

**Newport-Mesa Unified School District  
Office of Career Technical Education  
High School Course of Study**

<b>Course Title</b>	<i>Design Engineering (DE)</i>				<b>Course Code</b>		
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<b>Transcript Title:</b>	<i>DesignEngin 1AB</i>	<b>Grades Levels:</b>	<i>9</i>	<b>Board Adoption Date:</b>		
<b>Content Area:</b>	<i>Inter-Disciplinary</i>	<b>GPA Scale:</b>	<i>4.0</i>	<b>Date Course Submitted:</b>	<i>4/23/21</i>	
<b>Credential Required:</b>	<i>CTE</i>	<b>Graduation Subject Areas:</b>	<i>Elective</i>	<b>CALPADS Code:</b>	<i>7700</i>	
<b>UC/CSU "A-G" Area Approvals:</b>				<b>School Site/person that wrote and submitted the course:</b>		<i>CDM/Eman Samir</i>
<b>Recommend Skills:</b>	Strong math skills					
<b>Next course(s):</b>	<i>Electro-Mechanical Engineering</i>					
<b>Textbook to be used:</b>	<i>Computer-aided design (CAD) software - SolidWorks</i>					

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Design Engineering

**DATE:** April 22, 2021

**INDUSTRY SECTOR:** Engineering and Architecture

**PATHWAY:** Engineering Design 152

**CALPADS TITLE:** Introduction to Design 7700

**CALPADS CODE:** 7700

**HOURS:**

Total	Classroom	Laboratory/CC/CVE
180	47	133

JOB TITLE	ONET CODES	JOB TITLE	ONET CODES
Electronic Drafter	17-3012.01	Manufacturing Engineering Technologist	<b>17-3029.06</b>
Civil Drafter	17-3011.02		
Industrial Engineering Technologist	17-3029.05		

**COURSE DESCRIPTION:**

Design Engineering (DE) is a high school level foundation course in the Engineering Design pathway. DE students are introduced to the engineering profession, design process and hands-on projects to give them the understanding of the design process from the sketching stage until prototyping. Students will learn the designing process and sketching rules. They learn to design on a 3-D CAD program. They will learn to work in teams to produce various projects.

**PREREQUISITES:**

High School Name:	Site Prerequisite:
Corona del Mar HS	none

**A – G APPROVAL:** ☐ Yes ☐ No ☒ Desired

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**ARTICULATION: N/A**

High School Name:	College Name:	College Course Title:

**LEVEL:** ☒ Introductory    ☐ Concentrator    ☐ Capstone

**CERTIFICATION: N/A**

High School Name:	Embedded/Leads to:	Description:

**METHOD OF STUDENT EVALUATION:**

- ✓ Pre and Post test
- ✓ Student Projects
- ✓ Written work
- ✓ Observation record of student performance
- ✓ Completion of assignments

**METHOD OF INSTRUCTION:**

- ✓ Lecture
- ✓ Group and individual applied projects
- ✓ Demonstration
- ✓ Field Trips
- ✓ Guest Speaker

**RECOMMENDED TEXTS OR SOFTWARE:**

Computer-aided design modeling software - SolidWorks

**MODEL CTE PATHWAY:**

Grade:	Fall Semester:	Spring Semester:
9	Design Engineering	Design Engineering
10	Electro-Mechanical Engineering	Electro-Mechanical Engineering
11	Robotics and Artificial Intelligence	Robotics and Artificial Intelligence
12	Advanced Design Engineering	Advanced Design Engineering

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**CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**

California Department of Education CTE Standards website: <http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp>

**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. (Direct alignment with LS 9-10, 11-12.6)

- 2.1 Recognize the elements of communication using a sender-receiver model.
- 2.2 Identify barriers to accurate and appropriate communication.
- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.4 Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.

**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. (Direct alignment with SLS 11-12.2)

- 3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.
- 3.2 Evaluate personal character traits, such as trust, respect, and responsibility, and understand the impact they can have on career success.
- 3.3 Explore how information and communication technologies are used in career planning and decision making.
- 3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.
- 3.5 Integrate changing employment trends, societal needs, and economic conditions into career planning.
- 3.6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.7 Recognize the importance of small business in the California and global economies.
- 3.8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates.
- 3.9 Develop a career plan that reflects career interests, pathways, and postsecondary options.

