

Advanced Computer Aided Design

COURSE OUTLINE

1. Course Title: Advanced Computer Aided Design

2. CBEDS Title: Computer Aided Drafting/Design

3. CBEDS Number: 5705

4. Job Titles:

Framers

Contractors

Plumbers

Civil Engineers

Surveyors

Construction Inspectors

Architects

Engineers

Landscape Architects

Facilities Managers

5. Course Description:

In this advanced competency-based course students will be prepared for careers in architecture, engineering, and construction. Students will gain advanced skills in drafting layout, CAD editing techniques, dimensioning and visual presentation. Students will learn how to create virtual 3-D models and how to render them with color, light and shadows. Projects will involve architectural, civil and mechanical engineering applications. This course includes classroom instruction, laboratory activities and work-place learning projects.

Student Outcomes & Objectives:

In this course students will:

- Demonstrate a basic knowledge of CAD and the ability to use appropriate technique and procedures for the care and use of hardware and software to produce a series of orthographic and isometric drawings.
- Understand the importance of developing precise basic entities and will demonstrate the ability to produce accurate drawings, using computer techniques and procedures.
- Understand the function of editing commands and will demonstrate the ability to use edit commands to produce accurate drawings.
- Demonstrate an understanding of zoom, pan, views, layers, color units, windows, grids, snaps, and command functions. The student will demonstrate the ability to manipulate geometric entities on the monitor and to produce a drawing.
- Understand the proper use of American National Standards Institute (ANSI) standards and architectural standards and demonstrate the ability to represent dimensions properly.
- Understand the development, use and outcome of an attribute file and demonstrate the ability to provide a bill of materials.
- Understand the proper technique of scaling and plotting to proper size and will be able to demonstrate that ability by plotting industry-quality drawings.
- Understand the importance of measuring systems and the measuring instruments involved in drafting and related fields. The student will develop the use of fractions, decimals, and metrics in measurement units.

- Understand the history of drafting as a graphic language, will be able to identify early drafting tools and implements, and will understand why CAD is presently used.
- Understand the educational qualifications and levels on the drafting career ladder and will be able to demonstrate the ability to write a resume and complete a job application.

Pathway

Recommended Sequence	Courses	
	Engineering	Construction
Introductory	Computer Foundations	Applied Technology
Skill Building	Computer Aided Design	Construction Technology
Advanced Skill	Advanced Computer Aided Design	Computer Aided Design

6. Hours: *Students receive up to 180 hours of classroom instruction.*

7. Prerequisites: Computer Aided Design

8. Date (of creation/revision): July 2010

9. Course Outline

COURSE OUTLINE				
Upon successful completion of this course, students will be able to demonstrate the following skills necessary for entry-level employment.				
Instructional Units and Competencies	Course Hours	Model Curr. Standards	CA Academic Content Standards	CAHSEE
<p>I. CAREER PREPARATION STANDARDS</p> <p>A. Career Planning and Management.</p> <ol style="list-style-type: none"> 1. Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers. <ol style="list-style-type: none"> a. Students will identify skills needed for job success b. Students will identify the education and experience required for moving along a career ladder. 2. Understand the scope of career opportunities and know the requirements for education, training, and licensure. <ol style="list-style-type: none"> a. Students will describe how to find a job. b. Students will select two jobs in the field and map out a timeline for completing education and/or licensing requirements. 3. Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options. <ol style="list-style-type: none"> a. Students will conduct a self—assessment and explain how professional qualifications affect career choices. 4. Understand the role and function of professional organizations, industry associations, and organized labor in a productive society. <ol style="list-style-type: none"> a. Contact two professional organization and identify the steps to become a member. 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. <ol style="list-style-type: none"> a. Students will describe careers in the building trades construction industry sector. b. Students will identify work-related cultural differences to prepare for a global workplace. 6. Know the main strategies for self-promotion in the hiring process, such as completing job applications, resume writing, interviewing skills, and preparing a portfolio. <ol style="list-style-type: none"> a. Students will write and key a resume, cover letters, thank you letters, and job applications. b. Students will participate in mock job interviews. <p>B. Technology.</p> <ol style="list-style-type: none"> 1. Understand past, present and future technological advances as they relate to a chosen pathway. 2. Understand the use of technological resources to gain access to, manipulate, and produce information, products and services. 3. Understand the influence of current and emerging technology on selected segments of the economy. 4. Use appropriate technology in the chosen career pathway. <p>C. Problem solving and Critical Thinking.</p> <ol style="list-style-type: none"> 1. Apply appropriate problem-solving strategies and critical thinking to work-related issues and tasks. 2. Understand the systematic problem-solving models that incorporate input, process, outcome and feedback components. 	<p>22</p> <p>Additional hours are integrated throughout the course.</p>	<p>Agriculture & Natural Resources Industry Sector, Model Curriculum Standards</p> <p>3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0</p> <p>Engineering & Design Industry Sector, Model Curriculum Standards</p> <p>3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0</p>	<p><u>Language Arts</u> (8) R 1.3, 2.6 W1.3, 2.5. LC 1.4,1.5, 1.6 LS1.2, 1.3, 1.7 (9/10) R2.1,2.3,2.6 W2.5 LC1.4 LS 1.1, 2.3 (11/12) R2.3 W2.5 LC1.2 <u>Math</u> (7) NS1.2, 1.3 1.7 MR 1.1,1.3,2.1 2.7,2.8, 3.1</p>	<p>Lang. Arts R 8.2.1</p> <p>(9/10) R 2.1, 2.3 W2.5</p> <p>Math (7) NS 1.2, 1.3, 1.7 MR 1.1, 2.1, 3.1</p>

