

Newport-Mesa Unified School District
Office of Secondary Curriculum and Instruction
High School Course of Study

Course Title	<i>Introduction to Design Engineering and Architecture</i>	Course Code	<i>[KT368-KT369]</i>
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Transcript Title:	Intro to Design EngArc			Grades Levels:	9	Board Adoption Date:		05/22/2018
Content Area:	Engineering/CTE			GPA Scale:	4.0		Date Course Submitted:	3/2018
Credential Required:	CTE		Graduation Subject Areas:		Fine Arts			
UC/CSU "A-G" Area Approvals:		F		School Site/person that wrote and submitted the course:			CDM-Jacqueline Vorona	
Recommend Skills:	none							
Next course(s):	Principles of Engineering							

Introduction to Design Engineering and Architecture

DATE: March 7, 2018

INDUSTRY SECTOR: Engineering and Architecture

PATHWAY Engineering Design 152

CBEDS TITLE: Introduction to Design 7700

CBEDS Code: 7700

HOURS:

Total	Classroom	Laboratory/CC/CVE
180	51 hours	129 hours

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

COURSE DESCRIPTION: Introduction to design is a high school level foundation course in the PTLW Engineering Program. ID students are introduced to the engineering profession and a common approach to the solution of engineering problems and engineering design process.

PREREQUISITES:

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

A – G APPROVAL: ☒ Yes ☐ No ☐ Desired

ARTICULATION:

High School Name:	College Name:	College Course Title:
NA		

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LEVEL: ☒ Introductory ☐ Concentrator ☐ Capstone

X

☐☐

CERTIFICATION:

High School Name:	Embedded/Leads to:	Description:
NA		

METHOD OF STUDENT EVALUATION:

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

METHOD OF INSTRUCTION:

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

RECOMMENDED TEXTS:

PLTW curriculum

MODEL CTE PATHWAY:

[Click here to enter text.](#)

Grade	Fall Semester	Spring Semester
9th	Introduction to Design 1A	Introduction to Design 1B
10 th	Principals of Engineering 1A	Principals of Engineering 1B
11 th	TBD	
12th	TBD	
Elective		

CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS

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

**Advanced Manufacturing and Engineering
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.

4.5 Research past, present, and projected technological advances as they impact a particular pathway.

4.6 Assess the value of various information and communication technologies to interact with constituent

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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.

8.3 Demonstrate ethical and legal practices consistent with Engineering and Architecture sector workplace standards.

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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 LAB/CC = Laboratory/Shop/Community Classroom

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 <i>What is Engineering and why is it important to the world in which we live?</i></p> <p>B. Topics</p> <ol style="list-style-type: none"> 1. What is engineering? 2. Engineering Fields 3. The Design Process 4. The Engineer's Notebook 	5	10	<p>Academic: 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</p> <p>CCR RBPK 2</p> <p>ELA Reading AS.R.4</p> <p>NGSS HS_ETS1</p> <p>ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution</p> <p>CTE Anchor: 3.0</p> <p>CTE Pathway: 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"> 1. What does it mean to visually represent something with a sketch? <p>B. Topics</p> <ol style="list-style-type: none"> 1. Types of Lines 2. Isometric Sketching 3. Oblique Sketching 4. Perspective Sketching 5. Glass-view Sketching 	5	10	<p>Academic:</p> <p>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-CO-12 G-SRT1 SEP 4,5,6,8 CSR 1,4 CRR VAU</p> <p>AS.SL.5</p> <p>G.MG.1</p> <p>NGSS HS ETS1</p>