**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. (Direct alignment with ws 11-12.6)

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.2 Employ Web-based communications responsibly and effectively to explore complex systems and issues.
- 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
- 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
- 4.3 Research past, present, and projected technological advances as they impact a particular pathway.

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Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.

### **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. (Direct alignment with WS 11-12.7)

- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
- 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.

### **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. (Direct alignment with RSTS 9-10, 11-12.4)

- 6.1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.
- 6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
- 6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.4 Practice personal safety when lifting, bending, or moving equipment and supplies.
- 6.5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.
- 6.6 Maintain a safe and healthful working environment.
- 6.7 Be informed of laws/acts 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. (Direct alignment with SLS 9-10, 11-12.1)

- 7.1 Recognize how financial management impacts the economy, workforce, and community.
- 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to changing and varied roles and responsibilities.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 7.6 Demonstrate knowledge and practice of responsible financial management.
- 7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
- 7.8 Explore issues of global significance and document the impact on the Engineering and Architecture sector.

### **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. (Direct alignment with SLS 11-12.1d)

- 8.1 Access, analyze, and implement quality assurance standards of practice.
- 8.2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Engineering and Architecture industry sector.

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- 8.3 Demonstrate ethical and legal practices consistent with Engineering and Architecture sector workplace standards.
- 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.
- 8.5 Analyze organizational culture and practices within the workplace environment.
- 8.6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.
- 8.7 Conform to rules and regulations regarding sharing of confidential information, as determined by Engineering and Architecture sector laws and practices.

### **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. (Direct alignment with SLS 11-12.1b)

- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills, as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities.
- 9.5 Understand that the modern world is an international community and requires an expanded global view.
- 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.
- 9.7 Participate in interactive teamwork to solve real Engineering and Architecture sector issues and problems.

### **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. (Direct alignment with ws 11 - 12.6)

- 10.1 Interpret and explain terminology and practices specific to the Engineering and Architecture sector.
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Engineering and Architecture sector.
- 10.3 Construct projects and products specific to the Engineering and Architecture sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

### **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.

- 11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Engineering and Architecture sector program of study.
- 11.2 Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level.
- 11.3 Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures.
- 11.4 Employ entrepreneurial practices and behaviors appropriate to Engineering and Architecture sector opportunities.
- 11.5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.

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CR = Classroom Hours LAB/CC = Laboratory/Shop/Community Classroom Hours

I.	Design Process	CR	LAB/CC	STANDARDS
	<p>The goal is to introduce students to the broad field of engineering and design process that engineers use to develop innovative solutions to real problems. Students become familiar with the traditional big four disciplines of engineering and the extensive array of career opportunities and engineering problems addressed within each discipline.</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> <li>1. What is Engineering and why is it important to the world in which we live?</li> </ol> <p>B. Topics</p> <ol style="list-style-type: none"> <li>1. What is engineering?</li> <li>2. Engineering Fields</li> <li>3. The Design Process</li> <li>4. The Engineer's Notebook</li> </ol>	5	10	<p><b>Academic:</b> Common Core Anchor RSIT 11-12.2 RHSS 11.12.2, 12.7, 12.10 RLST 11-12.2 ,12.7, 12.10 CSR1,4  CCR RBPK 2  ELA Reading AS.R.4  NGSS HS_ET51 ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution  <b>CTE Anchor:</b> 3.0  <b>CTE Pathway:</b> C1.1. C1.2</p>
II.	Technical Sketching and Drawing	CR	LAB/CC	STANDARDS
	<p>The goal is for students to develop an understanding of the purpose and practice of visual representations and communication within engineering in the form of technical sketching and drawing.</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> <li>1. What does it mean to visually represent something with a sketch?</li> </ol> <p>B. Topics</p> <ol style="list-style-type: none"> <li>1. T types of Lines</li> <li>2. Isometric Sketching</li> <li>3. Oblique Sketching</li> <li>4. Perspective Sketching</li> <li>5. Glass-view Sketching</li> <li>6. Multi-View Sketching</li> </ol> <p>C. Learn it</p> <ol style="list-style-type: none"> <li>1. Sketching on Isometric Grid</li> <li>2. Scale and proportion PLTW</li> <li>3. Angles and Perspective</li> </ol>	5	10	<p><b>Academic:</b> RSIT 11-12.2 RHSS 11-12.2 12.7,12.10 RLST 11-12.2, 12.7, 12.10 F-IF 1,7,8 G-C0-12 G-SRT1 SEP 4,5,6,8 CSR 1,4 CRR VAU AS.SL.5 G.MG.1 NGSS HS ETS1 HS ET S1.B HS ETS1-4  <b>CTE Anchor:</b> 2.0 10.0  <b>CTE Pathway:</b> C1.2 C3.2 C3.3</p>