<ul style="list-style-type: none"> 3. Use critical thinking skills to make informed decisions and solve problems. 4. Apply decision-making skills to achieve balance in the multiple roles of personal, home, work and community life. <p>D. Health and Safety.</p> <ul style="list-style-type: none"> 1. Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities. 2. Understand critical elements of health and safety practices related to storing, cleaning and maintaining tools, equipment, and supplies. <p>E. Responsibility & Flexibility.</p> <ul style="list-style-type: none"> 1. Understand the qualities and behaviors that constitute a positive and professional work demeanor. 2. Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles. 3. Understand the need to adapt to varied roles and responsibilities. 4. Understand that individual actions can affect the larger community. <p>F. Ethics and Legal Responsibilities</p> <ul style="list-style-type: none"> 1. Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations. 2. Understand the concept and application of ethical and legal behavior consistent with workplace standards. <ul style="list-style-type: none"> a. Contact a business and obtain a copy of their rules for employment. b. Role play difference ethical scenarios. 3. Understand the role of personal integrity and ethical behavior in the workplace. <p>G. Leadership and Teamwork.</p> <ul style="list-style-type: none"> 1. Understand the characteristics and benefits of teamwork, leadership, citizenship in the school, community, and workplace settings. 2. Understand the ways in which professional associations and competitive career development activities enhance academic skills, career choices, and contribute to promote employability. 3. Understand how to organize and structure work individually and in teams for effective performance and attainment of goals. 4. Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace. 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. 				
--	--	--	--	--

Instructional Units and Competencies	Hours	Model Curr. Standards.	CA Academic Standards	CAHSEE
<p>A. Measuring Tools & Instruments</p> <ol style="list-style-type: none"> 1. Using a measuring tape, level, laser level, transit, water level, GIS, ultrasonic measuring device, protractor, stud finder, micrometer, vernier & gaging 2. Using a string line, plumb line, & chalk line 3. Engineering & architectural drawings using measuring tools & instruments 	10	Architectural & Structural Engineering Pathway A2.3	M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0	M. 7; MG; 1.2, 2.1- 2.4, 3.1- 3.5
<p>B. Architectural Drafting</p> <ol style="list-style-type: none"> 1. Site Planning <ul style="list-style-type: none"> ○ Surveying ○ Site orientation ○ Planning Codes ○ Fire Codes ○ Health Department Codes 2. Floor Plans <ul style="list-style-type: none"> ○ Room planning ○ Styles, symbols, blocks, multi-view blocks, and schedules ○ California Uniform Building Code ○ The Electrical, Mechanical and Fire Codes ○ Dimensioning floor plans ○ Labeling the rooms, doors and windows ○ Annotating the floor plan ○ Calculating the floor space and the window area ○ Shear Walls, braced Walls, hold-downs and other essential structural information ○ Electrical, plumbing & mechanical layout 3. Framing, Foundation & Slab Plans <ul style="list-style-type: none"> ○ Floor Framing ○ Wall Framing ○ Roof Framing 4. Sections, Details & Notes <ul style="list-style-type: none"> ○ Building cross sections ○ Wall sections ○ Foundation details ○ Other Important Structural Details and Notes ○ Title 24 Calculations 5. Elevations <ul style="list-style-type: none"> ○ Exterior elevations ○ Interior elevations 6. Kitchen & millwork design 7. Stair design & detailing 	20	Architectural & Structural Engineering Pathway A4.1, 4.2, 4.3, 4.6 A5.0, 5.3 Engineering & Heavy Construction Pathway B4.1 B6.2 Mechanical Construction Pathway C6.2	ELA 8; R; 2.1 – 2.6 W; 1.1-1.3, 2.6 M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0	M. 7; MG; 1.2, 2.1- 2.4, 3.1- 3.5

