

AC R040: HEATING AND CONTROL SYSTEMS

Originator
aainsworth

College

Oxnard College

Discipline (CB01A)

AC - AirConditioning&Refrigeration

Course Number (CB01B)

R040

Course Title (CB02)

Heating and Control Systems

Banner/Short Title

Heating and Control Systems

Credit Type

Credit

Start Term

Fall 2021

Formerly

ENVT R040

Catalog Course Description

This course develops competency in the theoretical troubleshooting of mechanical and electrical problems in heating systems through an understanding of the operating principles for 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 lab course (AC R040L), 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)

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 | Diagnose a mechanical combustion problem with a heating system. |
| 2 | List and describe the various types of heating system used in building heating application. |
| 3 | Summarize a solution to a specific mechanical combustion problem. |

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

- | | |
|---|---|
| 1 | Describe each of the types of heating and control systems that are commonly encountered in building heating applications. |
| 2 | Identify the various types of mechanical combustion problems, and state how each is remedied. |
| 3 | Read electrical control diagrams for various heating systems and explain the sequence of operation. |
| 4 | Use electrical control diagrams to troubleshoot heating systems with operating problems. |

Course Content**Lecture/Course Content**

1. Gas-fired Furnaces
 - a. Combustion process
 - b. Heat exchangers
 - c. Pilot safeties
 - d. Fan controls
 - e. Millivolt systems

- f. Electronic ignition systems
- g. Reading electrical schematics
- 2. Pumps and Piping
 - a. Pressure drop
 - b. Pump curves
 - c. Impellor type and size
 - d. End suction and double suction pumps
 - e. Water treatment and fouling
- 3. Other Heating Systems
 - a. Steam piping and accessories
 - b. Oil burners
 - c. Solar heating and storage
 - d. Boilers

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

Class discussions

Distance Education

Demonstrations

Group discussions

Lecture

Describe specific examples of the methods the instructor will use:

- Classroom lecture and equipment demonstrations: Actual heating system components are displayed during the lecture pertaining to those components used in residential and commercial heating systems. Troubleshooting service procedures for various heating systems are demonstrated, giving the student the background to actually perform these procedures in the lab class.
- Frequent quizzes and practice problems, related to concepts and equipment used in heating systems, are used to stimulate student discussion.
- Class discussions related to various types of residential and commercial heating systems, including problems encountered by students presently working in the field, are encouraged.

Representative Course Assignments

Writing Assignments

Students complete written homework that consists of end-of-chapter questions and solving problems, related to various heating systems, 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.

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, related to various heating systems, 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

Resource Type

Other Instructional Materials

Description

DVDs from NOVA and the History Channel that pertain to HVAC concepts.

Resource Type

Other Instructional Materials

Description

Instructional websites including www.hvactc.com and www.natex.org.

Resource Type

Other Instructional Materials

Description

Troubleshooting guides, manuals, and schematics from HVAC vendors.

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 present a topic such as "Describe the sequence of operation for a gas furnace that uses a hot surface igniter" 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 provide study materials/tools.
Face to Face (by student request; cannot be required)	Face to face interactions will be offered to students needing help and for major exams.

Other DE (e.g., recorded lectures) Frequent use of recorded lectures pertaining to various aspects of heating systems.

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:

- Recorded Lectures, Narrated Slides, Screencasts
- Instructor created content
- OC Online Library Resources
- Canvas Peer Review Tool
- Canvas Student Groups (Assignments, Discussions)
- 3rd Party (Publisher) Tools (MyOpenMath)
- Websites and Blogs
- Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)

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 present a topic such as "Describe the sequence of operation for a gas furnace that uses a hot surface igniter" 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 provide study materials/tools.

Other DE (e.g., recorded lectures)

Frequent use of recorded lectures pertaining to various aspects of heating systems.

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

CCC000268532

DOE/accreditation approval date

MM/DD/YYYY