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	4. Orthographic Projections 5. 3-D sketching  D. Use it 1. Draw construction lines 2. Tonal Shading 3. Identify product and discuss genre form and function			
<b>III.</b>	<b>Introduction to 3-D Modeling</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>The goal of the unit is for students to become familiar with appropriate functions of computer aided-design (CAD) 3D modeling software and how it's used to design simple shapes, for example a cube, pyramid, rectangular prism and cylinders.</p> <p>A. Essential Question  1. How does modeling and building prototypes support engineers?</p> <p>B. Introduce it  1. 3D Models and Drawings- isometric views, projections  2. CAD Basics</p> <p>C. Learn it  1. 2d sketches, Extrude, Revolve, Cut  2. Name Project  3. CAD instructional videos</p> <p>D. Use it  1. 3D Models and Drawings- isometric views, projections, CAD Basics</p>	5	10	<b>Academic:</b> ws 11-12.6 SEP6 cc 3,6,7 NGSS ETS 2.A HS ETS1 HS ETS1-4  <b>CTE Anchor:</b> 2.0 10.0  <b>CTE Pathway:</b> C2.1
<b>IV.</b>	<b>Team work/Automata Box</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>In this unit students are provided the opportunity to design and print a prototype of an Automata box. This will teach them how to apply motion on a 3-D software.</p> <p>1. Essential Questions:  1. What is rotation and revolution?  2. How can we be team players?  3. How can we apply what we know to help our team members?  4. What is a timeline of a project?</p>	5	20	<b>Academic:</b> ws 11-12.6 SEP6 cc 3,6,7 NGSS ETS 2.A HS ETS1 HS ETS1-4  <b>CTE Anchor:</b> 2.0 10.0  <b>CTE Pathway:</b> C2.1



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	<p>5. How can we make sure we will be done before the deadline?</p> <p>B. Topics</p> <ol style="list-style-type: none"> <li>1. Properties of solids</li> <li>2. Surface Area</li> <li>3. Volume</li> <li>4. Rotations</li> </ol>			
<b>V.</b>	<b><i>Reverse Engineering (Car Project)</i></b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>This unit exposes students to the application of engineering principles and practices to reverse engineer a consumer product. Reverse engineering involves disassembling and analyzing a product or system in order to understand and document the visual, function and/or structural aspects of its design.</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> <li>1. What is the purpose of reverse engineering and how does it continue to impact society today?</li> </ol> <p>B. Topics</p> <ol style="list-style-type: none"> <li>1. Visual/Functional Analysis</li> <li>2. Disassembly of items</li> <li>3. Software modeling</li> <li>4. Documentation</li> </ol> <p>C. Introduce it</p> <ol style="list-style-type: none"> <li>1. Elements of Visual design</li> </ol> <p>E. Use it</p> <ol style="list-style-type: none"> <li>1. Pencil Project</li> <li>2. Windup toy reverse engineering</li> <li>3. Structural Analysis</li> <li>4. Reverse Engineering Presentation</li> </ol> <p>D. Learn it</p> <ol style="list-style-type: none"> <li>1. Functional Analysis</li> <li>2. Visual Analysis</li> </ol>	10	30	<p><b>Academic:</b></p> <p>RHSS 11-12.2, 12.7</p> <p>RLST 11-12.7</p> <p>G-GMD 5</p> <p>G-MD 3</p> <p>N-VM 2, 3, 4, 5</p> <p>NGSS</p> <p>SEP 4, 5, 6, 8</p> <p>cc 3</p> <p>HS ETS2.A</p> <p><b>CTE Anchor:</b></p> <p>2.0</p> <p>5.0</p> <p><b>CTE Pathway:</b></p> <p>C1.1</p> <p>C 8.0</p>

