

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

Course Title	<i>Principles of Engineering Re-Write</i>	Course Code	<i>KT355-356</i>
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Transcript Title:	<i>Principles of Engineering</i>	Grades Levels:	<i>10</i>	Board Adoption Date:	
Content Area:	<i>Engineering Design</i>	GPA Scale:	<i>4.0</i>	Date Course Submitted:	<i>3/16/18</i>
Credential Required:	<i>Yes--CTE</i>	Graduation Subject Areas:			
UC/CSU "A-G" Area Approvals:	<i>Yes</i>	School Site/person that wrote and submitted the course:		<i>Rich Mayfield</i>	
Recommend Skills:	<i>Strong Math Skills</i>				
Next course(s):	<i>Computer Integrated Manufacturing</i>				

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DATE: 3/13/18

INDUSTRY SECTOR: Engineering and Architecture

PATHWAY: Engineering Design (152)

CBEDS TITLE: Introduction to Engineering and Architecture

CBEDS Code: 7700

HOURS:	Total	Classroom	Laboratory/CC/CVE
	180 hours	71 hours	109 hours

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

COURSE DESCRIPTION:

Principles of Engineering (POE) is a foundation course of the high school engineering pathway. This survey course exposes students to some of the major concepts that they will encounter in a postsecondary engineering course of study. Through problems that engage and challenge, students explore a broad range of engineering topics, including mechanisms, the strength of materials and structures, automation, and kinematics. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology.

Students have the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APB) learning. By solving rigorous and relevant design problems using engineering and science concepts within a collaborative learning environment, APB learning challenges students to continually hone their interpersonal skills, creative abilities, and problem solving skills. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

PREREQUISITES:

High School Name:	Site Prerequisite:
Estancia	Introduction to Engineering Design

A – G APPROVAL: Yes No Desired

ARTICULATION:

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

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

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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>

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

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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 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.

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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.

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

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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

1	ENERGY AND POWER	CR	LAB/CC	STANDARDS
	<p>The goal of Unit 1 is to introduce students to mechanisms, energy sources, and alternative energy applications. Students will gain an understanding of mechanisms through the application of theory-based calculations accompanied by lab experimentation. They will also learn that as energy and power are transferred and transformed, losses to friction in the system will occur. Students will understand that such losses affect the overall efficiency of the system. They will have an opportunity to investigate thermal energy and alternative energy applications. Students will explore and gain experiences relating to solar hydrogen systems and thermal energy transfer through materials. The unit concludes with students working in teams to solve a design problem that focuses on energy and power. They will use the knowledge and understanding built through the previous learning events to create a solution to the problem. It is important for students to understand that an acceptable solution is one that fits the criteria and constraints of the design brief.</p> <ul style="list-style-type: none"> ● Lesson 1.1 Mechanisms ● Lesson 1.2 Energy Sources ● Lesson 1.3 Energy Applications ● Lesson 1.4 Design Problem – Energy and Power 	17	40	<p>Academic: N.Q.1-3 A.SSE.1 A.CED.1,4 A.REI.3 F.LE.1.B G.MG.1,3 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,7,10 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-TF 1 N-Q 3 SEP 4-8 LS 11-12.1-2 RLST 11-12.2,4,7 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B</p> <p>CTE Anchor: 1.0 4.0 5.0 10.0 11.0</p> <p>CTE Pathway: C1.0 C2.0 C4.0 C11.0</p>
2	MATERIALS AND STRUCTURES	CR	LAB/CC	STANDARDS
	<p>The goal of Unit 2 is for students to have a more concrete understanding of engineering through materials properties and statics. Students begin by learning about beam deflection and then forces on truss structures. They learn to identify forces acting on those structures and then gain the ability to calculate internal and external</p>	15	20	<p>Academic: AS.R.1,2,7,9,10 AS.W.2,4,7,8-10 AS.SL.2,4,5 AS.L.1,2,6 N.Q.1-3</p>

