Course Outline

Job Title:
CAD Technician

Career Pathway:
Architecture Design

Industry Sector:
Engineering and Architecture

O*NET-SOC CODE:
17-3011.00

CBEDS Title:
Computer-Aided Drafting/Design

CBEDS No.:
5705

74-25-70

Computer-Aided Design (CAD): Architectural

Credits: 5   **Hours:** 90

Course Description:
This competency-based course is one of the two designed for computer-aided design (CAD). It provides students with project-based experiences in architectural CAD. Technical instruction includes an orientation, workplace safety policies and procedures, trade mathematics, and employability skills. Emphasis is placed on architectural terminology, design standards, and methods. Drawing construction with CAD focuses on architectural drafting based on conventional techniques that range from basic to intermediate and advanced levels. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

Prerequisites:
Enrollment requires successful completion of the Computer Aided Design: Mechanical (74-25-80) course.

NOTE: For Perkins purposes this course has been designated as a **concentrator/capstone** course.

This course cannot be repeated once a student receives a Certificate of Completion.

Los Angeles Unified School District
Division of Adult and Career Education
Instructional and Couseling Services Unit
Adult Curriculum Office
www.wearedace.org

COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS   **LOCATION**

GOALS AND PURPOSES   Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES   pp. 7-12

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPONENTS	LOCATION

INSTRUCTIONAL STRATEGIES   p. 14

Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT   Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.   pp. 7-12

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

EVALUATION PROCEDURES   pp. 14-15

The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT   Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

ACKNOWLEDGMENTS

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CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS
Engineering and Architecture Industry Sector
Knowledge and Performance Anchor Standards

1.0 Academics
Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Engineering and Architecture academic alignment matrix for identification of standards.

2.0 Communications
Acquire and accurately use Engineering and Architecture sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management
Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology
Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Engineering and Architecture sector workplace environment.

5.0 Problem Solving and Critical Thinking
Conduct short, as well as more sustained research projects to create alternative solutions to answer a question or solve a problem unique to the Engineering and Architecture sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety
Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Engineering and Architecture sector workplace environment.
pertaining to the Occupational Safety and Health Administration (OSHA).

7.0 Responsibility and Flexibility
Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Engineering and Architecture sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities
Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork
Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.

10.0 Technical Knowledge and Skills
Apply essential technical knowledge and skills common to all pathways in the Engineering and Architecture sector, following procedures when carrying out experiments or performing technical tasks.

11.0 Demonstration and Application
Demonstrate and apply the knowledge and skills contained in the Engineering and Architecture anchor standards, pathway standards, and performance indicators in classroom, laboratory and workplace settings, and through the SkillsUSA career technical student organization.

Engineering and Architecture
Pathway Standards

A. Architectural Design Pathway

The Architectural Design pathway provides learning opportunities for students interested in preparing for careers in such areas as architecture, industrial design, and civil engineering.

Sample occupations associated with this pathway:

♦ Drafter
♦ Architect
♦ Structural Designer
♦ Building Department Plan Examiner
♦ City Planner

A1.0 Understand how history shaped architecture and know significant events in the history of architectural design.

A2.0 Compare the theoretical, practical, and contextual issues that influence design.

A3.0 Understand the sketching processes used in concept development.

A4.0 Understand the use of computer-aided drafting (CAD) in developing architectural designs.

A5.0 Compare the relationship between architecture and the external environment.

A6.0 Understand methods used to analyze simple structures.

A7.0 Understand the properties of structural materials.

A8.0 Systematically complete an architectural project.
   A8.1 Describe the various components of structures, including lighting; heating,

A9.0 Using various methods create both written and digital portfolios to represent architectural renderings.

COMPETENCY-BASED COMPONENTS
for the Computer-Aided Design (CAD): Architectural Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS

A. ORIENTATION AND SAFETY
 	
Understand, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.
 	
(3 hours)
	1. Describe the scope and purpose of the course.
	2. Describe the overall course content as a part of the Linked Learning Initiative.
	3. Describe classroom policies and procedures.
	4. Identify classroom and workplace first aid and emergency procedures based on the American Red Cross (ARC) standards.
	5. Describe the different occupations in the Engineering and Design Industry Sector which have an impact on the role of architectural CAD drafters.
	6. Describe the opportunities available for promoting gender equity and the representation of non-traditional populations in architectural CAD.
	7. Explain the impact of Environmental Protection Agency (EPA) legislation on Engineering and Design Industry Sector practices in protecting and preserving the environment.
	8. Describe and demonstrate the procedures for contacting proper authorities for the removal of hazardous materials based on the EPA standards.
	9. Describe and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to architectural CAD.
	10. Describe the provisions of the California Title 24 Energy Efficiency Standards (a.k.a. 2008 California Green Building Standards Code) as they relate to the Engineering and Design Industry Sector.
	11. Describe the California Occupational Safety and Health Administration (Cal/OSHA) and its laws governing architectural CAD.
	12. Describe how each of the following insures a safe workplace:
	  a. employees' rights as they apply to job safety
	  b. employees' obligations as they apply to safety
	  c. safety laws applying to electrical tools
	13. Pass the safety test with 100% accuracy.
		Career Ready Practice:
		1, 2, 5, 7, 12
		
