Course Acronym:	ACR
Course Number:	31
Descriptive Title:	HVAC Electronics
Division:	Industry and Technology
Department:	Air Conditioning and Refrigeration
Course Disciplines:	Air Conditioning and Refrigeration, Heating
Catalog Description:	In this course, the fundamentals of Direct Digital Controls (DDC) used in Heating, Ventilation, Air Conditioning and Refrigeration (HVACR) systems are presented. The topics covered include DDC system components, single and multi-function electronic controls, DDC and pneumatic Variable Air Volume (VAV) systems, variable speed motors, controllers, programmable and configurable logic controller operation and application, introduction to communication protocols, and electronic diagram interpretation.
Prerequisite:	Air Conditioning and Refrigeration 5 with a minimum grade of C or equivalent
Co-requisite:	
Recommended Preparation:	Air Conditioning and Refrigeration 21
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	0
Outside Study Hours:	4
Total Course Hours:	36
Course Units:	2
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	fall 2005
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	

Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Electronic Board on a High Efficiency System** After reading the textbook and participating in class discussions, students will apply their knowledge of appropriate lab practices, concepts and theories to an electronic board on a High Efficiency system. Students will check for the proper function of the electronic board and study the LED indicator lights for an improper function of the operating system. **SLO #2 Basic Entry Level Industry Standards in Automation Systems** After completion of this course students will have the basic knowledge and skills necessary to meet basic entry level industry standards in automation systems. Students will apply the skills learned in identifying and defining communication protocols, automation system components, and motor controls. **SLO #3 Basic Electronic Components, Controllers, and Systems** Students completing this course will gain the knowledge and skills necessary to identify basic electronic components, controllers, and systems. Students will apply knowledge gained to read and interpret sequencing, logic and electronic schematics.
Course Objectives:	1. Complete a safety test with 100% accuracy. 2. Identify and test HVACR electronic system components. 3. Install, test and troubleshoot single and multi-function electronic controls. 4. Identify and describe the operation of VAV controls and systems. 5. Perform tests on logic switches and integrated circuits. 6. Program and troubleshoot programmable logic controllers. 7. Compare and contrast the efficiency and performance of various types of single speed motors with variable speed motors. 8. Identify and describe electronic components and functions.
Major Topics:	**I. Overview of HVACR Electronics (3 hours, lecture)** A. Mechanical B. Electrical C. Personal protective equipment **II. Electronic Control Components and Functions (6 hours, lecture)** A. Diodes and rectifiers B. Light-emitting diodes C. Semiconductors D. Thermistors E. Transistors F. Triacs G. Diagrams

	III. Single and Multi-Function Controls (6 hours, lecture) A. Programmable B. Configurable C. Structure D. Commissioning E. Testing **IV. VAV Systems (6 hours, lecture)** A. Direct digital controls B. Pneumatic C. Controllers D. Application E. Air distribution **V. Motor Control (6 hours, lecture)** A. Variable speed B. Alternating Current (AC) control C. Direct Current (DC) control D. Applications **VI. Logic Controllers (6 hours, lecture)** A. Programmable B. Configurable C. Inputs and outputs D. Logic **VII. Communication Protocols (3 hours, lecture)** A. Types B. Differentiation C. Requirements D. Application E. Structure
Total Lecture Hours:	36
Total Laboratory Hours:	0
Total Hours:	36
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Identify the following electronic components as single-function (A) or multifunction (B); include logic control units, roof top modules, motor controllers, communication protocols, and VAV control modules. Write a one-sentence description of each component and submit to your instructor.

	a. Logic control units b. Roof top module c. Motor controller d. Communication protocol e. VAV control module
Critical Thinking Assignment 1:	HVAC unit #3 in the laboratory has been converted from analog control to direct digital control. The control records a fault. Diagnose the system fault and determine the corrective action needed. Complete a one-page data log report and include diagnosis and action taken. Submit data log report to your instructor.
Critical Thinking Assignment 2:	Locate the Programmable Logic Controller (PLC) in the HVACR laboratory and evaluate the input and output functions of the sensors. Measure the output signal to the stand-alone controller and record the values on a one-page data log report. Submit data log report to your instructor.
Other Evaluation Methods:	Class Performance Completion Matching Items Multiple Choice Performance Exams True/False
Instructional Methods:	Demonstration Lecture Multimedia presentations Role play/simulation
If other:	Internet Presentation/Resources
Work Outside of Class:	Answer questions Problem solving activity Required reading Skill practice Study Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Textbooks:	Althouse, Turnquist, Bracciano, and Bracciano. Modern Refrigeration and Air Conditioning, 22nd edition. Goodheart Willcox, 2025 Textbook is available in printed text and digital text format.
Alternative Textbooks:	
Required Supplementary Readings:	

Other Required Materials:	Notebook Safety glasses Safety gloves Workbook
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Air Conditioning and Refrigeration 5
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Interpret HVAC electrical drawings and wiring diagrams.** ACR 5 - Analyze schematic diagrams to troubleshoot Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) systems. **Utilize test equipment to evaluate voltages and resistance.** ACR 5 - Troubleshoot HVACR systems with the use of a multimeter.
Requisite Skill:	or equivalent
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	If students have taken an equivalent course at another college, students will be prepared to enroll in this course. It is highly recommended that students have skills in interpreting HVAC drawings and wiring diagrams and utilize test equipment to evaluate voltages and resistance to succeed in this course.
Requisite course:	Air Conditioning and Refrigeration 21
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**If students have these skills, their experience in the class will be enhanced.** **Utilize test equipment to evaluate voltages and resistance.** ACR 21 - Interpret and apply schematic wiring diagrams for air conditioning applications. **Interpret HVAC electrical drawings and wiring diagrams.** ACR 21 - Interpret and apply schematic wiring diagrams for air conditioning applications.
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:	Raymond Havrella
Date:	09/01/1986
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Henry Der Antonian
Date:	10/03/2023
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