Course Title	Electro-Mechanical Engineering (EME)	Course Code	KT377-KT378

Transcript Title:	ElecMechEngi 1A	**Grades Levels:**	10	**Board Adoption Date:**		5/18/2021
Content Area:	Inter-Disciplinary	**GPA Scale:**	4.0	**Date Course Submitted:**		4/23/21
Credential Required:	CTE	**Graduation Subject Areas:**	Elective	**CALPADS Code:**		7730
UC/CSU "A-G" Area Approvals:				**School Site/person that wrote and submitted the course:**		CDM/Christine Darnall
Recommend Skills:	Strong math skills; prerequisite is Design Engineering (DE)					
Next course(s):	Robotics and Artificial Intelligence					
Textbook to be used:	Software, industry publications and scholarly articles					

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

Electro-Mechanical Engineering

DATE: March 5, 2021

INDUSTRY SECTOR: Engineering and Architecture

PATHWAY: Engineering Design 152

CALPADS TITLE: Introduction to Engineering and Architecture

CALPADS CODE: 7730

Hours:

Total	Classroom	Laboratory/CC/CVE
180	71	109

JOB TITLE	ONET CODES	JOB TITLE	ONET CODES
Electronics Engineering Technologist	17-3029.04	Robotics Technicians	17-3024.01

COURSE DESCRIPTION:

Electro-Mechanical Engineering (EME) is the 2nd engineering pathway course at CdM. Through problems that engage and challenge, students explore a broad range of engineering topics, including simple and compound machines, 3D modeling using SolidWorks, robotics using Vex products, programming motors and sensors with RobotC, Python 3.7 programming units, circuitry, Ohms Law and electrical engineering concepts, solar energy, hydraulics and pneumatics and computer engineering including Raspberry Pi technologies.

Students will develop skills and understanding of course concepts through project-based learning. Students will solve rigorous and relevant design problems using engineering and science concepts within a collaborative learning environment. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community.

PREREQUISITES:

High School Name:	Site Prerequisite:
Corona del Mar HS	Design Engineering (DE)

A – G APPROVAL: ☒ Yes   ☐ No   ☐ Desired

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:
N/A		

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:
TeachEngineering.com
AI-4-All.org
Solidworks
GrabCAD
CodeHS (Python)
Vex Cortex Curriculum
RobotC
RaspberryPi.org
Khan Academy

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

CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS
California Department of Education CTE Standards website: http://www.cde.ca.gov/ci/ct/sf/ctemcstandards.asp

<table>
<tr><td align="center">INDUSTRY SECTOR
KNOWLEDGE AND PERFORMANCE ANCHOR STANDARDS</td></tr>
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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 Employ Web-based communications responsibly and effectively to explore complex systems and issues.
4.4 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
4.5 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
4.6 Research past, present, and projected technological advances as they impact a particular pathway.
4.7 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.

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.
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.

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

I.	Mechanisms	CR	LAB/CC	STANDARDS
	The goal of Unit 1 is to introduce students to work and the mechanical advantages of six simple machines that make work easier - the inclined plane, wedge and screw, lever, pulley, and wheel-and-axle - including each machine's mechanical advantages (ideal and actual), effort, resistance, force, torque, work, power and efficiency. Students will work through	17	40	**Academic:** LS11-12.1,2 RSIT11-12.2,7 RHSS11-12.2,7,10 RLST11-12.2,4.7,10 A-REI1-7 A-CED1-4 G-MG5 G-MG3 N-Q1-3

