

**Newport-Mesa Unified School District  
Middle School Course of Study**

<b>Course Title</b>	<i>Automation and Robotics (MS)</i>	<b>Course Code</b>	
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Transcript Title:	Autom&Robotics		Grades Levels:	7-8	Board Adoption Date:	
Content Area:	Inter-Disciplinary		GPA Scale:	N/A	Date Course Submitted:	March 2021
Credential Required:	CTE	Graduation Subject Areas:		N/A	CALPADS Code:	7000
UC/CSU “A-G” Area Approvals:		N/A		School Site/person that wrote and submitted the course:		CDM/Ogulnik
Recommend Skills:	Reading, Math, Speaking and Writing					
Next course(s):	This is a year long course					
Textbook to be used:	PLTW LMS Curriculum & RobotC software					

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Automation and Robotics (Year-Long)

**DATE:** March 26, 2021

**INDUSTRY SECTOR:** Multiple Industry Sectors (MIS)

**PATHWAY:** Multiple Pathways (Pathway 999)

**CALPADS TITLE:** Exploratory Career Technical Education

**CALPADS CODE:** 7000

<b>HOURS:</b>	<b>Total</b>	<b>Classroom</b>	<b>Laboratory/CC/CVE</b>
	180	96	84

<b>JOB TITLE</b>	<b>ONET CODES</b>	<b>JOB TITLE</b>	<b>ONET CODES</b>
N/A			

**COURSE DESCRIPTION: (catalog version)**

Design, Build, and Program a Robot! Students use tools such as the engineering design process, an engineering notebook, and VEX Robotics® programming software to invent and innovate. Learn how creative thinking and problem solving can change your world! Automation and Robotics (AR) allows students to trace the history, development, and influence of automation and robotics as they learn about mechanical systems, energy transfer, machine automation, and computer control systems. Students use the VEX Robotics® platform to design, build, and program real-world objects such as traffic lights, toll booths, and robotic arms. This is a year-long version of the semester course previously approved. Topics are gone into more depth with more opportunity to apply learning.

**GOALS** (expected performance outcomes for students):

1. Apply appropriate technical skills and academic knowledge.
2. Communicate clearly, effectively, and with reason.
3. Develop an education and career plan aligned with personal goals.
4. Apply technology to enhance productivity.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
6. Practice personal health and understand financial literacy.
7. Act as a responsible citizen in the workplace and the community.
8. Model integrity, ethical leadership, and effective management.
9. Work productively in teams while integrating cultural and global competence.
10. Demonstrate creativity and innovation.
11. Employ valid and reliable research strategies.

**PREREQUISITES: N/A**

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<b>Middle School Name:</b>	<b>Site Prerequisite:</b>
TeWinkle	N/A

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

**CERTIFICATION:** N/A

<b>Middle School Name:</b>	<b>Embedded/Leads to:</b>	<b>Description:</b>
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 OR SOFTWARE:**

PLTW LMS Curriculum and (ROBOTC software and updates)

**MODEL CTE PATHWAY:**

This course is part of a series of middle school courses that focus on STEM and may lead to other engineering and STEM related courses at the high school level.

<b>Grade:</b>	<b>Fall Semester:</b>	<b>Spring Semester:</b>
7-8		

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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>

**Engineering and Architecture 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. 4.5 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

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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 Skills USA 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 s 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 student clubs and competitions. 11.1 Utilize work-based workplace learning experiences to demonstrate and expand upon knowledge and skills gained

