

# AT R170: AUTOMOTIVE AIR CONDITIONING

## Originator

kevin\_corse1

## College

Oxnard College

## Discipline (CB01A)

AT - Automotive Technology

## Course Number (CB01B)

R170

## Course Title (CB02)

Automotive Air Conditioning

## Banner/Short Title

Automotive Air Conditioning

## Credit Type

Credit

## Start Term

Fall 2021

## Catalog Course Description

This course provides a comprehensive study of the principles of operation and theory of automotive air conditioning. This course offers a study of design features of each manufacturer to include servicing, troubleshooting, diagnosis and system repair. Students will be given practical skills for servicing, repair, and diagnosis.

## Taxonomy of Programs (TOP) Code (CB03)

0948.00 - \*Automotive Technology

## Course Credit Status (CB04)

D (Credit - Degree Applicable)

## Course Transfer Status (CB05) (select one only)

B (Transferable to CSU only)

## 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**

35

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

35

**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**

87.5

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

87.5

**Outside-of-Class**

**Internship/Cooperative Work Experience**

**Paid**

**Unpaid**

**Total Outside-of-Class**

**Total Outside-of-Class**

**Minimum Outside-of-Class Hours**

70

**Maximum Outside-of-Class Hours**

70

**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

**Advisories on Recommended Preparation**

AT R110

**Student Learning Outcomes (CSLOs)**

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

- |   |                                                                                                                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Correctly assess the performance of the common automobile air conditioning system                                                                                                                               |
| 2 | Identify and comprehend environmental safety rules and regulations, in the following areas. Shop safety, personal safety, hazardous material safety, air bag safety, power tools, and typical equipment safety. |
| 3 | Correctly determine a vehicle has reached proper operating temperature.                                                                                                                                         |

**Course Objectives**

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

- |    |                                                                       |
|----|-----------------------------------------------------------------------|
| 1  | Identify safety hazards of refrigerant and personal safety equipment  |
| 2  | Describe and demonstrate proper customer relations                    |
| 3  | Explain the principles of air conditioning systems                    |
| 4  | Perform the proper steps to calibrate shop diagnostic equipment       |
| 5  | Explain the differences between R-12 and the new R-134 refrigerants   |
| 6  | Compare the conventional and electronic temperature control systems   |
| 7  | Explain the refrigerant oils and related chemicals                    |
| 8  | Identify engine cooling systems and vehicle heaters                   |
| 9  | Explain the evaporators, condensers, accumulators, and receiver-dries |
| 10 | Identify compressors, clutches and drive components                   |

## Course Content

### Lecture/Course Content

1. Safety Rules
  1. Protective eye goggles
  2. Discharging refrigerants
  3. Refrigerant storage area
  4. High system pressure precautions
2. Basic Principles of Refrigeration
  1. State of matter
  2. Heat and matter
  3. Pressure and heat
  4. Refrigerants types
3. Basic Refrigeration Cycle
  1. Compression
  2. Condensation
  3. Expansion
  4. Evaporation
4. Refrigerants and Oils
  1. Pressure temperature relationships
  2. Handling refrigerants
  3. Moisture in system
  4. Refrigerant oil
5. Basic Air Conditioning Components
  1. Compressor
  2. Condenser
  3. Evaporator
  4. Receiver- dehydrator
  5. Thermostat and magnetic clutch systems
  6. By-pass system
  7. Suction throttling regulators
6. Lines and Connections
  1. Suction line-cold
  2. Discharge line-hot
  3. Hot gas bypass line
7. Service Equipment
  1. Gauge and manifold set
  2. Service valves
  3. Leak detectors
  4. Vacuum pump
  5. Charging station
  6. Service hand tools
  7. Protective eye goggles
8. Types of Air Conditioning Systems
  1. Automotive
  2. Recreational vehicles
  3. Buses application
9. Troubleshooting
  1. Customer complaints
  2. Abnormal pressure gauge readings
  3. Diagnosing system tests