		CTE Anchor:
		Communications:
		2.5, 2.7
		Career Planning and Management:
		3.4
		Problem Solving and Critical Thinking:
		5.2, 5.4
		Health and Safety:
		6.1, 6.2, 6.7
		Responsibility and Flexibility:
		7.0
		Ethics and Legal Responsibilities:
		8.2
		
		CTE Pathway:
		C1.0, C2.0, C3.0, C4.0, C5.0, C6.0, C7.0, C8.0, C9.0

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
B. RESOURCE MANAGEMENT Understand, apply, and evaluate the resource management principles and techniques in architectural CAD. (1 hour)	1. Define the following: a. resources b. management c. sustainability 2. Describe the management of the following resources in architectural CAD: a. time b. materials c. personnel 3. List specific examples of effective management of the following in architectural CAD: a. time b. materials c. personnel 4. Describe the benefits of effective resource management in architectural CAD: a. profitability b. sustainability c. company growth 5. Describe the economic benefits and liabilities of managing resources in an environmentally responsible way.	**Career Ready Practice:** 2 **CTE Anchor:** Communications: 2.5 Responsibility and Flexibility: 7.4 Technical Knowledge and Skills: 10.1 **CTE Pathway:** C4.1
C. CAD INTRODUCTION Understand, apply, and evaluate the appearance and basic functions of architectural CAD. (5 hours)	1. Identify and describe the following: a. architectural CAD file management basics/commands b. components of the Graphic Screen c. elements of the Cartesian coordinate system 2. Describe the use of absolute and relative coordinates. 3. Describe and demonstrate the following: a. performing basic commands to create lines, circles, to erase, and to cancel commands b. creating preliminary practice drawings 4. Pass an introductory concepts and commands for architectural CAD quiz with 80% accuracy.	**Career Ready Practice:** 1, 2, 5 **CTE Anchor:** Communications: 2.5 Problem Solving and Critical Thinking: 5.4 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1, 11.2 **CTE Pathway:** C2.2, C3.1, C4.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
D. TRADE MATHEMATICS Understand, apply, and evaluate basic math skills applicable to architectural CAD. (3 hours)	1. Complete pre-test to assess basic math skills. 2. Describe and solve basic whole number, fraction, and decimal problems. 3. Describe and solve complex fraction, exponent, and powers/roots problems. 4. Describe and solve metric conversion, geometry, and pre-algebra ratio/scale problems. 5. Pass an applied basic mathematics review quiz with 80% accuracy.	**Career Ready Practice:** 1, 2, 5 **CTE Anchor:** Academics: 1.0 Communications: 2.5 Problem Solving and Critical Thinking: 5.4 Technical Knowledge and Skills: 10.1 Demonstration and Application: 11.1, 11.2 **CTE Pathway:** C4.1, C4.2

E. ARCHITECTURAL TERMINOLOGY, DESIGN STANDARDS, AND METHODS
 	
Understand, apply, and evaluate architectural terms, types of drawings, reproduction methods, and drafting standards.
 	
(20 hours)
	1. Define design as a concept essential to the creative architectural process.
	2. Identify and describe the ANSI Standards for the following:
	  a. sheet sizes
	  b. drawing scales
	  c. line types
	  d. symbols
	  e. dimensions
	3. Identify and describe the features and functions of the following:
	  a. tools for manual (board) drafting and for architectural CAD
	  b. mechanical drafting reference information
	  c. symbols used in mechanical drafting
	  d. types of drawings (i.e., schematic and pictorial)
	4. Describe and demonstrate the following:
	  a. creating standard title and revision block information
	  b. creating basic architectural CAD text needed for title blocks
	  c. creating top, front, side, section, and auxiliary views
	  d. drawing using components and construction techniques based on traditional drafting methods using architectural CAD
	  e. planning and building a small scale-model fence using architectural CAD
	5. Pass an architectural drafting terminology, standards, and methods quiz with 80% accuracy.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Communications:
		2.5
		Problem Solving and Critical Thinking:
		5.4
		Technical Knowledge and Skills:
		10.1
		Demonstration and Application:
		11.1, 11.2
		
		CTE Pathway:
		C4.1, C4.2, C8.1, C10.3, C10.4, C11.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS

F. COMPUTER FUNDAMENTALS
 	
Understand, apply, and evaluate operating systems, file management, and their relation to architectural CAD applications.
 	
