AC R021L: ELECTRICAL SYSTEMS II LAB

Originator
aainsworth

College
Oxnard College

Discipline (CB01A)
AC - AirConditioning&Refrigeration

Course Number (CB01B)
R021L

Course Title (CB02)
Electrical Systems II Lab

Banner/Short Title
Electrical Systems II Lab

Credit Type
Credit

Start Term
Fall 2021

Formerly
ENVT R021L

Catalog Course Description
This course develops additional competency in the hands-on troubleshooting of mechanical problems in air conditioning and refrigeration systems through an understanding of the operating principles for electrical wiring systems used in air conditioning and refrigeration installations. It is recommended for persons who want to continue their development of electrical troubleshooting job skills in the air conditioning, heating and refrigeration industry through practice on live equipment. Together with the introductory electrical lab course (AC R020L), this course targets the service technician who wishes to develop a higher skill level in reading wiring diagrams, identifying electrical components, and electrical troubleshooting and repair skills. It is also applicable for students wishing to enter the industry in the capacity of installer, sales representative, maintenance technician, or designer.

Taxonomy of Programs (TOP) Code (CB03)
0946.00 - *Environmental Control Technology (HVAC)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
C (Not transferable)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Grading method
Letter Graded

Alternate grading methods
Credit by exam, license, etc.

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
17.5
Maximum Contact/In-Class Lecture Hours
17.5

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
70
Total Maximum Contact/In-Class Hours
70

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
35
Maximum Outside-of-Class Hours
35

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
105
Total Maximum Student Learning Hours
105

Minimum Units (CB07)
2
Maximum Units (CB06)
2

Prerequisites
AC R020L

Entrance Skills

Entrance Skills
Familiarization with and ability to use various techniques, electrical tools and equipment required of an HVAC technician including but not limited to: volt/ohm meters, wiring diagrams (read and draw)

Prerequisite Course Objectives
AC R020L-Use a volt-ohm meter to locate and repair electrical failures on all types of refrigeration and air conditioning systems.
AC R020L-Analyze, identify and resolve potential electrical malfunctions based on a given description of a failed sequence of operations for various air conditioning or refrigeration systems. Verify the fault using a volt- ohm meter or other electrical tester.
AC R020L-Draw a wiring diagram for a basic air conditioning or refrigeration system.

Requisite Justification

Requisite Type
Prerequisite

Requisite
AC R020L

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Given a description of a failed sequence of operations, the student will verify the electrical fault using a Volt-Ohm meter.
2	Draw a wiring diagram for an air conditioning or refrigeration system so that it can be used to re-wire the system.
3	Wire all three compressor starting relay circuits from memory.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Demonstrate, without instructor assistance, an advanced ability to troubleshoot and repair electrical failures on all types of refrigeration and air conditioning systems.
2	Analyze, identify and resolve potential electrical malfunctions for complex control systems (e.g. zone systems, energy management system) based on a given description of a failed sequence of operations. Verify the fault using a volt-ohm meter or other electrical tester.
3	Draw a wiring diagram for an air conditioning or refrigeration system and use it to re-wire the system. The system chosen will be inspected by the instructor to verify proper operation post wiring.
4	Wire all three refrigeration starting relay circuits by memory, without assistance from the instructor.

Course Content

Lecture/Course Content

1. Applied Electricity
   a. Interpreting and applying the national electrical code
   b. Measurement of analog and digital signals used in advanced process controllers
   c. Reading, drafting and interpreting complex wiring diagrams for specialty refrigeration systems
2. Circuits
   a. Installing and troubleshooting capacity control devices for complex refrigeration systems
   b. Troubleshooting sensors used in energy management systems
   c. Designing control systems
   d. Installation and troubleshooting of controllers for multi-zone systems
   e. Industrial and residential wiring practices
3. Specialty Systems
   a. Wiring and troubleshooting devices used with programmable logic controllers
   b. Installation and testing of variable frequency drives
   c. Using a megohmmeter to test circuit and motor winding quality
   d. Wiring photovoltaic cells (solar power)

Laboratory or Activity Content

The 21L lab class affords students an opportunity to get "hands on" experience/ training in the following.

