Course Acronym:	ECHT
Course Number:	191
Descriptive Title:	Introduction to Microprocessors and Interfacing
Division:	Industry and Technology
Department:	Electronics and Computer Hardware Technology
Course Disciplines:	Electronic Technology, Electronics
Catalog Description:	This course is an introduction to industrial microprocessors as they relate to industrial and consumer equipment. Included are the fundamentals of computer languages, use of software to simulate hardware, digital and analog interfacing, data storage, and troubleshooting.
Prerequisite:	Electronics and Computer Hardware Technology 11 or Electronics and Computer Hardware Technology 130 or Engineering Technology 14 or Manufacturing Technology 70 with a minimum grade of C
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	4
Outside Study Hours:	4
Total Course Hours:	108
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	
Effective Date:	Prior to July 1992
Transfer UC:	
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	

IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Machine Assembly Language** Students will demonstrate their knowledge of fundamentals of machine assembly language **SLO #2 Digital & Analog Interfacing** Students will demonstrate their use of software to simulate hardware and digital and analog interfacing. **SLO #3 Microprocessors and Microcontrollers** Students will demonstrate their knowledge of microprocessors and microcontrollers as they relate to industrial and consumer equipment.
Course Objectives:	1. Recognize how both hardware and software work together in a system. 2. Understand the basics of troubleshooting a microprocessor system. 3. Understand how microprocessor data is transfered. 4. Understand how timing and interrupts operate. 5. Recognize the differences in serial and parallel interfaces and the timing requirements. 6. Set up an oscilloscope to measure the clock and output waveforms of a microprocessor. 7. Outline the steps required to solve a problem and convert the steps into a logical program. 8. Recognize the trade off between different microprocessor architectures and why some applications may find one architecture better than another.
Major Topics:	**I. MICROPROCESSORS AND INTERFACING OVERVIEW (6 hours, lecture)** A. Hardware and software introduction B. Digital concepts C. Logic (AND, OR, XOR) D. Decimal, Binary, and Hex numbers E. Different microprocessor architectures **II. MICROPROCESSORS AND INTERFACING OVERVIEW (12 hours, lab)** A. Hardware and software introduction B. Digital concepts C. Logic (AND, OR, XOR) D. Decimal, Binary, and Hex numbers E. Different microprocessor architectures **III. MEMORY AND DATA STORAGE (2 hours, lecture)** A. Random Access Memory (RAM) B. Read Only Memory (ROM)

C. Programmable Read Only Memory (PROM), Erasable Programmable Read Only Memory (EPROM) and Electrically Erasable Programmable Read Only Memory (EEPROM)
D. Volatile and non-volatile memories
E. Memory paging
F. Other forms of data storage

IV. MEMORY AND DATA STORAGE (4 hours, lab)

A. RAM
B. ROM
C. PROM, EPROM, and EEPROM
D. Volatile and non-volatile memories
E. Memory paging
F. Other forms of data storage

V. BASIC INPUT/OUTPUT (I/O) (2 hours, lecture)

A. Push button
B. Switches
C. Speakers
D. Light Emitting Diodes (LED)s
E. Liquid Crystal Display (LCD)s
F. Sensors
G. Serial and parallel data

VI. BASIC I/O (4 hours, lab)

A. Push button
B. Switches
C. Speakers
D. LEDs
E. LCDs
F. Sensors
G. Serial and parallel data

VII. ANALOG TO DIGITAL AND DIGITAL TO ANALOG (4 hours, lecture)

A. Analog to Digital (A/D) converters
B. Digital to Analog (D/A) converters
C. Pulse Width Modulation (PWM)
D. Use of Resistive-Capacitive (RC) time measurements

VIII. ANALOG TO DIGITAL AND DIGITAL TO ANALOG (8 hours, lab)

A. A/D converters
B. D/A converters
C. PWM
D. Use of RC time measurements

IX. TEAM PROJECT (2 hours, lecture)

A. Assignment
B. Requirements
C. Work ethic and responsibility

X. TEAM PROJECT (4 hours, lab)

A. Assignment
B. Requirements
C. Work ethic and responsibility

XI. TIMING AND INTERRUPTS (4 hours, lecture)

A. Clocking choices
B. Accuracy
C. Counting clock cycles in a program
D. Time delays
E. Measuring time
F. Non-maskable interrupts
G. Maskable interrupts

XII. TIMING AND INTERRUPTS (8 hours, lab)

A. Clocking choices
B. Accuracy
C. Counting clock cycles in a program
D. Time delays
E. Measuring time
F. Non-maskable interrupts
G. Maskable interrupts