(15 hours)
	1. Identify and describe the following:
	   a. computer hardware components
	   b. operating systems
	   c. operating procedures for mechanical CAD on a DOS platform
	   d. procedures for Windows basics
	   e. required keyboarding techniques
	   f. operating procedures for architectural CAD on a Windows platform
	   g. directory structure, file extensions, various architectural. CAD programs, word processors, and spreadsheets
	2. Describe and demonstrate the following:
	   a. documentation of mechanical projects
	   b. file storage and management strategies for architectural applications
	3. Pass a computer fundamentals quiz with 80% accuracy.
		Career Ready Practice:
		1, 2, 4, 5, 10
		CTE Anchor:
		Communications:
		2.5
		Problem Solving and Critical Thinking:
		5.4
		Technical Knowledge and Skills:
		10.1
		Demonstration and Application:
		11.1, 11.2
		
		CTE Pathway:
		C2.1, C2.2

G. CAD BASICS
 	
Understand, apply, and evaluate the modification techniques for two-dimensional drawings.
 	
(15 hours)
	1. Identify and describe the following:
	   a. draw tool
	   b. modification of the tool menus and program defaults in detail
	   c. appropriate settings for architectural drawings
	2. Describe and demonstrate the following:
	   a. using the input of entity data to the drawing
	   b. using the drawing aids/tools
	   c. drawing and simply modifying architectural drawings
	   d. changing the window view (zoom/pan)
	   e. using blocks as saved drawings
	   f. creating drawings by using correct layers and entity types
	   g. creating a drawing for a 3-D assembly by hand
	   h. querying the drawing for entity and general instrumentation
	   i. designing, constructing, and testing a small scale-model skateboard park
	3. Pass an architectural CAD basics quiz with 80% accuracy.
		Career Ready Practice:
		1, 2, 4, 5, 10
		
		CTE Anchor:
		Communications:
		2.5
		Problem Solving and Critical Thinking:
		5.4
		Technical Knowledge and Skills:
		10.1
		Demonstration and Application:
		11.1, 11.2
		
		CTE Pathway:
		C8.1, C8.2

H. INTERMEDIATE CAD
 	
Understand, apply, and evaluate the setting up techniques for various architectural drawings.
	1. Describe and demonstrate the following:
	   a. types of drafting references available
	   b. setting up the drawing environment appropriate for a variety of drawings
	   c. creating multiple views in two-dimensional architectural drawings
		Career Ready Practice:
		1, 2, 5

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS

(15 hours)	d. navigating a three-dimensional software and define the advantages for drawing and designing
	     e. creating dimension drawings
	     f. editing dimensions
	     g. creating an architectural drawing for a 3-D assembly by hand
	     h. creating symbols as blocks/groups
	     i. creating a mechanical symbol library
	     j. creating basic printed/plotted architectural CAD drawings
	     k. completing numerous intermediate level CAD drawings that comprise a small set of construction documents
	     l. designing and constructing a small-scale model deck
	2. Pass an intermediate architectural CAD quiz with 80% accuracy.
		CTE Anchor:
		Communications: 2.5
		Problem Solving and Critical Thinking: 5.4
		Technical Knowledge and Skills: 10.1
		Demonstration and Application: 11.1, 11.2
		
		CTE Pathway:
		C4.1, C4.2, C10.4

I.   ADVANCED CAD
 	
Understand, apply, and evaluate basic three-dimensional wire frame and three-dimensional solid geometry; create rendered images and basic customization of the program interface.
 	
