

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

Course Title	<i>Computer Science for Innovators and Makers</i>	Course Code	<i>[Office use only]</i>
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Transcript Title:	CSIM		Grades Levels:	7 - 8	Board Adoption Date:	
Content Area:	Engineering		GPA Scale:	4.0	Date Course Submitted:	4/2/18
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, Writing, Speaking, Mathematics					
Next course(s):	Green Architecture, App Creators, Flight and Space, Medical Detectives, Design and Modeling, and Automation and Robotics					

Computer Science for Innovators and Makers

DATE: March, 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: Computer Science for Innovators and Makers teaches students that programming goes beyond the virtual world into the physical world. Students are challenged to creatively use sensors and actuators to develop systems that interact with their environment. Designing algorithms and using computational thinking practices, they code and upload programs to microcontrollers that perform a variety of authentic tasks. The unit broadens students' understanding of computer science concepts through meaningful applications. Teams select and solve a personally relevant problem related to wearable technology, interactive art, or mechanical devices.

PREREQUISITES: N/A

High School Name:	Site Prerequisite:
N/A	N/A

A – G APPROVAL: ☐ ☐ Yes ☒ No **Desired**

ARTICULATION: N/A

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

LEVEL: ☒ Introductory ☐ Concentrator ☐ Capstone

CERTIFICATION: N/A

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:

PLTW Course Curriculum

MODEL CTE PATHWAY:

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Grade	Fall Semester	Spring Semester
10 th or 11 th		
11 th or 12 th		
Elective		

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 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 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.

I.	Blink!	CR	LAB/ CC	STANDARDS
	Students begin to explore the capabilities of physical computing systems with The Digital Dive game, an engaging, live-action activity where students “become” computer parts and transmit commands. They learn to use algorithmic thinking as they prepare to code. Students use block-based coding to create, download, and upload programs to the micro:bit microcontroller. They learn processes and gain skills to debug programs starting with pre-bugged programs. They apply these skills to their own project where they code a blinking message that includes text, images such as emojis, and animation. Activity 1.1 The Brain What's a Computer Scientist? The Digital Dive Wireless Connections Compare the Hardware Activity 1.2 What To Do Execute a Task Writing an Algorithm Flowcharting Mirror Drawings Activity 1.3 How To Do It Micro:bit Scavenger Hunt Flowcharting the “Blink” Programming the “Blink” Connections and Board Confirmation LED Grad Practice Exercises Activity 1.4 Crush The Bug A Famous Bug Finding a Bug Debug Your Hardware, Too Helpful Comments Debug Steps Buggy Code Import Your Buggy Program Project 1.5 The Blinking Message Informative LEDs & Emojis The Blinking Message Project & Requirements What to Do and How to Do it Debugging Your Program Spread the Word Project 1.5 Challenge: The Blinking Message	7 hrs	15 Hours	Academic: Reading: AS.R.4.10 6.RI.4.7 6.W.2 6.W.3.d 6.L.6 AS.L.4.6 History 6-8.RH.4.7 6-8.RST.4.7,9 6-8.WHST.7 Technology: 1.6-8.F,G,H 2.6-8.P,Q 3.6-8.D,E,F 4.6-8.D 6.6-8.F 10.6-8.F,G 12.6-8.H,I,J,K 17.6-8.H,I,K Computer Science TA 2-A-7-2,4 2-A-3-9 2-A-6-10 2-C-4-12,13 2-D-7-15,17 2-I-7-18,19,22 2-N-4-25 Math: Science: NGSS.P1,4,6 CTE Anchor: 2.0 3.0 4.0 5.0 9.0 10.0 11.0 CTE Pathway: C.11.0

