

AC R040L: HEATING AND CONTROL SYSTEMS LAB

Originator
aainsworth

College

Oxnard College

Discipline (CB01A)

AC - AirConditioning&Refrigeration

Course Number (CB01B)

R040L

Course Title (CB02)

Heating and Control Systems Lab

Banner/Short Title

Heating & Control Systems Lab

Credit Type

Credit

Start Term

Fall 2021

Formerly

ENVT R040L

Catalog Course Description

This course develops competency in the hands-on troubleshooting of mechanical and electrical problems in heating systems through an understanding of the operating principles of heating and furnace electrical control circuits. It is recommended for persons who want to develop or improve job skills in the heating segment of the air conditioning, heating and refrigeration industry. Together with the lecture course (AC R040), this course targets the service technician who wishes to develop skills in designing and troubleshooting heating systems and controls. 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)

D - Possibly 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

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

- | | |
|---|---|
| 1 | Identify the various types of mechanical combustion problems, and demonstrate how each is remedied. |
| 2 | Read electrical control diagrams for various heating systems and wire these systems in accordance with the diagram. |
| 3 | Use electrical control diagrams to troubleshoot heating systems with operating problems. |
| 4 | Identify the types of heating and controls systems commonly used in building heating applications. |

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

- | | |
|---|--|
| 1 | Identify from actual equipment each of the types of heating and controls systems that are commonly encountered in building heating applications. |
| 2 | Identify the various types of mechanical combustion problems, and demonstrate how each is remedied. |
| 3 | Read electrical control diagrams and wire systems in accordance with the diagrams. |
| 4 | Use electrical control diagrams to troubleshoot heating systems with operating problems. |

Course Content

Lecture/Course Content

1. Troubleshooting Gas-fired Furnaces
 - a. Combustion process
 - b. Heat exchangers
 - c. Pilot safeties
 - d. Fan controls
 - e. Millivolt systems
 - f. Electronic ignition systems
 - g. Reading/ interpreting electrical schematics
2. Troubleshooting Pumps and Piping from manufacturers' data
 - a. Pressure drop
 - b. Pump curves
3. Troubleshooting Other Heating Systems
 - a. Steam piping and accessories
 - b. Oil burners
 - c. Solar heating and storage
 - d. Boilers

Laboratory or Activity Content

The 40L lab class affords students an opportunity to get "hands on" experience/ training in the following.

1. Troubleshooting Gas-fired Furnaces
 - a. Combustion process
 - b. Heat exchangers
 - c. Pilot safeties
 - d. Fan controls
 - e. Millivolt systems
 - f. Electronic ignition systems
2. Troubleshooting Pumps and Piping from manufacturers' data
 - a. Pressure drop
 - b. Pump curves
3. Troubleshooting Other Heating Systems
 - a. Steam piping and accessories
 - b. Oil burners
 - c. Solar heating and storage
 - d. Boilers

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
Skills demonstrations

Other

Textbook Assignments

Instructional Methodology

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

Audio-visual presentations

Class discussions
Demonstrations
Laboratory activities
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 troubleshooting, in the lab class.
- Frequent quizzes and practice problems are used to stimulate student discussion.
- Class discussion, including problems encountered by students presently working in the field, are encouraged.
- Lab exercises: Instructor demonstrates a particular task after which the student practices the task until the instructor deems them proficient in performing the task.

Representative Course Assignments

Writing Assignments

Students complete written homework that consists of end-of-chapter questions, and solving problems presented during the class.

Critical Thinking Assignments

Students will be assigned problems describing specific conditions for various types of heating 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 assigned chapters in the text and handouts provided by the instructor.

Skills Demonstrations

Identify the various types of mechanical combustion problems, and demonstrate how each is remedied.

Read electrical control diagrams for various heating systems and wire these systems in accordance with the diagram.

Use electrical control diagrams to troubleshoot heating systems with operating problems.

Identify the types of heating and controls systems commonly used in building heating applications.

Outside Assignments

Representative Outside Assignments

Reading: Students are assigned chapters in the text and handouts provided by the instructor.

Writing: Students complete written homework that consists of end-of-chapter questions, and solving 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

CCC000284333

DOE/accreditation approval date

MM/DD/YYYY