Perris Union High School District
Course of Study

A. COURSE INFORMATION

Course Title:
RCOE Systems Programming 02

- ✓ New
- ☐ Revised

If revised previous course name if changed

Transcript Course Code/Number:
(To be assigned by Educational Services)

Subject Area:
- ☐ Social Science
- ☐ English
- ☐ Mathematics
- ☐ Laboratory Science
- ☐ World Languages
- ☐ Visual or Performing Arts
- ✓ College Prep Elective
- ☐ Other

Is this classified as a Career Technical Education course?
- ✓ Yes
- ☐ No

PATHWAY: Software and Systems Development - Systems Programming CAPSTONE

Grade Level
- ☐ MS
- ☐ HS
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ✓ 11
- ✓ 12

Required for Graduation:
- ☐ Yes
- ✓ No

Credentials Required to teach this course:
Designated subject
CTE: Information and Communication Technology
Single Subject: Information and Communication Technology

To be completed by Human Resources only:

DocuSigned by:
Ned Hilton 3/12/2021
D0FF5... **Signature** **Date**

Meets UC/CSU Requirements?
- ✓ Yes
- ☐ No

Was this course *previously approved by UC* for PUHSD?
- ✓ Yes
- ☐ No

(Will be verified by Ed Services)

Meets "Honors" Requirements?
- ☐ Yes
- ✓ No

Meets "AP" Requirements?
- ☐ Yes
- ✓ No

Unit Value/Length of Course:
- ☐ 0.5 (half year or semester equivalent)
- ✓ 1.0 (one year equivalent)
- ☐ 2.0 (two year equivalent)
- ☐ Other:

Submitted by: Dian Martin
Site: Educational Services
Date:03/02/2021

Approvals	Name/Signature	Date
Director of Curriculum & Instruction		3/16/21
Asst. Superintendent of Educational Services		3/12/21
Governing Board		

Riverside County Office of Education – Career Technical Education

RCOE SYSTEMS PROGRAMMING 02

DATE:

INDUSTRY SECTOR: Information and Communication Technologies Sector

PATHWAY: Software and Systems Development - Systems Programming

CALPADS TITLE: Advanced Systems Programming (Capstone)

CALPADS CODE: 8132

HOURS:

Total	Classroom	Laboratory/CC/CVE
180	90	90

JOB TITLE	O*NET CODE	JOB TITLE	O*NET CODE
Logistics Engineers	13-1081.01	Electronics Engineering Technologists	17-3029.04
Robotics Engineers	17-2199.08	Industrial Engineering Technologists	17-3029.05

COURSE DESCRIPTION:

This competency-based course is designed to provide students with a sound foundation in Automation Processing incorporating Electronic, Robotics and UAS Technology that exist in society today and the very near future. Technology and Industrial Automation will emphasize the basic skills utilized in identifying the concepts of automated machines and equipment and describe the terms and phrases associated with industrial automation. The student will perform preventative maintenance, identify and solve problems with machines, and other technologies. Students will demonstrate competency in the automation of simple processes in the workforce and conceive, design, and prototype solutions. Using the engineering design team concept as a model, students will work in small groups to research, design, program, and construct robotic devices used in competition, including NASA'S U.S. FIRST. Materials used in this course will consist of, but not limited to LEGO Mindstorm EV3 Robots, BOE-Bot Robots, Unmanned Aerial Systems (Drones and Quadcopters), Pitsco Technic Robotics Kits, and LynxMotion Robotic Arms. Upon completion of this course, students will have the knowledge to qualify for the following certificates: UAS Pilot's License and Carnegie Mellon Robotics Academy. This course will increase the student's ability to succeed in postsecondary education and training through well-developed research and analytical skills.

A-G APPROVAL: G

ARTICULATION: None

DUAL ENROLLMENT: None

PREREQUISITES:

Prerequisite
RCOE Systems Programming 01

METHODS OF INSTRUCTION

- Direct instruction
- Group and individual applied projects
- Multimedia
- Demonstration
- Field trips
- Guest speakers

STUDENT EVALUATION:

- Student projects
- Written work
- Exams
- Observation record of student performance
- Completion of assignment

INDUSTRY CERTIFICATION:

- None

RECOMMENDED TEXTS:

- EV3 Curriculum Carnegie Mellon http://www.education.rec.ri.cmu.edu/content/lego/ev3/
- Unmanned Aircraft Systems - Federal Aviation Administration https://www.faa.gov/uas/