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	<p>6. Multi-View Sketching</p> <p>C. Learn it</p> <ol style="list-style-type: none"> 1. Sketching on Isometric Grid 2. Scale and proportion PLTW 3. Angles and perspective 4. Orthographic Projections 5. 3-D sketching <p>D. Use it</p> <ol style="list-style-type: none"> 1. Draw construction lines 2. Tonal Shading 3. Identify product and discuss form and function 			<p>HS ET S1.B HS ETS1-4</p> <p>CTE Anchor: 2.0 10.0</p> <p>CTE Pathway: C1.2 C3.2 C3.3</p>
III.	Measurement and Statistics	CR	LAB/ CC	STANDARDS
	<p>The goal of the unit is for students to become familiar with appropriate practices and the applications of measurements using both US Customary and SI units. Students will learn appropriate methods of making and recording measurements, including the use of dial calipers.</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> 1. What is an industry standard and why is it important for something like dimensioning? <p>B. Topics</p> <ol style="list-style-type: none"> 1. The metric system 2. Dial Calipers 3. Dimensioning Standards 	3	7	<p>Academic: CCT PKI 1 Reading AS.SL.2</p> <p>NGSS HS ETS1 HS ETS 1-4</p> <p>CTE Anchor: 1.0 10.0</p> <p>CTE Pathway: C2.2 C4.1 C4.2</p>
IV.	Modelling Skills	CR	LAB/ CC	STANDARDS
	<p>This unit introduces students to a variety of modeling methods used to represent systems, components and processes in design</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> 1. How does modeling and building prototypes support Engineers? <p>B. Introduce it</p> <ol style="list-style-type: none"> 1. 3D Models and Drawings- isometric views, projections 2. Inventor OR Solid Works Basics <p>C. Learn it</p> <ol style="list-style-type: none"> 1. 2d sketches, Extrude, Revolve, Cut 2. Name Project 3. Solid Works/Inventor instructional videos <p>C. Use it</p> <p>3D Models and Drawings- isometric views, projections, Inventor OR Solid Works Basics</p>	10	15	<p>Academic: WS 11-12.6 SEP6 CC 3,6,7</p> <p>NGSS ETS 2.A HS ETS1 HS ETS1-4</p> <p>CTE Anchor: 2.0 10.0</p> <p>CTE Pathway: C2.1</p>

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V.	Geometry of Design	CR	LAB/ CC	STANDARDS
	<p>In this unit students are provided opportunities to investigate two and three dimensional geometric concepts and apply statics to engineering decision making and problems solving</p> <p>A. Essential Question</p> <ol style="list-style-type: none"> What are the "properties of solids" and why is it important to know how to calculate them <p>B. Topics</p> <ol style="list-style-type: none"> Properties of solids Surface Area Volume Mass Density <p>C. Introduce it</p> <ol style="list-style-type: none"> Calculations of Area, Volume, Density Units of measurement Unit conversion <p>D. 2-D Sketch Tools</p> <p>E. Use it</p> <ol style="list-style-type: none"> Soap dish project Basic color theory Bottle project Label project 	3	7	<p>Academic: G-CO 12, 13 SEP 5,6,8 CC 3</p> <p>NGSS ETS2.A HS ETS1 HS ETS 1-4</p> <p>AS.SL.4 G.MG.1 G.MG.2 G.MG.3</p> <p>CTE Anchor: 5.0 11.0</p> <p>CTE Pathway: C5.4</p>
VI.	Reverse Engineering	CR	LAB/ CC	STANDARDS
	<p>Unit 6 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"> What is the purpose of reverse engineering and how does it continue to impact society today? <p>B. Topics</p> <ol style="list-style-type: none"> Visual/Functional Analysis Disassembly of items Software modeling Documentation <p>C. Introduce it</p> <ol style="list-style-type: none"> Elements of Visual design Reverse Engineering Presentation <p>D. Learn it</p> <ol style="list-style-type: none"> Functional Analysis Visual Analysis 	5	15	<p>Academic: RHSS 11-12.2, 12.7 RLST 11-12.7 G-GMD 5 G-MD 3 N-VM 2, 3, 4, 5</p> <p>NGSS SEP 4, 5, 6, 8 CC 3 HS ETS2.A</p> <p>CTE Anchor: 2.0 5.0</p> <p>CTE Pathway: C1.1 C 8.0</p>