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VI.	Documentation	CR	LAB/CC	STANDARDS
	<p>In this unit students will enhance their basic knowledge of technical drawing representation learned earlier in the course to include the creation of alternate (section and auxiliary) views and appropriate dimensioning and annotation of technical drawings.</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> <li>1. What would happen if engineers failed to document their work?</li> </ol> <p>B. Topics</p> <ol style="list-style-type: none"> <li>1. Tolerances</li> <li>2. Documentation</li> </ol> <p>C. Introduce it</p> <ol style="list-style-type: none"> <li>1. Dimensioning Standards</li> <li>2. Tolerances</li> </ol> <p>D. Learn it</p> <ol style="list-style-type: none"> <li>1. The Hole Project</li> <li>2. Activities on Dimensioning Standards, Sectional Views and Tolerances</li> </ol> <p>E. Use it</p> <ol style="list-style-type: none"> <li>1. Pencil Animation</li> <li>2. Assembly models and drawings</li> </ol>	5	15	<p><b>Academic:</b></p> <p>LS 11-12.1, 12.2 RLST 11-12.2, 12.4, 12.7 WS11-12.2, 12.4 ,12.5, 12.6, 12.7, 12.8 WHSST 11-12.2, 12.6 G-MG 3 NGSS SEP 4, 5, 6, 7, 8 cc 3 HS ETS2.A 2.8</p> <p><b>CTE Anchor:</b></p> <p>2.0 5.0</p> <p><b>CTE Pathway:</b></p> <p>C9 C10 C11</p>
VII.	Final Project (Sportsplex)	CR	LAB/CC	STANDARDS
	<p>In this unit students will learn advanced 3D computer modeling skills. These advanced skills include creating animated assembly views of an assigned sports field. In this project each group has to work with the group that will have the entrance to their sports field and the group that has the exit to their sports field. They need to design all the details for their sports field and assembled work using CAD software. The final will be divided into two parts, the first part is the submission of the assembled work as a WHOLE class and the second part will be a presentation of the sportsplex for each group.</p>	10	34	<p><b>Academic:</b></p> <p>LS 11-12.1, 12.2 RLST 11-12.2, 12.4, 12.7 WS11-12.2, 12.4 ,12.5, 12.6, WHSST 11-12.2, 12.6 G-MG 3 NGSS SEP 4, 5, 6, 7, 8 cc 3 HS ETS2.A 2.8</p> <p><b>CTE Anchor:</b></p> <p>4.0 5.0</p> <p><b>CTE Pathway:</b></p> <p>C4.0</p>

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	<p>A. Essential Question</p> <ol style="list-style-type: none"> <li>How does software help ensure the best possible outcomes with regards to Engineering Design?</li> </ol> <p>B. Topics</p> <ol style="list-style-type: none"> <li>Advanced software techniques using CAD software</li> <li>Using research to advance ideas and skills</li> <li>Presentation skills</li> </ol> <p>C. Introduce it</p> <ol style="list-style-type: none"> <li>Parametric Modeling</li> <li>Advanced modelling tools</li> </ol>			<p>C5.0 C9.0 C10.0 C11.0</p>
<b>VIII.</b>	<b>Employment Portfolio</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>In the unit, students will prepare a professional portfolio.</p> <ol style="list-style-type: none"> <li>Portfolio showcases best professional level work.</li> <li>Portfolio is organized</li> <li>Research engineers/careers specific to content.</li> </ol>	2	4	<p><b>Academic:</b> Reading: AS.R. 1,4,7 AS.W.2,4,7 AS. SL. 1,2,4 AS.L. 1,2,6</p> <p><b>CTE Anchor:</b> 1.0 2.0 3.0 11.0</p> <p><b>CTE Pathway:</b> C11.0</p>