PROGRAM OF STUDY

Grade	Fall	Spring	Year	Course Type	Course Name
9, 10, 11, 12			• •	Concentrator	RCOE Systems Programming 01
10, 11, 12			• •	Capstone	RCOE Systems Programming 02

I.	ORIENTATION	CR	Lab/ CC	Standards
	Students will demonstrate a thorough understanding of the industry. Students will use internet resources and critical thinking to familiarize themselves with what takes place in the industry. Students will receive materials developed by the Riverside County Office of Education, containing information about: sexual harassment, technology ethics, workplace ethics, and how to be successful in the workplace. **Unit Assignment:** Initially, students will take a multiple-choice safety test pertaining to the Engineering and ICT pathways. Students will demonstrate a concise understanding of harassment by completing a series of Digital Citizenship Hyper-Documents. Students will identify some forms of harassment that could be experienced in their environment. Students will demonstrate how technology has an effect on harassment, ethics, and success in their current environment and in the current workplace. In an open discussion, students will express some concerns they might have regarding these technologies. Finally, students will retake the safety test from the beginning of the unit and evaluate what they have learned in a Think-Pair-Share activity.	7	8	**Academic:** **CTE Anchor:** **CTE Pathway:**
II.	**CAREER PLANNING AND MANAGEMENT**	**CR**	**Lab/ CC**	**Standards**
	Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. Research and describe the expectations of careers in the current job market. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. Compare and explain the differences in careers and the requirements that are necessary to prosper in the job market. Examine how education, training, and licensing are necessary for particular careers. **Unit Assignment(s):** Students will research the personal qualifications, interests, aptitudes, information, and skills necessary to succeed in the current job market for this industry. Students will develop a typewritten career plan, that is designed to reflect career interests, pathways, and post-secondary options. The student will then demonstrate the important strategies for self-promotion in the hiring process, such as job applications, resume writing, interviewing skills, and preparation of a portfolio. Students will complete each of the following: (1) Formulate a cover letter to help students develop writing skills, (2) Apply for a job online showing electronic and technological skills, (3) Students will illustrate their job skills by maintaining a professional portfolio. Using a rubric, students will provide feedback to other classmates to the three career products above.	8	7	**Academic:** **CTE Anchor:** **CTE Pathway:**
III.	**PRINCIPLES OF TECHNOLOGY AND ENGINEERING**	**CR**	**Lab/ CC**	**Standards**
	The Principles of Technology and Engineering will introduce students to technology and engineering concepts that will emphasize problem-solving and critical thinking. Students will be able to demonstrate their technical knowledge and skills. Students will learn how to be successful problem solvers through examination of a real-world issue. Students will learn about real-world examples of engineering innovations, including global civil engineering projects, cutting-edge medical technology, and environmentally friendly designs. **Unit Assignment:** In small groups, students will research and evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints. These constraints will include cost, safety, reliability,	12	13	**Academic:** **CTE Anchor:** **CTE Pathway:**

