

# Computer Aided Design

## COURSE OUTLINE

**1. Course Title: 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 competency-based course students will learn the fundamentals of drafting in a modern, networked, computer lab using AutoCAD drafting software. The course will cover the concepts and application of orthographic projection, isometric representation, and basic dimensioning. Topics also include linetype conventions, lettering, freehand drafting, geometric construction, sections, and auxiliary views. Students will be introduced to 3-D visualization using computer wire frame and surface modeling techniques. Advanced students will learn 3-D modeling techniques and have the opportunity to use AutoDesk's Inventor Software. This course includes classroom instruction and laboratory activities.

### **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                     |
| <b>Introductory</b>   | Computer Foundations           | Applied Technology               |
| <b>Skill Building</b> | <b>Computer Aided Design</b>   | Construction Technology          |
| <b>Advanced Skill</b> | Advanced Computer Aided Design | Advanced Construction Technology |

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

**7. Prerequisites:** Algebra 1

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

## 9. Course Outline

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

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| <ul style="list-style-type: none"> <li>3. Use critical thinking skills to make informed decisions and solve problems.</li> <li>4. Apply decision-making skills to achieve balance in the multiple roles of personal, home, work and community life.</li> </ul> <p>D. Health and Safety.</p> <ul style="list-style-type: none"> <li>1. Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.</li> <li>2. Understand critical elements of health and safety practices related to storing, cleaning and maintaining tools, equipment, and supplies.</li> </ul> <p>E. Responsibility &amp; Flexibility.</p> <ul style="list-style-type: none"> <li>1. Understand the qualities and behaviors that constitute a positive and professional work demeanor.</li> <li>2. Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.</li> <li>3. Understand the need to adapt to varied roles and responsibilities.</li> <li>4. Understand that individual actions can affect the larger community.</li> </ul> <p>F. Ethics and Legal Responsibilities</p> <ul style="list-style-type: none"> <li>1. Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations.</li> <li>2. Understand the concept and application of ethical and legal behavior consistent with workplace standards. <ul style="list-style-type: none"> <li>a. Contact a business and obtain a copy of their rules for employment.</li> <li>b. Role play difference ethical scenarios.</li> </ul> </li> <li>3. Understand the role of personal integrity and ethical behavior in the workplace.</li> </ul> <p>G. Leadership and Teamwork.</p> <ul style="list-style-type: none"> <li>1. Understand the characteristics and benefits of teamwork, leadership, citizenship in the school, community, and workplace settings.</li> <li>2. Understand the ways in which professional associations and competitive career development activities enhance academic skills, career choices, and contribute to promote employability.</li> <li>3. Understand how to organize and structure work individually and in teams for effective performance and attainment of goals.</li> <li>4. Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.</li> <li>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.</li> </ul> |  |  |  |  |
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| Instructional Units and Competencies   | Hours | Model Curr. Standards.                                   | CA Academic Standards                               | CAHSEE                                 |
|--|-------|--|---|--|
| <b>A Drafting Fundamentals</b><br>1. Using drafting equipment<br>2. Using scales (architectural, engineering, metric)<br>3. Measuring & sketching projects<br>4. Scaled drawings from your sketches<br>5. Basic dimensioning techniques<br>6. Applying tolerances<br>7. Using common symbols and abbreviations<br>8. Demonstrating lettering styles<br>9. Performing freehand lettering<br>10. Sketching a drawing<br>11. Using proper layout techniques   | 25    | Architectural & Structural Engineering Pathway A7.0      | M. 8-12;<br>Geom.; 8.0-13.0                         | <b>(7)NS1.2, 1.2</b><br><b>(6)P3.3</b> |
| <b>B Orthographic &amp; Multi-view Drawing</b><br>1. Properly using the six principle views to fully describe an object<br>2. Demonstrating the process of projection<br>3. Differentiating line drawing procedure/priority<br>4. Constructing an auxiliary view from an oblique plane<br>5. Using sectional line conventions and symbols<br>6. Drawing sections and sections details  | 20    | Engineering Design Pathway C4.2, .3; C7.0                | ELA 9-10; R; 2.6<br><br>M. 8-12;<br>Geom.; 8.0-13.0 |  |
| <b>C Pictorial Drawing</b><br>1. Producing isometric drawings<br>2. Producing oblique drawings<br>3. Producing perspective drawings<br>4. Rendering pictorial drawings   | 15    | Engineering Design Pathway C4.5                          |   |  |
| <b>D Fundamental Computer Graphic Application Skills</b><br>1. AutoDesk command structure, tutorials and help<br>2. AutoDesk program settings<br>3. CADD fundamentals<br>4. CADD drawing methods<br>5. CADD editing methods<br>6. CADD drawing display options (model & paper space)<br>7. Plotting and Printing Files<br>8. Working with Vector & Raster Images<br>9. Annotating and dimensioning<br>10. Geometric construction<br>11. Orthographic multi-view drawing<br>12. Sections and Elevations<br>13. Creating Block Libraries<br>14. Attributes and Object Properties | 45    | Architectural & Structural Engineering Pathway A6.0, 6.2 | ELA 9-10; W; 1.3<br>11-12;<br>W1.8                  |  |

