLEM SOLVING & CRITICAL THINKING

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
5.3 Use critical thinking skills to make informed decisions and solve problems.

6.0 HEALTH & SAFETY

Students understand health and safety policies, procedures, regulations, and practices, including the use of equipment and handling of hazardous materials:

6.1 Know the policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
6.2 Understand the critical elements of health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.

7.0 RESPONSIBILITY & FLEXIBILITY

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.
7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
7.3 Understand the need to adapt to varied roles and responsibilities.
7.4 Understand that individual actions can affect the larger community.

8.0 ETHICS & LEGAL RESPONSIBILITY

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms:

8.1 Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations.
8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.
8.3 Understand the role of personal integrity and ethical behavior in the workplace.

9.0 LEADERSHIP & TEAMWORK

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
9.2 Understand the ways in which preprofessional associations, such as SkillsUSA, and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
9.3 Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.
9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
9.5 Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.
9.6 Understand how to organize, conduct, lead, and participate in student-centered activities and events through student-based organizations.

10.0 TECHNICAL KNOWLEDGE & SKILLS

10.1 Use and maintain industrial and technological products and systems.
10.2 Understand the importance of technical and computer-aided technologies essential to the language of the engineering and design industry.
10.3 Understand how to use, adjust, maintain, and troubleshoot the equipment and tools of the engineering and design industry in a safe, effective, and efficient manner.
10.4 Acquire, store, allocate, and use materials and space efficiently.
10.5 Understand the role of the engineering and design industry in the California economy.
10.6 Understand and apply the appropriate use of quality control systems and procedures.
10.7 Understand the need and process to obtain and maintain industry-standard, technical certifications and affiliations with professional organizations, including the American Society for Engineering Education, the Accreditation Board for Engineering and Technology, and the American Society of Civil Engineers.
10.8 Understand the need to obtain and maintain industry-standard, technical certifications significant to a particular industry.

11.0 DEMONSTRATION & APPLICATION

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

12. Engineering Design Pathway Standards

C1.0 Students recognize historical and current events related to engineering design and their effects on society:

C1.1 Know historical and current events that have relevance to engineering design.
C1.2 Understand the development of graphic language in relation to engineering design.

C2.0 Students understand the effective use of engineering design equipment:

C2.1 Use the appropriate methods and techniques for employing all engineering design equipment.
C2.2 Apply conventional engineering design processes and procedures accurately, appropriately, and safely.
C2.3 Apply the concepts of engineering design to the tools, equipment, projects, and procedures of the Engineering Design Pathway.

C3.0 Students understand measurement systems as they apply to engineering design:

C3.1 Know how the various measurement systems are used in engineering drawings.
C3.2 Understand the degree of accuracy necessary for engineering design.

C4.0 Students use proper projection techniques to develop orthographic drawings:

C4.1 Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means.
C4.2 Understand the orthographic projection process for developing multiview drawings.
C4.3 Understand the various techniques for viewing objects.
C4.4 Use the concepts of geometric construction in the development of design drawings.
C4.5 Apply pictorial drawings derived from orthographic multiview drawings and sketches and from a solid modeler.

C5.0 Students know various object-editing techniques and CADD programs:

C5.1 Understand the commands and concepts necessary for editing engineering drawings.
C5.2 Know the various object-altering techniques.
C5.3 Know the CADD components and the operational functions of CADD systems.
C5.4 Apply two-dimensional and three-dimensional CADD operations in creating working and pictorial drawings, notes, and notations.
C5.5 Understand how to determine properties of drawing objects.

C6.0 Students understand and apply proper dimensioning to drawings:

C6.1 Know a variety of drafting applications and understand the proper dimensioning styles for each.
C6.2 Apply dimensioning to various objects and features.
C6.3 Edit a dimension by using various editing methods.

C7.0 Students understand sectional view applications and functions:

C7.1 Understand the function of sectional views.
C7.2 Use a sectional view and appropriate cutting planes to clarify hidden features of an object.

C8.0 Students understand the tolerance relationships between mating parts.

C8.1 Understand what constitutes mating parts in engineering design.
C8.2 Use tolerancing in an engineering drawing.
C8.3 Interpret geometric tolerancing symbols in a drawing.

C9.0 Students understand the methods of inserting text into a drawing:

C9.1 Understand the processes of lettering and text editing.
C9.2 Develop drawings using notes and specifications.
C9.3 Understand the methods of title block creation.

C10.0 Students understand the sketching process used in concept development:

C10.1 Understand the process of producing proportional two- and three-dimensional sketches and designs.
C10.2 Use sketching techniques as they apply to a variety of architectural and engineering models.
C10.3 Use freehand graphic communication skills to represent conceptual ideas, analysis, and design concepts.

C11.0 Students understand the methods of creating both written and digital portfolios:

C11.1 Develop a binder of representative student work for presentation.
C11.2 Produce a compact disc, Web site, or other digital-media portfolio.
C11.3 Know how to give an effective oral presentation of a portfolio.

LEGEND FOR REFERENCE OF ACADEMIC STANDARDS

Parenthetical notation preceding the content standard item refers to the grade level for the standard. i.e. (8) refers to grade 8, (9-10) refers to grades 9 & 10.
Example: (8) W2.1 refers to the Eighth Grade Writing Standard Item 2.1

English-Language Arts:
R Reading
W Writing
WOC Written & Oral Conventions
LS Listening & Speaking

Mathematics:
NS Number Sense
AF Algebra & Functions
SDP Statistics, Data Analysis & Probability
MR Mathematical Reasoning
MG Measurement & Geometry
AI Algebra I
G Geometry
AII Algebra II
P&S Probability & Statistics
APP&S Advanced Placement Probability & Statistics
C Calculus

Science:
PH Physics
CH Chemistry
ES Earth Science
I&E Investigation and Experimentation

History-Social Science:
WH World History, Culture and Geography
USH United States History and Geography
AD American Democracy
ECON Economics

Visual and Performing Arts:
APP: Artistic Perception Proficient Level
APA: Artistic Perception Advanced
CEP: Creative Expression Proficient
CEA: Creative Expression Advanced
HCCP: Historical & Cultural Proficient
HCCA: Historical & Cultural Advanced
AVP: Aesthetic Valuing Proficient
AVA: Aesthetic Valuing Advanced
CRP: Connections, Relationships, Proficient
CRA: Connections, Relationships, Advanced

ELA: English-Language Arts with in VPA
ELA- LRA: Literary Response and Analysis
ELA-WSA: Writing Strategies & Applications
ELA-WOELC: Written & Oral English Language Conventions

Sectors
AME Arts, Media and Entertainment
BTC Building Trades and Construction
ECDFS Education, Child Development & Family Services
EU Energy & Utilities
ED Engineering & Design
FID Fashion and Interior Design
FAB Finance and Business
HSMT Health Science & Medical Technology
HTR Hospitality, Tourism & Recreation
IT Information Technology
MPD Manufacturing and Product Development
MSS Marketing, Sales, & Services
PS Public Services
T Transportation