	and aesthetics, as well as possible social, cultural, and environmental impacts. Using the engineering design process, students will demonstrate the series of steps that engineers follow when they are trying to solve a problem and design a solution. Ultimately, the group will collaboratively design and present a technical report detailing their issue and culminating with their solution, which will be presented to the class.			
IV.	**HOW SIMPLE MACHINES BUILT ANCIENT STRUCTURES**	**CR**	**Lab/ CC**	**Standards**
	Simple machines are devices with few or no moving parts that make work easier. Simple machines usually use leverage or an angle to convert our human effort in some way to make something easier. Students are introduced to the six types of simple machines — the wedge, wheel and axle, lever, inclined plane, screw, and pulley. Through the construction of a pyramid, students will gain high-level insights into tools that have been used since ancient times and still used today. The student will demonstrate the understanding of the concepts of physics that are fundamental to engineering technology. They will illustrate the principles of force, work, rate, power, energy, and resistance related to mechanical, electrical, fluid, and thermal engineering systems. Students will explain the design process to solve analytical and design problems. In conclusion, students will show an understanding of the industrial engineering processes, including the use of tools and equipment, methods of measurement, and quality assurance. **Unit Assignment:** Students research and begin to design a pyramid. Students perform calculations to determine the area of their pyramid base, stone block volumes, the number of blocks required for their pyramid base, and make an isometric drawing of a pyramid. Students will learn that an isometric projection is a method for visually representing three-dimensional objects in two-dimensional technical and engineering drawings. Working in engineering project teams, students choose a site for the construction of a pyramid. Students base their decision on-site features as provided by a surveyor's report; distance from the quarry, river, and palace; and other factors students deem important to the project. Students will then create a production plan, using documents and spreadsheets utilizing two methods: (1) simple machines and (2)modern technology. Following the creation of these two production plans, students will then choose which plan to present to the class. The instructor will make sure there is an even number of teams presenting both methods to assure that the students will exhibit a firm understanding of simple machines and how they have changed throughout history and the impact they have made on modern technologies.	13	12	**Academic:** **CTE Anchor:** **CTE Pathway:**
V.	**INTRO TO MICROPROCESSORS / MICROCONTROLLERS**	**CR**	**Lab/ CC**	**Standards**
	Using Raspberry Pi and Arduinos, students will explore computer electronics and how to make things with microprocessors and microcontrollers. Students will use problem-solving and critical thinking skills to create and control these technologies to create fun and useful projects while preparing them for work and life in the future. Computational thinking is at the heart of the learning, and with the use of demonstration and application, students will be able to explore a world of technologies that practically have limitless boundaries. Students will understand the fundamental control system design and develop systems that complete pre-programmed tasks. Students will formulate a problem and express its solution in a way that a computer can effectively carry it out. **Unit Assignment:** Research and Evaluate the vast types of microprocessors and microcontrollers and how they are used in the industry and around the world. Students will construct a 4-5 page research paper detailing the use and impact of each device in the world. Students will learn how to program applications and sensors with both the Arduino and Raspberry Pi technologies and utilizing this	12	13	**Academic:** **CTE Anchor:** **CTE Pathway:**

	knowledge for their final projects. For their final project of this unit, students will design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved with these technologies. Students will then evaluate their solutions amongst their groups and the class as a whole by creating a product pitch presentation for their solution. This 30-60 second "elevator pitch" will introduce the students to a very important industry approach to delivering their ideas to important industry people in a short amount of time. Using a rubric, students will demonstrate skills while viewing other student group pitches. Following their pitch presentations, students must make better sense of their problems and persevere in solving them. Finally, students will then create a prototype of their solution drawing evidence from technical websites, such as; raspberrypi.org (https://www.raspberrypi.org/), adafruit.com (https://www.adafruit.com/), hackaday.com (http://www.hackaday.com), and instructables.com (https://www.instructables.com/) to support analysis, reflection, and research which will ultimately explain why they chose their solutions.			
VI.	**PRINCIPLES OF ROBOTICS**	**CR**	**Lab/ CC**	**Standards**
	This multiple-month unit will introduce students to the principles of robotic technology by subjecting them to a very rigorous curriculum designed to teach core computer programming logic and reasoning skills using a robotics engineering context. Students will learn about robotics technologies, which impact all modern industries, from agriculture to healthcare, banking, manufacturing, transportation, energy, and security. It contains a sequence of complex projects (plus one capstone challenge) organized around key robotics and programming concepts. Such concepts involve robotic movements, utilizing motors and sensors to total automation using complex programming and concise decision-making. Mastery of these concepts will give students the knowledge to be able to evaluate and adapt to any real-world issue utilizing robotic technology. **Unit Assignment(s):** Students will research and document how robotics has revolutionized the manufacturing process. Students will demonstrate an understanding of the EV3 software (drag-and-drop) and RobotC Software (Line-Based Coding) to solve a series of tasks. Students will submit their programs and explain how they chose to come up with the solution. Students will use geometric measurements and display a concrete knowledge of distance, rate, and time by differentiating that tire dimensions and motor speed has an impact in calculating the rate a robot travels. Students will formulate a hypothesis on what how far they believe their robot will travels using 2 different tire sizes. Students will complete a spreadsheet on the time traveled over different distances and determine the rate. Students will discover that robots are nothing like those seen in the movies. Robots can be anything that consists of a motor, sensor, and processing unit. For their final assessment, students will perform a catapult challenge where they have to demonstrate a firm understanding of the Pythagorean Theorem to complete the assignment, students will create a catapult and collect data from their catapults to determine the angle of trajectory and predict where their ping pong ball will land. Examples of some of the Robotics Activities - https://youtu.be/DYID2M1Vgys (https://youtu.be/DYID2M1Vgys)	18	17	**Academic:** **CTE Anchor:** **CTE Pathway:**
VII.	**PRINCIPLES OF UNMANNED AERIAL SYSTEMS (UAS)**	**CR**	**Lab/ CC**	**Standards**
	The rapid proliferation of commercial Unmanned Aerial Systems (UAS) has created tremendous demand for hundreds of thousands of new jobs in multiple industries, which include: construction, manufacturing, landscaping, photography, videography, land-management in fire fighting, and military applications. During this multi-week unit, students will be introduced to the safety and risk management practices associated with UAS. The unit will expose students to the rules and operation of UAS in the industry. Students	10	10	**Academic:** **CTE Anchor:** **CTE Pathway:**