1. Applied Electricity
   a. Interpreting and applying the national electrical code
   b. Measurement of analog and digital signals used in advanced process controllers
   c. Reading, drafting and interpreting complex wiring diagrams for specialty refrigeration systems
2. Circuits
   a. Installing and troubleshooting capacity control devices for complex refrigeration systems
   b. Troubleshooting sensors used in energy management systems
   c. Designing control systems

   d. Installation and troubleshooting of controllers for multi-zone systems
   e. Industrial and residential wiring practices
3. Specialty Systems
   a. Wiring and troubleshooting devices used with programmable logic controllers
   b. Installation and testing of variable frequency drives
   c. Using a megohmmeter to test circuit and motor winding quality
   d. Wiring photovoltaic cells (solar power)

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Laboratory activities
Objective exams
Other (specify)
Projects
Problem-Solving Assignments
Quizzes

Other

Textbook Assignments
Discussion Participation

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Class discussions
Demonstrations
Lecture

Describe specific examples of the methods the instructor will use:

- Classroom lecture: including equipment demonstrations followed by the student actually performing these procedures and electrical troubleshooting, for air conditioning and refrigeration systems, in the lab.
- Frequent quizzes and practice problems, pertaining to electrical concepts and systems for air conditioning and refrigeration systems, are used to stimulate student discussion.
- Reading and answering questions from chapters in the textbook provides students with information pertaining to various electrical concepts, equipment and service procedures used in the air conditioning and refrigeration field, and a means to check their comprehension of the information. In addition to the text, current literature related to electrical systems (solar, energy management) will be distributed as it becomes available.
- Class discussions, including electrical problems encountered by students working in the air conditioning and refrigeration field and those doing projects in the lab, are encouraged.

Representative Course Assignments

Writing Assignments

Students complete written homework that consists of answering questions and solving problems based on information presented during the class.

Critical Thinking Assignments

Students will be assigned problems describing specific electrical conditions for various types of systems with the expectation of using logic and reasoning to identify if a fault exists and if one exists, formulate a plan to correct the fault.

Reading Assignments

Reading and answering questions from chapters in the textbook provides students with information pertaining to various electrical concepts, equipment and service procedures, used in the air conditioning and refrigeration field, and a means to check their comprehension of the information. In addition to the text, current literature related to electrical systems (solar, energy management) will be distributed as it becomes available.

Wiring diagrams, specific to certain specialty air conditioning and refrigeration systems, are made available for students to acclimate them to actual field service work conditions.

Skills Demonstrations

Students will be expected, at a minimum, to demonstrate the ability to:

1. Given a description of a failed sequence of operations, the student will verify the electrical fault using a Volt-Ohm meter.
2. Draw a wiring diagram for an air conditioning or refrigeration system so that it can be used to re-wire the system.
3. Wire all three compressor starting relay circuits by memory.

Outside Assignments

Representative Outside Assignments

1. Reading
   a. Reading and answering questions from chapters in the textbook provides students with information pertaining to various electrical concepts, equipment and service procedures, used in the air conditioning and refrigeration field, and a means to check their comprehension of the information. In addition to the text, current literature related to electrical systems (solar, energy management) will be distributed as it becomes available.
   b. Wiring diagrams, specific to certain specialty air conditioning and refrigeration systems, are made available for students to acclimate them to actual field service work conditions.
2. Writing
   a. Students complete written homework that consists of answering questions and solving problems based on information presented during the class.

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Carter Stanfield and David Skaves (2017). *AHRI Fundamentals of HVACR* (3rd). Saddle River Pearson. 9780134016

Primary Minimum Qualification
AIR COND/REFRIG/HEATING

Review and Approval Dates

Department Chair
09/04/2020

Dean
09/06/2020

Technical Review
10/14/2020

Curriculum Committee
10/14/2020

Curriculum Committee
12/09/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000312513

DOE/accreditation approval date
MM/DD/YYYY