(10 hours)
	1. Describe and demonstrate the following:
	     a. working drawing
	     b. creating and extracting attribute information for architectural applications such as facilities management
	     c. creating linked and embedded objects
	     d. creating exported and file transfer exchange files
	     e. creating basic customization of the program interface
	     f. creating basic three-dimensional solid geometry utilizing 3-D software
	     g. rendering and saving image and bitmaps of drawn entities
	     h. creating three-dimensional architectural entities as solid geometry and utilize them to create two-dimensional views
	     i. creating a drawing of a single-story house for a 3-D assembly by hand
	     j. designing and building a small scale-model house by reading a blueprint and practicing measuring in architectural scale
	     k. designing and constructing a small-scale playground
	2. Pass an advanced architectural CAD quiz with 80% accuracy.
		Career Ready Practice:
		1, 2, 5
		
		CTE Anchor:
		Communications: 2.5
		Problem Solving and Critical Thinking: 5.4
		Technical Knowledge and Skills: 10.1
		Demonstration and Application: 11.1, 11.2
		
		CTE Pathway:
		C4.1, C4.2, C10.4

J.   EMPLOYABILITY SKILLS
 	
Understand, apply, and evaluate the employability skills required in the computer drafting field.
	1. Describe employer requirements for the following:
	     a. punctuality
	     b. attendance
	     c. attitude toward work
	     d. quality of work
	     e. teamwork
	     f. responsibility
	     g. timeliness
	     h. communication skills
		Career Ready Practice:
		7
		
		CTE Anchor:
		Technology: 4.1
		Responsibility and Flexibility: 7.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	2. Identify potential employers through traditional and internet sources.	Ethics and Legal Responsibilities: 8.3
	3. Describe the role of social media in job search.	
	4. Design sample résumés and cover letters.	**CTE Pathway:**
	5. Describe the importance of filling out a job application legibly, with accurate and complete information.	C11.1
	6. Describe the common mistakes that are made on job applications.	
	7. Complete sample job application forms correctly.	
	8. State the importance of enthusiasm in the interview and on a job.	
	9. State the importance of appropriate appearance in the interview and on a job.	
	10. State the importance of the continuous upgrading of job skills.	
	11. Describe customer service as a method of building permanent relationships between the organization and the customer.	
	12. Describe and demonstrate appropriate interviewing techniques.	
	13. Identify the informational materials and resources needed to be successful in an interview.	
	14. Design sample follow-up letters.	
(3 hours)	15. Describe and demonstrate appropriate follow-up procedures.	

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Aubin, Paul F. Mastering AutoCAD Architecture 2010. Cengage Learning, 2009.

Brower, Myron Riggs. Architectural Drafting Assignments Using AutoCAD. Cengage Learning, 2005.

Jefferis, Allan and David Madsen. Architectural Drafting and Design, 6th Edition. Cengage Learning, 2010.

Kyles, Shannon. AutoCAD Workbook for Architects and Engineers. Wiley-Blackwell, 2008.

Larkin, John C.. Practical Problems in Mathematics for Drawing and CAD, 3rd Edition. Cengage Learning, 2004.

Madsen, David. Geometric Dimensioning and Tolerancing: Based on Asme Y14.5-2009 8th Edition. Goodheart-Willcox Publishing, 2010.

Wyatt. William G. Accessing AutoCAD Architecture 2012. Cengage Learning, 2011.

SOFTWARE PROGRAMS

Autodesk. Auto CAD (latest version). http://usa.autodesk.com

RESOURCES

Employer Advisory Board members

CTE Foundation Standards
http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf
http://www.cde.ca.gov/be/st/ss/documents/ctestandards.doc

Accrediting Commission of Career Schools and Colleges of Technology (ACCSCT), 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Phone: (703) 247-4212. Fax: (703) 247-4533.

American Design Drafting Association (ADDA), 105 E. Main St., Newbern, TN 38059. Phone: (731) 627-0802. Fax: (731) 627-9321.

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

A. Lecture and discussion

B. Multimedia presentations

C. Demonstrations and participations

D. Individualized instruction

E. Peer teaching

F. Role-playing

G. Guest speakers

H. Field trips and field study experiences

I. Projects

EVALUATION

SECTION A – Orientation and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management – Pass all assignments and exams on resource management with a minimum score of 80% or higher.

SECTION C – CAD Introduction – Pass all assignments and exams on CAD Introduction with a minimum score of 80% or higher.

SECTION D – Trade Mathematics – Pass all assignments and exams on trade mathematics with a minimum score of 80% or higher.

SECTION E – Architectural Terminology, Design Standards, and Methods– Pass all assignments and exams on architectural terminology, design standards, and methods with a minimum score of 80% or higher.

SECTION F –Computer Fundamentals – Pass all assignments and exams on computer fundamentals with a minimum score of 80% or higher.

SECTION G – CAD Basics – Pass all assignments and exams on CAD basics with a minimum score of 80% or higher.

SECTION H – Intermediate CAD – Pass all assignments and exams on intermediate CAD with a minimum score of 80% or higher.

SECTION I – Advanced CAD – Pass all assignments and exams on advanced CAD with a minimum score of 80% or higher.

SECTION J – Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color,
national origin, gender, or physical disability.