Course Acronym:	ACR
Course Number:	30
Descriptive Title:	Electric Controls
Division:	Industry and Technology
Department:	Air Conditioning and Refrigeration
Course Disciplines:	Air Conditioning and Refrigeration, Heating
Catalog Description:	This course covers the study of electrical and electronic components, motors, and circuitry for air conditioning and refrigeration controls. Students apply theoretical principles in diagnosing electrical and electronic problems and safely make necessary repairs to Refrigeration, Heating, Ventilating and Air Conditioning (HVAC) systems. Energy efficiency practices and process related to electric and electronic controls is the focus of this course.
Prerequisite:	Air Conditioning and Refrigeration 21 with a minimum grade of C or equivalent
Co-requisite:	
Recommended Preparation:	
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:	Prior to July 1992
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	

Term:	
Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Control Boards** After reading the textbook and participating in class discussions, students will apply their knowledge of appropriate lab practices, concepts and theories to an operating Air Conditioning Control Board. Students will check an A/C wire schematic for proper wiring of the board and energize the board taking electrical readings at each control device. **SLO #2 Electrical Board Ladder Diagram, VOM Check** After reading the textbook and participating in classroom discussions, students will apply their knowledge to draw a ladder diagram from an electrical board that simulates an air conditioning system, know the parts of the air conditioning system and use a VOM to check each part. **SLO #3 Electrical Board Troubleshooting** After reading the textbook and participating in classroom discussions, students will apply their knowledge of a ladder diagram to diagnose and troubleshoot the wiring and operation of an electrical board.
Course Objectives:	1. Identify and measure the elements and characteristics of controlled systems. 2. Inspect, diagnose and troubleshoot electrical/electronic problems associated with air conditioning and refrigeration systems. 3. Analyze a heating/cooling schematic diagram and follow the sequence of operation. 4. Diagnose and troubleshoot air conditioning and refrigeration control systems with the use of electrical diagrams. 5. Diagnose, repair, and adjust electric and electronic controls to maximize system energy efficiency.
Major Topics:	**I. ORIENTATION AND SAFETY (2 hours, lecture)** A. Safety procedures used in industry B. Application of lock out tag out C. Safe meter and tool usage **II. FUNDAMENTALS OF CONTROLS (8 hours, lecture)** A. Resistance in series circuits B. Current in series circuits C. Resistance in parallel circuits D. Power calculations E. Short circuit F. Open circuit G. Demonstration and use of electrical test instruments H. Control sequencing

	I. Energy efficient operation **III. AIR CONDITIONING CIRCUIT DESIGN (10 hours, lecture)** A. Symbols and matching components B. Loads: inductive, resistive 1. Line and low voltage 2. Single phase and three-phase cycles C. Introduction to electronic controls D. Motor control **IV. SCHEMATIC DIAGRAM INTERPRETATION (8 hours, lecture)** A. Heat cycle B. Cooling cycle C. Defrost control D. Relays and solenoids E. Electric/electronic controls introduction F. Energy efficiency controls introduction **V. GAS FURNACE (8 hours, lecture)** A. Operating and limit controls B. High limit C. Fan controls D. Sensors
Total Lecture Hours:	36
Total Laboratory Hours:	0
Total Hours:	36
Primary Method of Evaluation:	Skill demonstrations
Typical Assignment Using Primary Method of Evaluation:	After studying a process model, draw a one-page schematic wiring diagram for an air conditioning unit. Include the electrical/electronic controls, the air conditioning system, and the operation and efficiency of the model in the diagram. Submit diagram to the instructor.
Critical Thinking Assignment 1:	After examining an air conditioning schematic diagram, demonstrate to instructor troubleshooting techniques needed to solve and repair faults in an air conditioning system. Submit a diagnostic flowchart to the instructor.
Critical Thinking Assignment 2:	Given a process model, select and diagram the correct parameters and components for the proper sequence of operation for each air conditioning and refrigeration control system designated by the instructor. Submit diagram to the instructor.
Other Evaluation Methods:	Class Performance, Completion, Matching Items, Multiple Choice, Other (specify), Other Exams, Performance Exams, Quizzes, True/False, Written Homework
Instructional Methods:	Demonstration, Discussion, Group Activities, Lecture, Multimedia presentations, Role play/simulation
If other:	

Work Outside of Class:	Problem solving activity, Required reading, Skill practice, Study
If Other:	
Up-To-Date Representative Texts:	Andrew Althouse, Carl Turnquist, A.F. Bracciano, D. C. Bracciano and G. M. Bracciano. Modern Refrigeration and Air Conditioning. 22nd edition. Goodheart Willcox. 2025 The textbook is now available in printed text and digital formats.
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	Safety glasses Safety gloves
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Air Conditioning and Refrigeration-21
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Ability to read a multimeter.** ACR 21 - Define air conditioning and methods of achieving it. ACR 21 - Interpret and apply schematic wiring diagrams for air conditioning applications. ACR 21 - Measure and relate units of electricity. **Ability to check voltages with a multimeter.** ACR 21 - Complete a safety test with 100% accuracy. ACR 21 -Define air conditioning and methods of achieving it. ACR 21 - Diagnose operating and safety controls and switches. ACR 21 - Perform and log refrigeration system operations. **Understand schematic wiring diagrams.** ACR 21 - Measure and relate units of electricity. ACR 21 - Perform and log refrigeration system operations.
Requisite Skill:	or equivalent
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	ACR 30 is an electric controls class that focuses on HVACR equipment specifically. Without basic HVACR system, knowledge students would lack the knowledge necessary to fully understand the application and function of the controls reviewed in this course. This course builds on HVACR fundamentals.
Requisite course:	

Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
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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:	02/20/2024
Last Board Approval Date:	11/18/2024
Effective Term:	FALL 2025