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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.	The Design Process	CR	LAB/CC	STANDARDS
	<p>Activity 1.1 A Sandwich Algorithm</p> <ul style="list-style-type: none"> <li>• Design Process steps</li> <li>• Write Steps to Solve Problem</li> </ul> <p>Activity 1.1B Vex Build</p> <ul style="list-style-type: none"> <li>• Build VEX model and communicate steps to partner</li> </ul> <p>Activity 1.2 What We Use Robots for</p> <ul style="list-style-type: none"> <li>• Explore field of Robotics-invention vs innovation</li> <li>• Paper airplane Design Process hook lesson</li> </ul>	15	10	<p><b>Academic:</b> Science: MS.ETS1.2 Reading: AS.R.1,4,7 AS.W.4,7 AS, SL.1,2,4 AS.L. 1,2,6</p> <p><b>CTE Anchor:</b></p> <p><b>CTE Pathway:</b> C1.0 C2.0 C3.0 C4.0 C10.0 C11.0</p>
II.	Mechanical Systems	CR	LAB/CC	STANDARDS
	<p>Activity 2.1 Observing Mechanisms Students will learn what A mechanism is, how it can be used to a change the direction, speed, force, or type of movement. This need to change speed and torque is a problem common to machine tools, robots, automobiles, and airplanes. Students will study several techniques developed over the centuries to accomplish this task.</p> <p>Activity 2.2 Mechanical Gears Students and their classmates will build gear assemblies and observe how they are used. This information will come in handy when the class designs and builds an automated factory assembly line.</p>	7	18	<p><b>Academic:</b> AS.R.1,4,10 AS.W.4 AS.SL. 1,2,4 AS.L. 1,2,6 Technology: 1.6-8.F.GH 2.6-8.MN 3.6-8.E 8.6-8.E,G 9.6-8.F,G,H10.6-8.F 11.6-8.H-J 16.6-8.E-G Science: MS.PS3.1,2,4,5 MS.ETS1.1-4</p> <p><b>CTE Anchor:</b></p> <p><b>CTE Pathway:</b></p>
III.	Applying Mechanical Gears	CR	LAB/CC	STANDARDS
	<p>Project 2.3 Windmill Construction</p> <ul style="list-style-type: none"> <li>• Using their knowledge of the mechanisms recently built in class, students will design and build, and modify their solution to given criteria and constraints.</li> </ul> <p>Project 2.4 Pull Toy Construction</p> <ul style="list-style-type: none"> <li>• With their knowledge of mechanisms, students and their partner will use the design process</li> </ul>	13	15	<p><b>Academic:</b> Reading: AS.R.1,4,7 AS.W.4 AS.SL.1,2 AS.L.1,2,6</p> <p><b>CTE Anchor:</b> 2.0 3.0 4.0 5.0 6.4,6.6 7.0-10.0</p> <p><b>CTE Pathway:</b> C1.0 C2.0 C3.0 C4.0 C10.0 C11.0</p>

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	<p>to design and build a mechanism or series of mechanisms that will meet the specific criteria.</p> <p>Project 2.5 Survival Challenge Imagine that the year is 2201. The Earth as we know it no longer exists. Through a catastrophic event the human race has nearly ceased to exist. A multi discipline group has survived and needs to rebuild our civilization using only recycled materials that can be scavenged from the existing environment. In this challenge, each student is an engineer on a team that will create mechanical systems to help rebuild our civilization.</p> <p>Activity 3.1 "Beef" Up Your Technological Resources Understanding</p> <ul style="list-style-type: none"> <li>• Students will understand how technological resources produces the hamburger by watching a video Technical Systems</li> </ul>			
<b>IV.</b>	<b>Coding and ROBOTC</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>Activity 3.2 Robot Behaviors and Writing Pseudocode</p> <ul style="list-style-type: none"> <li>• Students will learn the three basic behaviors of a robot. They will learn that in order to make robots move, they will learn the hybrid language of Pseudocode</li> </ul> <p>Activity 3.3 Using ROBOTC Students will learn ROBOTC is a C-based programming language for robots.</p> <p>Activity 3.4A Claw Bot Competition Students will build and then sketch a VEX clawbot following the instructions step by step in groups of 3. There will be a mechanical, computer and electrical engineer per group. Student will compete with squash balls on a completion floor in the classroom.</p>	15	13	<p><b>Academic:</b> Technology: 1.6-8.F,G,H 2.6-8.M-S,V 3.6-8.D,E 8.6-8.E-G 9.6-8.F-H 10.6-8.F-H 11.6-8.H-L 12.6-8.H-K 17.6-8.H,K Science: MS.PS3.2,4,5 MS.ETS1.1-4</p> <p><b>CTE Anchor:</b></p> <p><b>CTE Pathway:</b></p>
<b>V.</b>	<b>Automation Through Programming</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>Activity 3.4B Automation Through Programming Students will apply what they've learned about hardware and</p>	11	13	<p><b>Academic:</b> Math: 6.RP.A.1,2,3,3d</p>

