

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

Course Title	<i>Engineering Design Development Re-Write</i>	Course Code	<i>KT364-365</i>
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Transcript Title:	Engineering Design Development		Grades Levels:	12	Board Adoption Date:	
Content Area:	Engineering Design		GPA Scale:	4.0	Date Course Submitted:	3/16/18
Credential Required:	Yes	Graduation Subject Areas:				
UC/CSU "A-G" Area Approvals:		Yes		School Site/person that wrote and submitted the course:		Rich Mayfield
Recommend Skills:	Strong Math Skills					
Next course(s):	N/A					

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DATE: 3/13/18

INDUSTRY SECTOR: Engineering and Architecture

PATHWAY: Engineering Design (152)

CBEDS TITLE: Advanced Engineering Design (Capstone)

CBEDS Code: 7731

HOURS:

Total	Classroom	Laboratory/CC/CVE
180 hours	40 hours	140 hours

JOB TITLE	ONET CODES	JOB TITLE	ONET CODES
Manufacturing Engineer	17-2199.04	Manufacturing Engineering Technologist	17-3029.06

COURSE DESCRIPTION:

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an open-ended engineering research course in which students work in teams to design and develop an original solution to a well-defined and justified open-ended problem by applying an engineering design process.

Students will perform research to select, define, and justify a problem. After carefully defining the design requirements and creating multiple solution approaches, teams of students select an approach, create, and test their solution prototype. Student teams will present and defend their original solution to an outside panel. While progressing through the engineering design process, students will work closely with experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem solving abilities, and their understanding of the design process.

PREREQUISITES:

High School Name:	Site Prerequisite:
Estancia	Introduction to Engineering Design or Principles of Engineering
Estancia	Computer Integrated Manufacturing

A – G APPROVAL: ☒ Yes ☐ No ☐ Desired

ARTICULATION:

High School Name:	College Name:	College Course Title:
N/A	N/A	N/A

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LEVEL: ☐ Introductory ☐ Concentrator ☒ Capstone

CERTIFICATION:

High School Name:	Embedded/Leads to:	Description:
N/A	N/A	N/A

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:

Curriculum resources provided on my.pltw.org

MODEL CTE PATHWAY:

Grade	Fall Semester	Spring Semester
9th	IED-1A	IED-1B
10th	POE-1A	POE-1B
11th	CIM-1A	CIM-1B
12th	EDD-1A	EDD-1B

CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS

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

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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.

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- 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 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

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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.

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

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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.

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

1	PROJECT MANAGEMENT	CR	LAB/CC	STANDARDS
	Major focuses of the course are project management and professional skills required to successfully complete and document an engineering design process. Topics student will study and skills they will refine are: Lessons: (α) – The EDD Design Process and Project Management (β) – Documenting the Engineering Design Process (γ) – Teams, Timelines, and Contacting Experts (δ) – Project Evaluations and Classroom Management (ε) – Intellectual Property	12	12	Academic: AS.R.1,2,4,10 AS.W.1,2,4-10 AS.SL.1-6 AS.L.1-6 N.Q.1-3 AS.SSE.1 S.ID.1-9 S.IC.2,3,5,6 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 SEP 6-8 CC 3,6,7 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 3.0 4.0 5.0 6.0 7.0

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				8.0 9.0 10.0 CTE Pathway: C1.0 C2.0 C11.0
2	RESEARCH	CR	LAB/CC	STANDARDS
	This component requires students to identify a problem for which they will design a solution during the remainder of the course. In the first lesson, students will write a clear problem statement and validate the problem by documenting credible sources that indicate that the problem exists. Validation is carried out through research and input from experts and mentors. Once their work is defined, students are asked to perform additional research in order to justify the problem by confirming that the expense and effort involved with solving the problem is warranted based on need and cost. Students will explore and analyze prior solution attempts. Based on their research, student will create a testable design requirement which will be used to explore possible solutions. The students will present a project proposal to ensure the project is justified and that all prior solution attempts have been explored. Lessons: Element A – Identification and Justification of the Problem Element B – Documentation and Analysis of Prior Solution Attempts Element C – Presentation and Justification of Solution Requirements	4	16	Academic: AS.R.1,2,4,6-10 AS.W.1-10 AS.SL.1-6 AS.L.1-6 N.Q.1-3 A.SSE.1 A.REI.10 F.IF.1,4,5 F.LE.1,3,5 S.ID.1-4,6,9 S.IC.1,3,4,6 S.MD.5-7 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 SEP 6-8 CC 3,6,7 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 3.0 4.0 5.0 6.0