| Instructional Units and Competencies  | Hours | Model Curr. Standards.  | CA Academic Standards  | CAHSEE                                 |
|---|-------|---|--|--|
| <p>E Measuring Tools &amp; Instruments</p> <ol style="list-style-type: none"> <li>1. Using a measuring tape, level, laser level, transit, water level, GIS, ultrasonic measuring device, protractor, stud finder, micrometer, vernier &amp; gaging</li> <li>2. Using a string line, plumb line, &amp; chalk line</li> <li>3. Engineering &amp; architectural drawings using measuring tools &amp; instruments</li> </ol>  | 10    | Engineering Design Pathway C3.1                               | M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0  | <b>M. 7; MG; 1.2, 2.1-2.4, 3.1-3.5</b> |
| <p>F Architectural Drafting</p> <ol style="list-style-type: none"> <li>1. Site Planning <ul style="list-style-type: none"> <li>o Site orientation</li> <li>o Bearing, scale and contours</li> <li>o Location and orientation of the building</li> </ul> </li> <li>2. Floor Plans <ul style="list-style-type: none"> <li>o Room planning</li> <li>o Dimensioning floor plans</li> <li>o Labeling the rooms, doors and windows</li> <li>o Annotating the floor plan</li> <li>o Calculating the floor space and the window area</li> <li>o Shear Walls, braced Walls, hold-downs and other essential structural information</li> <li>o Electrical, plumbing &amp; mechanical layout</li> </ul> </li> </ol> | 35    | Architectural & Structural Engineering Pathway A4.3 A5.0 A5.3 | ELA 8; R; 2.1 – 2.6 W; 1.1-1.3, 2.6<br><br>M. 7; MG; 3.6 8-12; Algebra 1; 3.0, 5.0 | <b>M. 7; MG; 1.2, 2.1-2.4, 3.1-3.5</b> |
| <p>G. Introduction to Civil Drafting Technology</p> <ol style="list-style-type: none"> <li>1. Maps in general</li> <li>2. Types of maps</li> <li>3. Civil engineering companies</li> <li>4. Map requirements</li> <li>5. Cartography</li> <li>6. Schooling</li> <li>7. Basic Civil drafting techniques</li> <li>8. Placing notes on a drawing</li> <li>9. Civil engineers scale</li> </ol>  | 10    | Environ. && Natural Science Engineering Pathway E2.4          |  |  |
| <p>H. Legal Descriptions and Plot Plans</p> <ol style="list-style-type: none"> <li>1. Plot Plans</li> </ol>   | 10    |   |  |  |

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