AC R011L: AIR CONDITIONING AND REFRIGERATION II LAB

Originator
aainsworth

College
Oxnard College

Discipline (CB01A)
AC - AirConditioning&Refrigeration

Course Number (CB01B)
R011L

Course Title (CB02)
Air Conditioning and Refrigeration II Lab

Banner/Short Title
Air Cond & Refrig II Lab

Credit Type
Credit

Start Term
Fall 2021

Formerly
ENVT R011L

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 refrigeration. It is recommended as a second semester course for persons who want to develop or improve job skills in the air conditioning, heating and refrigeration industry. Together with the first semester lab course (AC R010L), this class targets the service technician who wishes to develop refrigeration 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 R010L

Entrance Skills

Entrance Skills
Familiarization with and ability to use various tools and equipment required of an HVAC technician including but not limited to: oxygen acetylene torches, refrigerant recovering systems, volt/ohm meters and refrigeration gauges.

Prerequisite Course Objectives
AC R010L-Form, solder, and silver braze copper piping systems.
AC R010L-Evacuate, recover, and recharge refrigerant in systems.
AC R010L-Troubleshoot and repair poorly-operating systems based on a learned understanding of optimal operating conditions compared to actual operating conditions.

Requisite Justification

Requisite Type
Prerequisite

Requisite
AC R010L

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	Students will demonstrate in a lab setting the ability to evacuate, recover and recharge refrigerant in a HVAC system, without instructor assistance.
2	Students will demonstrate in a lab setting the ability to wire starting relays by memory.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Demonstrate advanced skills in forming, soldering and brazing copper piping systems.
2	Safely evacuate, recover, and recharge refrigerant in systems without assistance from the instructor.
3	Perform advanced troubleshooting and repairs on poorly-operating systems based on an advanced understanding of air conditioning and refrigeration concepts and service techniques.
4	Demonstrate advanced electrical and mechanical troubleshooting skills for various air conditioning and refrigeration systems.

Course Content

Lecture/Course Content

1. Safety
   a. Safe use of hand tools and power equipment used in the HVACR industry
   b. Recognizing the safety issues related to servicing specialty refrigeration systems
2. Operating Conditions
   a. Pressure-temperature relationships for specialty refrigeration systems (e.g. cascade systems)
   b. Tuning/ adjusting multistage air conditioning systems
   c. Setting and troubleshooting capacity control devices for air conditioning and refrigeration systems
   d. Troubleshooting and servicing various types of kitchen refrigeration systems including ice machines
3. Piping and Charging
   a. Proper installation techniques of specialty devices including CPR, EPR and HGB valves
   b. Proper piping techniques for advanced refrigeration systems including supermarket systems
   c. Piping techniques for multilevel systems including the sizing and installation of oil traps
   d. Piping system design for large refrigeration chillers using external water towers
   e. Introduction to plumbing and HVAC code requirements
   f. Retrofit techniques required for systems using the new environmentally friendly refrigerants
   g. Proper service techniques for ultra low temperature refrigeration systems
   h. Charging systems that use capacity control devices
4. Expansion Devices
   a. Electronic metering devices
   b. Setting thermostatic expansion valves and CPR valves on multiple evaporator systems

Laboratory or Activity Content

The 11L lab class affords students an opportunity to get "hands on" experience/ training in the following.

1. Safety
   a. Safe use of hand tools and power equipment used in the HVACR industry
   b. Recognizing the safety issues related to servicing specialty refrigeration systems
2. Operating Conditions
   a. Pressure-temperature relationships for specialty refrigeration systems (e.g. cascade systems)
   b. Tuning/ adjusting multistage air conditioning systems

c. Setting and troubleshooting capacity control devices for air conditioning and refrigeration systems
d. Troubleshooting and servicing various types of kitchen refrigeration systems including ice machines

3. Piping and Charging
   a. Proper installation techniques of specialty devices including CPR, EPR and HGB valves
   b. Proper piping techniques for advanced refrigeration systems including supermarket systems
   c. Piping techniques for multi level systems including the sizing and installation of oil traps
   d. Piping system design for large refrigeration chillers using external water towers
   e. Introduction to plumbing and HVAC code requirements
   f. Retrofit techniques required for systems using the new environmentally friendly refrigerants
   g. Proper service techniques for ultra low temperature refrigeration systems
   h. Charging systems that use capacity control devices
4. Expansion Devices
   a. Electronic metering devices
   b. Setting thermostatic expansion valves and CPR valves on multiple evaporator systems

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
Skills demonstrations

Other

Textbook Assignments
Discussion Participation

Instructional Methodology

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

Class discussions
Demonstrations
Laboratory activities
Lecture

Describe specific examples of the methods the instructor will use:

1. Classroom lecture, including equipment demonstrations, followed by student performance of advanced lab projects and actual repair assignments on specialty air conditioning and refrigeration systems.
2. Reading and answering questions from chapters in the textbook and advanced materials handed out as necessary. Reviewing the chapters read during AC R011L affords students the opportunity to better understand service techniques used in the air conditioning and refrigeration field. Service manuals from various specialty systems (ice machines, super market systems, freeze driers) are made available for students to increase their knowledge of the service techniques and operating concepts taught in AC R010 and AC R010L.
3. Frequent quizzes related to advanced techniques and equipment used in the air conditioning and refrigeration field are used to stimulate student discussion.
4. Class discussions pertaining to air conditioning and refrigeration problems encountered by students doing projects in the lab are encouraged.

Representative Course Assignments

Writing Assignments

For review purposes, students complete written homework that consists of answering end-of-chapter questions. In addition, advanced lab students will be expected to solve, in writing, various electrical, refrigeration and air conditioning problems presented during the class.

Critical Thinking Assignments

Students will be assigned problems describing specific mechanical 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

1. Students are asked to read the chapters assigned in order to understand more thoroughly the concepts, pertaining to specialty air conditioning and refrigeration systems, presented in the class.
2. Current service manuals and literature, specific to specialized air conditioning and refrigeration systems, are made available for students to help them better understand the operating sequence of these systems in preparation for actual field service work conditions.

Skills Demonstrations

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

1. Evacuate, recover and recharge refrigerant in a HVAC system, without instructor assistance.
2. Wire starting relays by memory.

Outside Assignments

Representative Outside Assignments

1. Reading
   a. Students are asked to read the chapters assigned in order to understand more thoroughly the concepts, pertaining to specialty air conditioning and refrigeration systems, presented in the class.
   b. Current service manuals and literature, specific to specialized air conditioning and refrigeration systems, are made available for students to help them better understand the operating sequence of these systems in preparation for actual field service work conditions.
2. Writing
   a. For review purposes, students complete written homework that consists of answering end-of-chapter questions. In addition, advanced lab students will be expected to solve, in writing, various electrical, refrigeration and air conditioning problems 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
CCC000194510

DOE/accreditation approval date
MM/DD/YYYY