

# AC R020: ELECTRICAL SYSTEMS I

**Originator**  
aainsworth

**College**

Oxnard College

**Discipline (CB01A)**

AC - AirConditioning&Refrigeration

**Course Number (CB01B)**

R020

**Course Title (CB02)**

Electrical Systems I

**Banner/Short Title**

Electrical Systems I

**Credit Type**

Credit

**Start Term**

Fall 2021

**Formerly**

ENVT R020

**Catalog Course Description**

This course develops competency in the theoretical 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 develop or improve job skills in the air conditioning, heating and refrigeration industry. Together with the lab course (AC R020L), this course targets the service technician who wishes to develop skills 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**

52.5

**Maximum Contact/In-Class Lecture Hours**

52.5

**Activity**

**Laboratory**

**Total in-Class**

**Total in-Class**

**Total Minimum Contact/In-Class Hours**

52.5

**Total Maximum Contact/In-Class Hours**

52.5

**Outside-of-Class****Internship/Cooperative Work Experience**

Paid

Unpaid

**Total Outside-of-Class****Total Outside-of-Class****Minimum Outside-of-Class Hours**

105

**Maximum Outside-of-Class Hours**

105

**Total Student Learning****Total Student Learning****Total Minimum Student Learning Hours**

157.5

**Total Maximum Student Learning Hours**

157.5

**Minimum Units (CB07)**

3

**Maximum Units (CB06)**

3

**Student Learning Outcomes (CSLOs)****Upon satisfactory completion of the course, students will be able to:**

- |   |  |
|---|--|
| 1 | Identify the electrical components used in air conditioning and refrigeration systems, and state the function of each. |
| 2 | State how each of the electrical components in a wiring diagram contributes to the sequence of operation.              |

**Course Objectives****Upon satisfactory completion of the course, students will be able to:**

- |   |   |
|---|---|
| 1 | Identify the electrical components used in air conditioning and refrigeration systems, and state the function of each.  |
| 2 | Analyze and describe an air conditioning or refrigeration system's sequence of operation using an electrical wiring diagram provided by the instructor.   |
| 3 | State how each of the electrical components in a wiring diagram contributes to the sequence of operation in an air conditioning or refrigeration system.  |
| 4 | Analyze, identify and resolve potential electrical malfunctions based on a given description of a failed sequence of operations in an air conditioning or refrigeration system. Describe the method used to verify the fault. |

**Course Content****Lecture/Course Content**

1. Applied Electricity
  - a. Symbols
  - b. Circuits
  - c. Series/parallel
  - d. Terminology: volts, ohms, amps, farads

- e. Ladder diagrams
- f. Interconnection diagrams
- 2. Motors
  - a. Single phase
  - b. Three phase
  - c. Motor starting components
  - d. Motor protection devices
- 3. Control Components
  - a. Solenoid valves
  - b. Voltage relays
  - c. Current relays
  - d. Overloads
  - e. Timers and time delay relays
  - f. Defrost systems
  - g. Refrigeration safeties
  - h. Flow switches
  - i. Pressure switches
  - j. Control transformers
  - k. Room thermostats
- 4. Power Sources
  - a. Wye and Delta starting-three phase
  - b. Ground fault power interruption
  - c. Power transformers

#### Laboratory or Activity Content

None

#### 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

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):

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

Audio-visual presentations

Computer-aided presentations

Class discussions

Distance Education

Demonstrations

Group discussions

Instructor-guided use of technology

Lecture

Describe specific examples of the methods the instructor will use:

1. Classroom lecture including equipment demonstrations: Actual refrigeration system electrical components are displayed during the lecture. Electrical troubleshooting service procedures for air conditioning and refrigeration systems are demonstrated, giving the student the background to actually perform these procedures in the lab course.
2. Frequent quizzes and practice problems, pertaining to electrical concepts and systems for air conditioning and refrigeration systems, are used to stimulate student discussion.

3. 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.
4. Class discussions, including electrical problems encountered by students working in the air conditioning and refrigeration industry, are encouraged.

## **Representative Course Assignments**

### **Writing Assignments**

Students complete written homework that consists of end-of-chapter questions and solving problems, related to the air conditioning/ refrigeration industry, 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**

Students are asked to read specific chapters from the text in order to understand the electrical concepts, related to air conditioning and refrigeration systems, presented in the class.

## **Outside Assignments**

### **Representative Outside Assignments**

Reading: Students are asked to read specific chapters from the text in order to understand the electrical concepts, related to air conditioning and refrigeration systems, presented in the class.

Writing: Students complete written homework that consists of end-of-chapter questions and solving problems, related to the air conditioning/ refrigeration industry, 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

## Distance Education Addendum

### Definitions

#### Distance Education Modalities

Hybrid (51%–99% online)

Hybrid (1%–50% online)

100% online

## Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

## Regular Effective/Substantive Contact

### Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Frequent discussions will be used. Instructor will post a discussion topic such as "Describe the relationship between resistance and amperes in an electrical circuit" with expectations that each student will post a reply. In addition, each student will be expected to post a response to at least two of their classmates posts on the topic.
E-mail	Email will occasionally be used to notify students and to share study materials/ tools.
Other DE (e.g., recorded lectures)	Frequent use of recorded lectures pertaining to various aspects of air conditioning and refrigeration electrical systems/components.
Face to Face (by student request; cannot be required)	Face to face interactions will be offered for students needing help and for major exams.

### Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Students will be required to respond to one another with substantive comments with the intent of creating a dialog. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online.

Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: <ul style="list-style-type: none"> <li>• Recorded Lectures, Narrated Slides, Screencasts</li> <li>• Instructor created content</li> <li>• OC Online Library Resources</li> <li>• Canvas Peer Review Tool</li> <li>• Canvas Student Groups (Assignments, Discussions)</li> <li>• 3rd Party (Publisher) Tools (MyOpenMath)</li> <li>• Websites and Blogs</li> <li>• Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)</li> </ul>
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Recordings of all live sessions will be made available within the LMS. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

**100% online Modality:**

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Frequent discussions will be used. Instructor will post a discussion topic such as "Describe the relationship between resistance and amperes in an electrical circuit" with expectations that each student will post a reply. In addition, each student will be expected to post a response to at least two of their classmates posts on the topic.
E-mail	Email will be used to communicate with students and to share study materials/ tools.
Other DE (e.g., recorded lectures)	Frequent use of recorded lectures pertaining to various aspects of air conditioning and refrigeration electrical systems/components.

**Examinations****Hybrid (1%–50% online) Modality**

Online  
On campus

**Hybrid (51%–99% online) Modality**

Online  
On campus

**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**

CCC000247036

**DOE/accreditation approval date**

MM/DD/YYYY