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	<p>E. Use it</p> <ol style="list-style-type: none"> 1. Pencil Project 2. Wind up toy reverse engineering 3. Structural Analysis 			
VII	Documentation	CR	LAB/C C	
	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) view and appropriate dimensioning and annotation of technical drawings.	2	3	
	<p>A. Essential Question</p> <ol style="list-style-type: none"> 1. What would happen if engineers failed to document their work? <p>B. Topics</p> <ol style="list-style-type: none"> 1. Tolerances 2. Documentation <p>C. Introduce it</p> <ol style="list-style-type: none"> 1. Dimensioning Standards 2. Tolerances <p>D. Learn it</p> <ol style="list-style-type: none"> 1. The Hole Project 2. Activities on Dimensioning Standards, Sectional Views and Tolerances <p>E. Use it</p> <ol style="list-style-type: none"> 1. Pencil Animation 2. Assembly models and drawings 			<p>Academic: 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</p> <p>NGSS SEP 4, 5, 6, 7, 8 CC 3 HS ETS2.A 2.B</p> <p>CTE Anchor: 2.0 5.0</p> <p>CTE Pathway: C9 C10 C11</p>
VIII	ADVANCED COMPUTER MODELING			
	<p>In this units students will learn advanced 3D computer modeling skills. These advanced skills include creating animated assembly views of multi-part products and using mathematical functions to represent relationships to enforce dimensional and motion constraints. Students will use the skills and knowledge previously bild in the coursed to develop and document the solution to a design challenge using and iterative design process.</p> <p>A. Essential Question</p> <p>How does software help ensure the best possible outcomes with regards to Engineering Design?</p> <p>B. Topics</p> <ol style="list-style-type: none"> 1. Advanced software techniques – SolidWorks/ Autodesk Inventor 2. Using research to advance ideas and skills 3. Presentation skilss 	10	30	<p>Academic: 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</p> <p>NGSS SEP 4, 5, 6, 7, 8 CC 3 HS ETS2.A 2.B</p> <p>CTE Anchor: 4.0 5.0</p> <p>CTE Pathway: C9.0</p>

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	C. Introduce it <ol style="list-style-type: none"> 1. Parametric Modeling 2. Advanced modelling tools D. Learn it <ol style="list-style-type: none"> 1. Train: Standard Parts 2. Activities using Solid Works E. Use it <ol style="list-style-type: none"> 1. Activities using SolidWorks 			
IX.	Design Challenges	CR	LAB/ CC	Click here to enter text.
	<p>In this units students will work in small collaborative teams, implement the design process and use skill and knowledge gained during the course to solve a culminating design challenge and document and communicate their proposed solution.</p> A. Essential Question How can we use the topics covered in this class to answer more challenging and global problems? B. Topics <ol style="list-style-type: none"> 1. Advanced Design Process 2. Advanced software techniques – SolidWorks/ Autodesk Inventor C. Introduce it/Learn it <ol style="list-style-type: none"> 1. Project Design Challenge Expectations/Requirements D. Use it <ol style="list-style-type: none"> 1. Project design challenge 	5	25	Academic: LS 11-12.1, 12.2 RLST 11-12.2, 12.4, 12.7 WS11-12.2, 12.4, 12.5, 12.6, 1 WHSST 11-12.2, 12.6 G-MG 3 NGSS SEP 4, 5, 6, 7, 8 CC 3 HS ETS2.A 2.B CTE Anchor: 2.0 5.0 7.0 8.0 9.0 11.0 CTE Pathway: C9.2, C9.3 C11.2
X.	EMPLOYMENT PORTFOLIO	CR	LAB/ CC	Click here to enter text.
	A. Students will prepare a professional portfolio. <ol style="list-style-type: none"> 1. Portfolio showcases best professional level work 2. Portfolio is organized 3. Job application 4. Resume 5. References 	3	7	Academic: LS 11-12.1,12.2 RLST 11-12.2,12.4 WS 12.2,4,5,6,7 NGSS SEP 6 ETS2.A CTE Anchor: 2.0 3.0 7.0 11.0 CTE Pathway: C10.0 C11.0