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
<p>D. Architectural Projects</p> <ol style="list-style-type: none"> 1. Measure and draw floor plan of an existing building 2. Design a single room building <ul style="list-style-type: none"> o Create one floor plan & copy it 5 times o Create 5 different roof designs o Generate 5 different roof plans & sets of elevations 3. Working drawings for a remodel/addition 4. Working drawings for a small residence 5. Working drawings for a two-story residence 	25	Architectural & Structural Engineering Pathway A7.1	ELA 8; R; 2.1 – 2.6 W; 1.1-1.3, 2.6 M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0	M. 7; MG; 1.2, 2.1-2.4, 3.1-3.5
<p>E. Mechanical Drawing, Computer Aided Mechanical (CAM) & Computer Numerical Control (CNC)</p> <ol style="list-style-type: none"> 1. Sketching a design 2. Multi-view Sketches 3. Sketching the design in Inventor & AutoDesk Mechanical Desktop 4. Converting the sketch into a solid model 5. Developing & editing the solid model 6. Placing constraints on the solid model 7. Producing orthographic, auxiliary, sectional & pictorial 3-D views of the solid model 8. Making Assemblies from solid models 9. Using Solid Models and CNC to manufacture parts 10. ANSI Y14 Standards – Government Standards for Manufacturing 11. Geometric Tolerances 12. Fasteners/Hardware 13. Mechanical Dimensioning <ul style="list-style-type: none"> o Rules for dimensioning per the ANSI Y14.5M Government Standards for dimensioning & tolerancing o Dimensioning techniques for line work & symbols o Geometric tolerance workbook o Applied dimensioning techniques o Professional problems using geometric tolerances 	30	Engineering Design Pathway C4.0, 4.1, 4.4 C5.0 Engineering Technology Pathway D1.1, 1.4	ELA 9-10; W; 1.3-1.8	
<p>F. Research and Design</p> <ol style="list-style-type: none"> 1. Determining client needs 3. Developing a design for a manufacturing and/or a construction project to meet a client's needs 4. Evaluating the product in light of its function and meeting the client's needs 	15	Building, Trades & Construction Pathway C4.6		

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
<p>G. Working Drawings</p> <ol style="list-style-type: none"> 1. Completing the various types of working drawings using appropriate line work, symbols, and current standards 2. Applying correct tolerance conventions to drawings 3. Developing primary orthographic and auxiliary views 4. Organizing and completing an assembly drawing using information collected from detail drawings 	20	Architectural & Structural Engineering Pathway A2.4	ELA 8; R; 2.1 – 2.6 W; 1.1-1.3, 2.6 M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0	M. 7; MG; 1.2, 2.1-2.4, 3.1-3.5
<p>H. Computer 3-D & Solid Modeling</p> <ol style="list-style-type: none"> C. Constructing 3-D Computer Models in AutoCAD, Inventor & Viz 2. Named Views of 3-D Models 3. The User Coordinate System 4. The primitive 3-D shapes – polyhedral, prism, cylinder, pyramid, cone, sphere, torus, and ellipsoid 5. Modifying & combining 3-D shapes and geometry 6. Wire frame, Hidden Line & Shaded Views in AutoCAD 7. Inventor & Viz – Solid Modeling & Rendering Programs 8. Importing AutoCAD drawings into Solid Modeling Programs 	20	Architectural & Structural Engineering Pathway A6.1, 6.2		
<p>I. Civil Engineering Contour Lines</p> <ol style="list-style-type: none"> 1. Contour lines characteristics 2. Types of contour lines 3. Constructing contour lines from field notes 4. Plotting contour lines with a CAD system 	10	Architectural & Structural Engineering Pathway A6.0		
<p>J. Profiles in Civil Engineering</p> <ol style="list-style-type: none"> 5. Contour map profiles 6. Plan and profile 7. Plan and profile with CAD 	10	Architectural & Structural Engineering Pathway A6.0		
<p>K. Highway Layout</p> <ol style="list-style-type: none"> 1. Plan layout 2. Plan layout with a CAD system 	10	Architectural & Structural Engineering Pathway A6.0		

10. Additional recommended/optional items

a. Articulation: After completion of Advanced course students may waive the following courses in the Santa Rosa Junior College Architectural Technician, Civil and Surveying Technology, or Construction Management Programs: APTECH 55 and APTECH 56 if they complete the advanced class with a "C" or better. The advanced Computer Aided Design class meets the prerequisite for APTECH 57.

b. Academic credit: None

c. Instructional strategies:

Assignments:

Tool identification, reports, and lab participation.

Methods of Evaluation:

The types of writing assignments required:

Written homework

CAD Projects

The problem-solving assignments required:

Homework problems

Quizzes

Exams

CAD Projects

The types of skill demonstrations required:

Class performances

Projects to match skills

The types of objective exams used in the course:

Multiple choice

True/False

CAD Projects

d. Instructional materials:

Teacher generated materials and projects provided by industry partners

e. Certificates: None