XIII. PSEUDOCODE AND OTHER PROBLEM SOLVING TECHNIQUES (4 hours, lecture)

A. Pseudocode
B. Flow charts
C. Stub code
D. Subroutines
E. Troubleshooting hardware and software problems

XIV. PSEUDOCODE AND OTHER PROBLEM SOLVING TECHNIQUES (8 hours, lab)

A. Pseudocode
B. Flow charts
C. Stub code
D. Subroutines
E. Troubleshooting hardware and software problems

XV. MICROPROCESSOR INSTRUCTIONS AND REGISTERS (8 hours, lecture)

A. Instructions and data flow
B. Register architecture
C. Addressing modes

	D. Development tools **XVI. MICROPROCESSOR INSTRUCTIONS AND REGISTERS (16 hours, lab)** A. Instructions and data flow B. Register architecture C. Addressing modes D. Development tools **XVII. MOTOR CONTROL AND ELECTROMAGNETIC ACTUATORS (4 hours, lecture)** A. Stepper motors B. Servos C. Solenoids D. Feedback **XVIII. MOTOR CONTROL AND ELECTROMAGNETIC ACTUATORS (8 hours, lab)** A. Stepper motors B. Servos C. Solenoids D. Feedback
Total Lecture Hours:	36
Total Laboratory Hours:	72
Total Hours:	108
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	Construct a circuit and write the code to read a set of input switches, and transfer this input to Light Emitting Diode (LED) outputs. Upon completion, consult instructor for evaluation.
Critical Thinking Assignment 1:	Construct a circuit and develop the code that will drive a seven-segment display. One push button will increment the count and the other push button will decrement the count on the display. Build and demonstrate the operation of the circuit to the instructor.
Critical Thinking Assignment 2:	Build a stepper motor circuit and develop the code to turn the motor both clockwise and counterclockwise using single and dual phase operation. Upon completion, demonstrate the operation of the circuit to the instructor.
Other Evaluation Methods:	Other Exams Quizzes Laboratory Reports Class Performance Homework Problems Multiple Choice Completion True/False

Instructional Methods:	Discussion Group Activities Laboratory Lecture Multimedia Presentations
If other:	
Work Outside of Class:	Answer questions Problem solving activity Required reading Study
If Other:	
Up-To-Date Representative Textbooks:	Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, 2nd Edition, Wiley, 2020 (Book is available in printed text and digital text formats).
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Electronics and Computer Hardware Technology 11 OR Electronics and Computer Hardware Technology 130 OR Engineering Technology 14 OR Manufacturing Technology 70
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Read and understand schematic symbols.** ECHT 11 -Differentiate color codes and component symbols to build a circuit. MTEC 70 - Examine and identify the electronic and mechanical components of a robot. Familiarize with the necessary tools to build the prototype robot. ECHT 130 - Design, construct, and test a small digital system, which may include one or more of the following functions: encoders and decoders, multiplexers and demultiplexers, parity generators and decoders, and Modulator (MOD) n counters. ETEC 14 - Recognize electronic schematic symbols and determine use.

	Ability to build basic circuits using a prototyping board. ECHT 11 -Differentiate color codes and component symbols to build a circuit. ETEC 14 - Describe the sequences in building and analyzing a simple circuit. MTEC 70 -Construct electronic circuits using a breadboard or protoboard. Configure circuits using electronic devices typical to robots (e.g., resistors, Light Emitting Diode (LED), integrated circuit, piezospeaker). ECHT 130 -Design, construct, and test a small digital system, which may include one or more of the following functions: encoders and decoders, multiplexers and demultiplexers, parity generators and decoders, and Modulator (MOD) n counters. **Knowledge of basic electronic components like resistors, LEDs, capacitors, and speakers.** ECHT 11 - Differentiate color codes and component symbols to build a circuit. ETEC 14 - Describe the sequences in building and analyzing a simple circuit. MTEC 70 - Examine and identify the electronic and mechanical components of a robot. Familiarize with the necessary tools to build the prototype robot." MTEC 70 - Construct electronic circuits using a breadboard or protoboard. Configure circuits using electronic devices typical to robots (e.g., resistors, Light Emitting Diode (LED), integrated circuit, piezospeaker). ECHT 130 - Design, construct, and test a small digital system, which may include one or more of the following functions: encoders and decoders, multiplexers and demultiplexers, parity generators and decoders, and Modulator (MOD) n counters. **Ability to use and connect basic electronic equipment such as a power supply, a digital multimeter, and an oscilloscope.** MTEC 70 - Examine and identify the electronic and mechanical components of a robot. Familiarize with the necessary tools to build the prototype robot. ETEC 14 -Connect meters to a circuit and obtain accurate measurements. ECHT 130 - Design, construct, and test a small digital system, which may include one or more of the following functions: encoders and decoders, multiplexers and demultiplexers, parity generators and decoders, and Modulator (MOD) n counters. ECHT 11 - Demonstrate the use of various types of test equipment, including Digital Multimeter (DMM), signal generators, power supplies and oscilloscope to make various circuit measurements.
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:	Walter Kahan
Date:	02/01/1988
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Arnulfo Runas
Date:	02/04/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024