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	<p>software to solve a problem. In this project they will work in a team to create a solution to a mission.</p> <p>Task #1 - Spinning Sign</p> <ul style="list-style-type: none"> <li>• Students must design a mechanism that will rotate a sign at a slow speed.</li> </ul> <p>Task #2 - Robot Drag Race</p> <ul style="list-style-type: none"> <li>• Students are to design a robot that will optimize drivetrain acceleration in a 20-ft distance using no more than two motors.</li> </ul> <p>Task #3 - Terry Traffic Tamer</p> <p>Students will design and build a model of a traffic light with green, yellow, and red lights. They will then work with the mechanical engineer and computer engineer to wire the three lights and pushbutton.</p> <p>Task #4 - Toll Booth</p> <ul style="list-style-type: none"> <li>• Students will construct a motorized gate with a potentiometer that will rotate 90°.</li> </ul> <p>Task #5 - Grandma's Chair</p> <p>Students will design an elevator that Grandma can start, that will automatically travel from the first or second floor by converting rotary motion into linear motion.</p> <p>Task #6 - Tekrocks Bridge</p> <ul style="list-style-type: none"> <li>• Students will design and build a bridge that should be rotated by a motor.</li> </ul> <p>Task #7 - Road Trip</p> <ul style="list-style-type: none"> <li>• Students will prove how responsible they are by simulating a trip to the movies using the VEX parts. Their car will need a motor, headlights, and back-up lights.</li> </ul> <p>Task #8 - Stay of Course</p> <p>A team of students will design, build, and program an autonomous vehicle that follows a 12 in. black line so as to stay off the hostile battlefield.</p> <p>Task #9 - Pick and Place</p> <p>Students will design a robot that when a pushbutton is pressed will pick up and place parts using the claw end effector.</p> <p>Task #10 - Freight Elevator Challenge</p> <p>Students act as an employee at a VEX factory. Their job requires them to deliver parts to various</p>			<p><b>CTE Anchor:</b> 2.0</p> <p><b>CTE Pathway:</b> C1.0 C2.0 C3.0 C4.0 C10.0 C11.0</p>
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	floors of the factory. Since a lifetime of climbing up and down stairs doesn't sound attractive to many, they must seek an alternative way. Students will design and build a scaled model of an elevator.			
<b>VI.</b>	<b>Engineers in the Real World</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>Project 3.5 Simulated Factory Assembly Line Students will apply the skills learned from previous activities to design, program and assemble a simulated factory assembly line to produce a stabilizer.</p> <p>Activity 3.5 B Students will work in groups of two to research an engineer career of their choice to present to the class including criteria, school degree needed, salary, job opportunities etc</p>	15	10	<p><b>Academic:</b> Math: 6.RP.A.1,2,3,3d</p> <p><b>CTE Anchor:</b> 2.0</p> <p><b>CTE Pathway:</b> C1.0 C2.0 C3.0 C4.0 C10.0 C11.0</p>
<b>VII.</b>	<b>Employment Portfolio</b>	<b>CR</b>	<b>LAB/CC</b>	<b>STANDARDS</b>
	<p>Students will prepare an update to their professional portfolio (lab book) A. Portfolio showcases best professional level work Portfolio is organized Research engineers/careers specific to content</p> <p>GOOGLE SLIDES OF CLASS COMPLETION &amp; CLASS PROJECTS for incoming Gateway students. Students will prepare a google slide presentation with their accomplishments from the year and will be sent to surrounding elementary schools to recruit and spread information regarding PLTW pathway</p>	20	5	<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>