II	The Ins and Outs	CR	LAB/ CC	STANDARDS
	In this lesson, students explore a variety of sensors and actuators to use as inputs and outputs in physical computing projects. Using different materials to transfer electrical signals, such as conductive thread, alligator clips, conductive paint, and copper tape, students create their own input device—a sensor or switch—to interact with a program they develop on the microcontroller. They use these skills in the lesson’s project to design, develop, and program a system to protect safes and secrets. Activity 2.1 Need Input What’s an Input? Pair Programming Programming Inputs Analog and Digital Inputs Create Your Own Input Device Activity 2.2 Responding Output What’s an Output? Exploring Outputs and Actuators LED & LED Boards What’s in a Pause? Buzzer Standard Servo and Continuous Servo Using Inputs to Control Outputs Activity 2.3 Get Connected Bluetooth Wireless Technology What’s the Answer? Code Tracing a Variable Smart Devices Remote Controls Activity 2.4 Secrets & Safes Keep It Secret....Keep It Safe Design Requirements and Design Process Define the Problem Generate Concepts Design a Solution Build and Test Your Device Evaluate Your Solution Present Your Solution	6 hrs	20 Hours	Academic: Reading: 6.RI.4,7 6.W.2.d 6.W.3.d 6.SL.1,5 6.L.G AS.R.4,10, AS.SL.1,2,4,5 AS.L.4,6 History: 6-8.RH.4,7 6-8.RST.4,7,9 6-8.WHST.7 Technology: 16-8.F,G,H 2-6-8.M,P,Q,R 3-6-8.D,E,F 4-6-8.D,E,F 6-6-8.E 7-6-8-C,E 8-6-8.E 9-6-8.G 10-6-8.F,G,H 11-6-8.J,K,L 12-6-8.H.I,J,K 17-6-8.H,K Computer Science TA 2-A-7-2,3,4 2-A-5-5,6,7 2-A-3-9 2-A-6-10 2-C-7-11 2-C-4-12 2-6-13 2-D-7-15,17 2-I-7-19 2-I-1-22 2-N-7-24,25 Math: 6.EE.2,2a,6,8,9 6.SP.3,5 7.EE.4 Next Generation Science Standard NGSS.MS.ETS1-3 NGSS.P1,4,5,6,8 CTE Anchor: 2.0 3.0 4.0 5.0 9.0 10.0 11.0 CTE Pathway:

				C.11.0
III.	Program the Physical World	CR	LAB/ CC	STANDARDS
	Within teams, students become innovators and makers. Teams apply their physical computing knowledge and skills as they design and create one of three problem options: • A wearable safety device someone might use when completing a physical activity outside at night • An engaging art installation to help improve a community space • A useful mechanical dispenser for a person or animal who needs assistance to retrieve an object Teams collaborate and learn that solving authentic problems involves the unit content knowledge, as well as skills from other disciplines, such as communications, mathematics, and science. Activity 3.1 Clean Up Your Code Elegant Code Programming Languages Lines of Code Abstraction Code Clean Up Activity 3.2 Interactions Physical Computing Interactions User Interactions Go Team! Design Process Define the Problem Generate Concepts Design a Solution Build and Test Your Device Evaluate Your Solution Present Your Solution	8 hrs	25	Academic: Reading: 6.RI.4,7 6.W.2.d 6.W.3.d 6.SL.1,5 6.L.6 AS.R.4,10, AS.SL.1,2,4,5 AS.L.4,6 History: 6-8.RST.4,7,9 Computer Science AS 2-A-7-2,3,4 2-A-5-5,6,7 2-A-3-9 2-A-6-10 2-C-7-11 2-C-4-12 2-6-13 2-D-7-15,17 2-I-7-19 2-I-1-20,22 2-I-6-23 2-N-7-24,25 Technology: 16-8.F,G,H 2.6-8.M,P,Q,R,S 3.6-8.D,E,F 4.6-8.D,E,F 6.6-8.E 7.6-8-C,E 8.6-8.E,F,G 9.6-8.F, G,H 10.6-8.F,G,H 11.6-8.H,I,J,K,L 12.6-8.H,I,J,K 17.6-8.H,K Math: 6.EE.2,2a,6,8,9 6.SP.3,5 7.EE.4 Next Generation Science Standard NGSS.MS.ETS1-1,3 NGSS.P1,4,5,6,8 CTE Anchor: 2.0 4.0 5.0 9.0 10.0 11.0

				CTE Pathway: C.11.0
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	4 hr ONGOING	5 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