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

Course Title	*Automation and Robotics Re-Write*	**Course Code**	*KT007*

Transcript Title:	*Autom&Robotics*	Grades Levels:	*7 - 8*	Board Adoption Date:	
Content Area:	***Engineering***	**GPA Scale:**	***4.0***	**Date Course Submitted:**	***3/27/2018***
Credential Required:	*CTE*	Graduation Subject Areas:	*Elective*		
UC/CSU "A-G" Area Approvals:	*n/a*	School Site/person that wrote and submitted the course:	*TeWinkle/Candice Woods*		
Recommend Skills:	*Reading, Math, Speaking, and Writing*				
Next course(s):	*Design and Modeling, Flight and Space, Medical Detectives*				

Automation and Robotics

DATE: March 6, 2018

INDUSTRY SECTOR: Engineering and Architecture

PATHWAY: Engineering Design

CBEDS TITLE: Introduction to Engineering and Architecture (999)

CBEDS Code: 7700

HOURS:

Total	Classroom	Laboratory/CC/CVE
90 Hours	25 hours	65 hours

JOB TITLE	ONET CODES	JOB TITLE	ONET CODES
N/A	N/A		

COURSE DESCRIPTION: ***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.**

PREREQUISITES: *N/A*

High School Name:	Site Prerequisite:
N/A	

A – G APPROVAL: ☐ Yes ☒ No ☐ Desired

ARTICULATION: N/A

High School Name:	College Name:	College Course Title:

LEVEL: [x] **Introductory** [ ] **Concentrator** [ ] **Capstone**

CERTIFICATION: *N/A*

High School Name:	Embedded/Leads to:	Description:

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 Course Curriculum

MODEL CTE PATHWAY:
Exploratory PLTW Course

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 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 develop¬ment 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.

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

I.	What Is Automation and Robotics?	CR	LAB/ CC	STANDARDS
	Activity 1.1A Sandwich Algorithm • An algorithm is a procedure or formula for solving a problem. A computer programcan be viewed as an elaborate algorithm. In mathematics and computer science, an algorithm usually involves a small procedure that solves a recurrent problem. Students will write the steps to solve the recurrent problem of how to make the perfect sandwich. **Activity 1.1B Vex Build** • An algorithm is a procedure or formula for solving a problem. A computer programcan be viewed as an elaborate algorithm. In mathematics and computer science, an algorithm usually involves a small procedure that solves a recurrent problem. Students will build a VEX® model and then communicate to a partner exactly how to build the same model, given the same pieces. **Activity 1.2 What Do We Use Robots For?** • Robots are powerful machines that give us access to places that are otherwise inaccessible to humans and perform tasks that are dangerous or tedious. Students will explore the field of robotics through their own research.	8 Hrs	10 Hrs	**Academic:** **Reading:** AS.R.1,4,7 AS.W.4,7 AS,SL.1,2,4 AS.L.1,2,6 **Technology:** 1.6-8.F,H 3.6-8.D 4.6-8.D-G 6.6-8.E 8.6-8.E,G 12.6-8.H,J **Science:** **MS.ETS1.2** **Math:** N/A **CTE Anchor:** 2.0 3.0 4.0 5.0 6.4,6.6 7.0-11.0 **CTE Pathway:** C1.0 C2.0 C3.0 C4.0 C10.0 C11.0
II.	**Mechanical Systems**	**CR**	**LAB/ CC**	**STANDARDS**
	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. **Activity 2.2 Mechancial 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.	7 Hrs	30 hrs	**Academic:** **Reading:** AS.R.1,4,10 AS.W.4 AS.SL.1,2,4 AS.L.1,2,6 **Technology:** 1.6-8.F,G,H 2.6-8.M,N 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:**

	Project 2.3 Windmill Construction • Using their knowledge of the mechanisms recently built in class, students will design and build, and modify their solution to given criteria and constraints. **Project 2.4 Pull Toy Construction** • With their knowledge of mechanisms, students and their partner will use the design process to design and build a mechanism or series of mechanisms that will meet the specific criteria. **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.			MS.PS3.1,2.4,5 MS.ETS1.1-4 **Math:** 7.RP.A.1,2 7.EE.B3 **CTE Anchor:** 2.0 3.0 4.0 5.0 6.4,6.6 7.0-10.0 **CTE Pathway:** C1.0 C2.0 C3.0 C4.0 C10.0 C11.0
III.	**Automated Systems**	**CR**	**LAB/ CC**	**STANDARDS**
	Activity 3.1 "Beef" Up Your Technological Resources Understanding • Students will undersand how technological resources produces the hamburger by watching a video *Technical Systems* **Activity 3.2 Robot Behaviors and Writing Pseudocode** • 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 **Activity 3.3 Using ROBOTC** • Studens will learn ROBOTC is a C-based programming language for robots. **Activity 3.4 Automation Through Programming** • Students will apply what they've learned about hardware and software to solve a problem. In this project they will work in a team to create a solution to a mission. **Task #1 – Spinning Sign** • Students must design a mechanism that will rotate a sign at a slow speed.	5 Hrs	15 Hrs	**Academic:** **Reading:** AS.R.1,4,7 AS.W.4 AS.SL.1,2 AS.L.1,2,6 **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 **Math:** 6.RP.A.1,2,3,3d **CTE Anchor:** 2.0 3.0 4.0 5.0 6.4,6.6

	Task #2 – Robot Drag Race • Students are to design a robot that will optimize drivetrain acceleration in a 20-ft distance using no more than two motors. **Task #3 – Terry Traffic Tamer** • 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. **Task #4 – Toll Booth** • Students will construct a motorized gate with a potentiometer that will rotate 90°. **Task #5 – Grandma's Chair** • 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. **Task #6 – Tekrocks Bridge** • Students will design and build a bridge that should be rotated by a motor. **Task #7 – Road Trip** • 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. **Task #8 – Stay of Course** • A team of students will design, build, and program an autonomous vehicle that follows a ½ in. black line so as to stay off the hostile battlefield. **Task #9 – Pick and Place** • Students will design a robot that when a pushbutton is pressed will pick up and place parts using the claw end effector. **Task #10 – Freight Elevator Challenge** • Students act as an employee at a VEX factory. Their job requires them to deliver parts to various 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.\			7.0-11.0 **CTE Pathway:** C1.0 C2.0 C3.0 C4.0 C10.0 C11.0

	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.			
IV.	**EMPLOYMENT PORTFOLIO**	**CR**	**LAB/ CC**	**STANDARDS**
	Students will prepare an update to their professional portfolio (lab book) A. Portfolio showcases best professional level work B. Portfolio is organized C. Research engineers/careers specific to content	5 hr ONGOING	10 hrs ONGOING	**Academic:** **Reading:** AS.R.1,4,7 AS.W.2,4,7 AS.SL.1,2,4 AS.L.1,2,6 **CTE Anchor:** 1.0 2.0 3.0 11.0 **CTE Pathway:** C11.0