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	<p>forces acting on those structures. The students learn about material properties, which lead students to the ability to properly select a material for a given task. Creating new products to meet a given need or want is not the only concern in this area of study. How to reuse/recycle materials for continued and unique uses is also learned. The primary way of studying materials properties in this unit is through destructive and non-destructive material testing on various materials. Tensile testing is the major destructive test. Students are engaged in how machines perform these tests and use either a classroom machine or a simulation to further their understanding of these processes. This unit concludes with a design problem whereby students, working in teams, follow the design process to solve a design problem.</p> <ul style="list-style-type: none"> ● Lesson 2.1 Statics ● Lesson 2.2 Material Properties ● Lesson 2.3 Material Testing ● Lesson 2.4 Design Problem – Materials and Structures 			<p>G.GMD.3,4 G.MG.1,2 N.Q.1-3 A.SSE.1 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,7,10 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-TF 1 N-Q 3 SEP 4-8 LS 11-12.1-2 RLST 11-12.2,4,7 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B</p> <p>CTE Anchor: 1.0 4.0 5.0 10.0 11.0</p> <p>CTE Pathway: C1.0 C2.0 C4.0 C11.0</p>
3	CONTROL SYSTEMS	CR	LAB/CC	STANDARDS
	<p>The goal of Unit 3 is for students to recognize the abundance of and infinite variety of computer use in our daily lives. Students learn to control mechanical systems by recognizing computer outputs and gaining an understanding of how to write code to control them. They additionally experiment with various input devices and learn how they can adapt computer code to control computer outputs. Furthermore students gain an understanding of fluid power, both hydraulic and</p>	17	35	<p>Academic: N.Q.3 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,7,10 AD 12.3 PE 12.1,2 US 11.5,6,8,11</p>

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	<p>pneumatic. They begin to recognize the power and control advantages of fluid power.</p> <p>The unit concludes with students working in teams to solve a design problem that focuses on using control systems. They will integrate their prior knowledge, skills, and understandings from Units 1 and 2.</p> <ul style="list-style-type: none"> ● Lesson 3.1 Machine Control ● Lesson 3.2 Fluid Power ● Lesson 3.3 Design Problem – Control Systems 			<p>WH 10.3,9,11 CSR 1,4 SEP 6 CC 3,6,7 ETS 2.A RLST 11-12.2,10 F-TF 1 N-Q 3 SEP 4-6 CC 3 ETS 2.A</p> <p>CTE Anchor: 1.0 2.0 4.0 5.0 10.0 11.0</p> <p>CTE Pathway: C1.0 C2.0 C4.0</p>
4	STATISTICS AND KINEMATICS	CR	LAB/CC	STANDARDS
	<p>In Unit 4 students are engaged in learning to use statistics to evaluate an experiment. Later they begin a study of dynamics, specifically kinematics, and apply statistical skills to study freefall motion. Students use theoretical and experimental data as a basis for learning statistical analysis. By collecting, organizing, and interpreting the data, students build the skills needed to understand data results. They further use these new skills and knowledge to design a vehicle that will propel itself. Later, students will address the problem of designing a machine to accurately launch an object a specified distance. Examining projectile motion is at the core of this design problem.</p> <ul style="list-style-type: none"> ● Lesson 4.1 Statistics ● Lesson 4.2 Kinematics 	20	10	<p>Academic: S.ID.1-4 S.IC.1,2,4 S.CP.1-9 S.MD.7 AS.W.5-10 AS.SL.2 AS.L.1,2,6 N.RN.2 N.Q.1-3 N.VM.1-3 A.SSE.1 A.CED.3,4 A.REI.3,4 F.TF.7 G.SRT.6,8 G.MG.3 RSIT 11-12.2 RHSS 11-12.2,7,10 RLST 11-12.2,7,10 AD 12.3</p>

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				PE 12.1,2 US 11.5,6,8,11 WH 10.3,9,11 CSR 1,4 CC 3,6,7 F-TF 1 N-Q 3 SEP 4-8 LS 11-12.1-2 RLST 11-12.2,4,7 WS 11-12.2,4-8 WHSST 11-12.2,6 ETS 2.A,B CTE Anchor: 1.0 4.0 5.0 10.0 11.0 CTE Pathway: C1.0 C2.0 C4.0 C11.0
5	EMPLOYMENT PORTFOLIO	CR	LAB/CC	STANDARDS
	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 	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