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				7.0 8.0 9.0 10.0 CTE Pathway: C1.0 C2.0 C11.0
3	DESIGN	CR	LAB/CC	STANDARDS
	Based on the design requirement identified through research, students develop multiple solution possibilities. Through an evaluation process that involves feedback from experts and stakeholders and the application of a decision matrix or data-driven process, students will select the best potential solution to pursue. Students will refine the final selected solution path and provide evidence that the solution selected is viable. Lessons: Element D – Design Concept Generation, Analysis, and Selection Element E – Application of STEM Principles and Practices Element F – Consideration of Design Viability	4	40	Academic: AS.R.1,2,4,6-10 AS.W.1-10 AS.SL.1-6 AS.L.1-6 N.Q.1-3 A.SSE.1,3 A.APR.1 A.CED.1,2,4 A.REI.3,4,10,11 F.IF.1,7,8 F.BF.1 F.LE.1,3,5 G.CO.1,4,5,12 G.GMD.4 G.MG.1-3 S.ID.7 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 CC 3,6,7 F-IF 1,7,8 G-CO 12 SEP 4-8 F-TF 1 N-Q 3 G-CO 12,13 CC 3-4 G-GMD 5

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				G-MG 3 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 4.0 5.0 7.0 9.0 10.0 11.0 CTE Pathway: C1.0 C2.0 C3.0 C4.0 C5.0 C6.0 C7.0 C8.0 C9.0 C10.0 C11.0
4	PROTOTYPE AND TEST	CR	LAB/CC	STANDARDS
	Student will create a testable prototype and an unbiased testing plan based on the defined design requirements to determine the effectiveness of the solution created. Lessons: Element G – Construction of a Testable Prototype Element H – Prototype Testing and Data Collection Plan Element I – Testing, Data Collection, and Analysis	4	40	Academic: AS.R.1,4,7,10 AS.W.1-10 AS.SL.1-6 AS.L.1-6 N.Q.1-3 A.SSE.1,3 A.CED.1,2,4 A.REI.3,6,10,12 F.IF.1,2,4-6,7a F.BF.1,2 F.LE.1-3 S.ID.1-9 S.IC.1,3-6 S.MD.5-7 RSIT 11-12.2 RHSS 11-12.2,7,10

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				RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 SEP 6-8 CC 3,6,7 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 4.0 5.0 7.0 9.0 10.0 11.0 CTE Pathway: C1.0 C2.0 C11.0
5	EVALUATION OF PROJECT AND PROCESS	CR	LAB/CC	STANDARDS
	At this point in the design process, it is critical to seek and document feedback from all stakeholders. The designer(s) should reflect on all design decisions and the analysis that was generated from the testing process. Finally, the designer(s) can begin to formulate next steps. Lessons: Element J – Documentation of External Evaluation Element K – Reflection on the Design Project Element L – Presentation of Designer's Recommendations	6	15	Academic: AS.R.1-10 AS.W.1-10 AS.SL.1-6 AS.L.1-6 N.Q.1-3 S.ID.1-9 S.IC.1-6 S.MD.5-7 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11

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				CSR 1,4 CC 3,6,7 F-IF 1,7,8 G-CO 12 SEP 4-8 F-TF 1 N-Q 3 G-CO 12,13 CC 3-4 G-GMD 5 G-MG 3 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 CTE Pathway: C1.0 C2.0 C3.0 C4.0 C5.0 C6.0 C7.0 C8.0 C9.0 C10.0 C11.0
6	REFLECTION AND PRESENTING THE DESIGN PROCESS	CR	LAB/CC	STANDARDS
	At the conclusion of the design process, students will be asked to present and defend the process and decision. Lessons: Element M – Presentation of the Project and Project	8	13	Academic: AS.R.1-10 AS.W.1-10 AS.SL.1-6 AS.L.1-6

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	Portfolio Element N – Writing Like an Engineer			A.SSE.1 A.REI.1,2 F.IF.5 S.ID.1-6 S.IC.3-6 S.MD.5,6 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,4,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 CC 3,6,7 F-IF 1,7,8 G-CO 12 SEP 4-8 F-TF 1 N-Q 3 G-CO 12,13 CC 3-4 G-GMD 5 G-MG 3 LS 11-12.1-2 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 CTE Pathway: C1.0 C2.0 C3.0 C4.0
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				C5.0 C6.0 C7.0 C8.0 C9.0 C10.0 C11.0
	EMPLOYMENT PORTFOLIO	CR	LAB/CC	STANDARDS
	Students will prepare a professional portfolio. - Portfolio showcases best professional level work - Portfolio is organized - Job application - Resume - References	2	4	Academic: AS.W.2.4,6,9,10 AS.SL.1,2,5 AS.L.1,2.6 LS 11-12.1-2 RLST 11-12.2,4,7 WS 11-12.2,4-8 WHSST 11-12.2,6 SEP 7-8 ETS 2.A,B CTE Anchor: 3.0 CTE Pathway: C11.0