		CR	LAB/CC	STANDARDS
	the engineering design process to research, design, build and test a compound machine. The unit will culminate in the evaluation and application of how these machines can be used in our everyday lives and help provide solutions to societal needs. It is important for students to understand that an acceptable solution is one that fits the criteria and constraints of the design brief. • Lesson 1.1 Simple Machines • Lesson 1.2 Compound Machines • Lesson 1.3 Engineering Design Process • Lesson 1.4 Redesign and Application			F-TF3 SEP.1-5 CC 1-7 PS2A-C ETS1A-C ETS2.A ETS2.B **CTE Anchor:** 1.0 4.0 5.0 10.0 11.0 **CTE Pathway:** C1.0 C2.0 C4.0 C11.0
II.	AI and Machine Learning	**CR**	**LAB/CC**	**STANDARDS**
	The goal of Unit 2 is for students to understand the connections and relationships between robotics automation and artificial intelligence and machine learning. Students will discover the definition of Artificial Intelligence (AI) and learn about the abilities and limitations of AI. They will explore the societal impacts of AI as well as examples of AI in different fields. Students will discover the definition of data, how it is utilized in Machine Learning (ML), and where it comes from. They will explore issues of data privacy and bias in algorithmic systems. Students will discover AI related career paths and connections to other fields. They will explore the career pathways of role models in the field of AI. Students will create a presentation to educate their community about AI. Students will follow a process that includes information gathering out in the community and considering their audience as well as planning and presenting a response to a foundational question about AI. In a final culminating project, students will	15	20	**Academic:** LS 11-12.1-6 RSIT 11-12.1-7 WS 11-12.1-9 A-CED1-4 A-REI1-2 F-IF1-10 N-RN1-3 N-Q1-3 N-VM 6-12 **CTE Anchor:** 1.0 4.0 5.0 10.0 11.0 **CTE Pathway:** C1.0 C2.0 C4.0 C11.0

		CR	LAB/CC	STANDARDS
	take everything they've learned about AI and imagine how it can affect things in their world that they care about. In the process, they will learn and use a design thinking process. • Lesson 2.1 What is AI? • Lesson 2.2 What is Data? • Lesson 2.3 Career Paths in AI • Lesson 2.4 AI in Your Community • Lesson 2.5 AI Project			
III.	**Robotics & Control Systems**	**CR**	**LAB/CC**	**STANDARDS**
	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 pneumatic. They begin to recognize the power and control advantages of fluid power. The unit concludes with students working in teams to solve a design problem that focuses on using control systems. • Lesson 3.1 Machine Control • Lesson 3.2 Control Systems • Lesson 3.3 Fluid Power	17	35	**Academic:** LS11-12.1,2 RSIT11-12.2,7 RHSS11-12.2,7,10 RLST11-12.2,4.7,10 A-REI1-7 A-CED1-4 G-MG5 G-MG3 N-Q1-3 F-TF3 SEP.1-5 CC 1-7 PS2A-C ETS1A-C ETS2.A ETS2.B **CTE Anchor:** 1.0 2.0 4.0 5.0 10.0 11.0 **CTE Pathway:** C1.0 C2.0 C4.0
IV.	Computer Engineering & Circuitry	**CR**	**LAB/CC**	**STANDARDS**
	The goal of Unit 4 is for students to build computers and circuits through the use of electronic parts including raspberry pi boards, arduinos, breadboards, jumper cables, LEDs, resistors, batteries, sensors, and more. Students will gain an	20	10	**Academic:** LS11-12.1,2 RSIT11-12.2,7 RHSS11-12.2,7,10 RLST11-12.2,4.7,10 A-REI1-7 A-CED1-4

		CR	LAB/CC	STANDARDS
	understanding of how to create circuit paths that connect and signal sensors allowing their designs to transmit and receive data, perform functions and create solutions. The culminating project will include a design build that incorporates computer engineering using Raspberry Pi technologies and circuitry components to perform and function and provide a solution that connects to everyday life. Students will document their work in their engineering notebook and create a final presentation aligned to a rubric, including a demonstration of their functional build. ● Lesson 4.1 Ohm's Law, Series & Parallel circuits ● Lesson 4.2 Circuit Design ● Lesson 4.3 Computer Engineering ● Lesson 4.4 Electronics Project			G-MG5 G-MG3 N-Q1-3 F-TF3 SEP.1-5 CC 1-7 PS2A-C ETS1A-C ETS2.A ETS2.B **CTE Anchor:** 1.0 4.0 5.0 10.0 11.0 **CTE Pathway:** C1.0 C2.0 C3.0 C4.0 C11.0
V.	**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