



El Camino College
COURSE OUTLINE OF RECORD – Official

Subject:	ROBO
Course Number:	150
Descriptive Title:	Intermediate Robotics
Division:	Industry and Technology
Department:	Robotics
Course Disciplines:	Electronics and Computer Hardware Technology, Manufacturing Technology
Catalog Description:	This intermediate course covers robotics and automation applications, with an emphasis on imbedded electronics, microcontroller programming, motors, and drive trains. Additional topics include electronics theory, electro-mechanical fabrication, sensors, manufacturing materials and processes, and career fields in which robotic applications are used. Students will construct, program and test a vehicular or process robot.
Prerequisite:	Robotics 110 with a minimum grade of C
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	3
Outside Study Hours:	6
Total Course Hours:	108
Course Units:	4
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	
Transfer UC:	Yes
Effective Date:	pending
General Education ECC:	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	
Term:	

Other:	
CalGETC:	
Term:	
Other:	
Student Learning Outcomes:	<ol style="list-style-type: none"> 1. SLO #1 – ROBOT ORIENTATION AND OVERVIEW. The student will be able to define what a robot is, identify the purpose of robots and all related subsystems of the varying robot types. Students will also be able to interpret the various subfields of robotics to help them continue on the path for their future career. 2. SLO #2 – ELECTROMECHANICAL FABRICATION. ' The students will be able to perform successful soldering, and develop a prototype proto-board. Materials and hand tools, as well as surface-mounted manufacturing technologies, will be provided. 3. SLO #3 – ROBOT OPERATIONAL PERFORMANCE. By the end of this course, students will be able to construct, program and test a vehicular or process robot.
Course Objectives:	<ol style="list-style-type: none"> 1. Define a robot, distinguish between the different types of robots, identify the purpose of robots. 2. Complete a safety test with complete accuracy. 3. Compare and contrast electrical motor configurations, transducers, sensors, and associated electronics and embedded devices. 4. Build robotic systems in accordance with industry standard schematics and diagrams. 5. Diagnose hardware and software errors in robotic systems. 6. Program robotic systems to perform operational tasks using software. 7. Build simple interface circuits capable of driving electromechanical devices such as motors. 8. Design appropriate gear and drive trains for robotic systems. 9. Modify simply servo or stepper motors to obtain a specific objective. 10. Demonstrate a basic understanding of microcontrollers. 11. Demonstrate an understanding of pulse width modulation and pulse coded modulation. 12. Demonstrate mastery of algorithms. Explain what an algorithm is, how it is developed, and how it is deployed in robotic systems.
Major Topics:	<ol style="list-style-type: none"> I. ROBOTICS ORIENTATION AND OVERVIEW (4 hours, Lecture) <ol style="list-style-type: none"> A. Historical perspective of robotics B. Robotic applications and career paths C. Electrostatic discharge safety II. ROBOTICS ORIENTATION AND OVERVIEW (4 hours, Lab) <ol style="list-style-type: none"> A. Historical perspective of robotics B. Robotic applications and career paths C. Electrostatic discharge safety

III. ELECTROMECHANICAL FABRICATION (12 hours, Lecture)

- A. Soldering, proto-boarding
- B. Materials and hand tools
- C. Surface mount technology
- D. Electrical and mechanical fasteners
- E. Machining processes, sheet metal work

IV. ELECTROMECHANICAL FABRICATION (12 hours, Lab)

- A. Soldering, proto-boarding
- B. Materials and hand tools
- C. Surface mount technology
- D. Electrical and mechanical fasteners
- E. Machining processes, sheet metal work

V. BASIC ELECTRONICS THEORY 6 hours, Lecture)

- A. Resistors and color codes
- B. Ohm's Law
- C. Test and measurement

VI. BASIC ELECTRONICS THEORY (6 hours, Lab)

- A. Resistors and color codes
- B. Ohm's Law
- C. Test and measurement

VII. MOTORS AND DRIVE TRAINS (14 hours, Lecture)

- A. Motors, charging systems, motor speeds
- B. Wheel types, tracks, gear boxes
- C. Platform balancing
- D. Embedded relays, solenoids
- E. Closed-loop systems, potentiometers
- F. Torque and Inertia
- G. Electrical support requirements

VIII. MOTORS AND DRIVE TRAINS (12 hours, Lab)

- A. Motors, charging systems, motor speeds
- B. Wheel types, tracks, gear boxes
- C. Platform balancing
- D. Embedded relays, solenoids
- E. Closed-loop systems, potentiometers
- F. Torque and Inertia
- G. Electrical support requirements

IX. MICROCONTROLLER PROGRAM TECHNIQUES (14 hours, Lecture)

- A. Electronics interfaces, wired and wireless
- B. PBASIC and industry control "C" editors

	<p>C. Compiler command lines and debug mode D. PC interface methods E. Embedded microcontrollers</p> <p>X. MICROCONTROLLER PROGRAM TECHNIQUES (12 hours, Lab)</p> <p>A. Electronics interfaces, wired and wireless B. PBASIC and industry control “C” editors C. Compiler command lines and debug mode D. PC interface methods E. Embedded microcontrollers</p> <p>XI. ROBOT OPERATIONAL PERFORMANCE (4 hours, Lecture)</p> <p>A. Troubleshooting and tuning B. Competition and performance evaluation</p> <p>XII. ROBOT OPERATIONAL PERFORMANCE (8 hours, Lab)</p> <p>A. Troubleshooting and tuning B. Competition and performance evaluation</p>
Total Lecture Hours:	54
Total Laboratory Hours:	54
Total Hours:	108
A.1. Primary Methods of Evaluation (Part 1 - CCN courses only):	
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Program robotic systems to perform operational tasks using software. Modify simple Servo or Stepper Motors to obtain a specified objective. Submit laboratory reports to instructor for evaluation.
Critical Thinking Assignment 1:	Write a three- to five-page report that describes how a robot function as a whole, the energy budget during its operation, subsystems selected, how each subsystem interacts with the other, and how a robot can be cost-effective if mass-produced. Submit report to the instructor.
Critical Thinking Assignment 2:	Design on paper or with a Computer Aided Design/Drafting (CADD) program appropriate gear and drive trains for robotic systems. Submit to the instructor. In a two- to three-page report, demonstrate an understanding of Pulse Width Modulation and Pulse Coded Modulation. Submit report to the instructor.
Other Evaluation Methods:	Class Performance, Completion, Essay Exams, Performance Exams, Presentation, Quizzes, Matching Items, Multiple Choice, True/False, Written Homework
If Other:	
Instructional Methods:	Demonstration, Discussion, Group Activities, Guest Speakers, Lab, Lecture, Multimedia presentations
If other:	

Work Outside of Class:	Answer questions, Required reading, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Texts:	Dr. Jisu Elsa Jacob. <u>Robotics Simplified</u> . BPB Publications. 2022
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite	Prerequisite
Category	sequential
Requisite course:	Robotics 110
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	<p>Ability to assemble a proto type robot.</p> <p>ROBO 110 – Assemble a prototype robot. Equip the assembled machine with necessary parts to classify it as a robot.</p> <p>Ability to identify the components of a robot and the tools to build a prototype robot.</p> <p>ROBO 110 - Examine and identify the electronic and mechanical components of a robot. Familiarize with the necessary tools to build the prototype robot.</p>
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill(s). if applicable	
Requisite course:	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). if applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Joseph Weichman

Date:	04/10/2024
Original Board Approval Date:	03/24/2025
Effective Term:	Fall 2025