	will demonstrate a firm understanding of the ethical and legal responsibilities of flying a UAS by completing a safety test and reiterating their knowledge in a 500-1000 word essay about the safety differences between national and local regulations. Students will follow a complex multi-step procedure to fly the UAS demonstrating safe and legal operation. **Unit Assignment(s):** Individually, students will research and formulate a presentation (document or slideshow) of the use of UAS in any industry. Students will evaluate and display an understanding of the FAA rules for UAS operation. Students will complete a Google Form safety test evaluating their knowledge. They must complete this test with 100% accuracy before moving onto the next phase. Following the safety test, students will demonstrate an understanding of operating a UAS in a controlled environment, which will consist of a safety net and away from any other students. After the students have fully proved their mastery of aerial flight in a controlled environment, they will be allowed to complete a flight without the use of the safety net. Students will always fly in a controlled environment, away from houses, people, and animals. For their final projects, students will exhibit their knowledge of automation with a UAS by researching and analyzing Unassisted Flight operations online. The student will design and demonstrate a flight plan using GPS technology. Students will formulate a sequence of waypoints (coordinates) using Google Earth and download these coordinates into the UAS software. Students will continue to demonstrate knowledge of all FAA regulations when planning their flight plan. Prior to initiation of a flight plan, students will submit a Microsoft Word or Google Doc to the instructor, illustrating this flight plan and explaining their overall intentions for the mission. Students must provide Google Earth screenshots with the overall flight path and zoomed-in waypoints. Once approved by the instructor, the students will autonomously operate the UAS and execute their flight mission outside in a "live" situation.			
VIII.	**INDUSTRIAL AUTOMATION**	**CR**	**Lab/ CC**	**Standards**
	The final unit prepares students for careers in the design, operation, and maintenance of industrial automation systems focusing on the local industries that utilize these technologies such as food production, petroleum production, fabrication, and logistics. This unit focuses on the application of electronics from computer technology to industrial automation systems, including instrumentation and control, industrial robotics, and process control systems. Significant emphasis is placed on project-based learning facilitated by comprehensive laboratory work containing simple machines, robots, robotic arms, and the use of unmanned aerial systems. **Unit Assignment:** Individually, students will research and create a digital or oral presentation about the history of automation. Students will identify and recall the answer to the following questions: When and where was the problem presented? How was this problem solved? How did it change the future of the industry? Students will then demonstrate the flow process of manufacturing and how their knowledge of the technologies addressed in this course are used to make automation more efficient. In small groups, students will research and design an Industrial Automation process. Students will have to model a current issue in the industry using tangible or virtual presentation materials (creating a 3D physical or virtual model). Students will construct a viable solution to this problem and diagram how their solution will help the industry. Using spreadsheets, each group will generate a financial impact analysis, on how their solution will be an advantage to the industry both short and long-term. Ultimately, students will conceptually design and actually develop their working prototype of their automated solution to their issue. Students will be allowed to use any technology that they have learned or any other technology that can utilize current classroom inventory. Final projects will be a visual presentation accompanied by a demonstration of their prototype. They will present each	10	10	**Academic:** **CTE Anchor:** **CTE Pathway:**

	project to a panel of industry advisories where they will receive real-world critiques and admiration of their projects through a scoring rubric.			
IX.	**COURSE NOTES:**	**CR**	**Lab/ CC**	**Standards**
	COURSE NOTES: Completed by ASG 4/12/19 – ADDED TO CTE S DRIVE **Former Course Title**: RCOE Technology and Industrial Automation	0	0	**Academic:** LS: 11-12.1 **CTE Anchor:** Communications: 2.1 **CTE Pathway:** C1.1

Entered by:

District: Riverside County Office of Education
Contact: Abel Gonzalez, CTE TOSA
Phone: 951-826-6801
Email: rcoecte@rcoe.us