### Laboratory or Activity Content

The following are examples of lab content for this course:

Press/Temp/Weight Conversions

ID HVAC Components

Complete Work Order

HVAC System Inspect CA

Diagnose Noise

ID System Refrigerant

Check for Sealant

Check System Pressure W/Gauge

A/C Performance Test  
Test Condenser Performance  
Test Evaporator Performance  
Check Expansion Device Op.  
Verify Charge, OT  
Verify Charge, Delta T  
Verify Charge, Sub-cooling  
A/C Leak Check, Electronic  
A/C Stress Test  
Check Heater System  
Test Mode Door Operation  
R&R Cabin Filter  
DVOM Usage  
Test A/C Clutch  
Bench Test A/C Clutch  
Test HVAC Blower Circuit  
Test Cooling Fan Circuit  
Test ATC Controls  
Test ATC Sensors/Actuators  
Recover Refrigerant  
Recycle Refrigerant  
Evacuate A/C System  
Charge A/C System  
Add Oil to A/C System  
R & R A/C Compressor  
R&R Compressor Clutch  
Compressor Bench Checks  
Check Compressor Oil Level  
R & R Refrigerant Hose  
R&R Accumulator  
R & R Major A/C Component  
Inspect Cooling System  
Inspect Coolant  
Exchange Coolant  
Inspect Fan/Clutch  
Pressure Test Rad. Cap/Cool System  
Test T-Stat  
Test for Combustion Leak  
R & R Hose (Do Not Cut!)  
R&R Drive Belt

## 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  
Written expression

**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):**

Essay exams  
Individual projects  
Objective exams  
Portfolios  
Quizzes

Research papers  
Skills demonstrations  
Skill tests

## **Instructional Methodology**

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

Audio-visual presentations  
Class activities  
Class discussions  
Case studies  
Distance Education  
Demonstrations  
Field trips  
Guest speakers  
Internet research  
Lecture

### **Describe specific examples of the methods the instructor will use:**

Classroom demonstrations and equipment practice will enhance the textbook work.

Instructor will present a problem a vehicle is having with their automotive air conditioning system. Instructor will facilitate student learning by explaining the theory of Air conditioning and its behavior as a sub system in the automobile.

Students then research possible problems and instructor demonstrates the proper procedure and the student gains valuable knowledge.

## **Representative Course Assignments**

### **Writing Assignments**

1. Students will be required to answer questions at the end of each chapter, all tests include essay questions.

### **Critical Thinking Assignments**

1. Understand latent heat transfer.
2. Understand the chemical make up of refrigerant.
3. Understand the pressure changes in the air conditioning system.
4. Identify the 5 major components of air conditioning system.

### **Reading Assignments**

1. Students will be required to do outside readings in professional journals such as Motor Age Magazine and Motor Service Journal in addition to the textbook assignments.

### **Skills Demonstrations**

1. Use of proper evacuation equipment.
2. Use of proper charging system equipment.
3. Monitoring pressure systems while on/off.
4. Proper use and care of refrigerant.
5. Repair of defective equipment.

### **Other assignments (if applicable)**

1. Students will access internet websites such as the State of California Bureau of Automotive Repair and Department of Consumer Affairs for additional information.

## **Outside Assignments**

### **Representative Outside Assignments**

1. Students will complete certification for the handling and storage of refrigerant.
2. Students will research chemical information and locate SDS sheets for the proper care and storage of two of the most popular refrigerants.

**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**

James Halderman (2018).Automotive Heating and Air conditioning.

Book ISBN: 9780134603698

eBook ISBN: 9780134603889

Printed Task Sheets ISBN: 9780134603780.

**Distance Education Addendum****Definitions****Distance Education Modalities**

Hybrid (51%–99% online)

Hybrid (1%–50% 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)	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. 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)	Students will have direct face-to-face contact with instructor during weekly class meetings. This time will provide the opportunity for students to discuss and ask questions about the material to facilitate student learning objectives and course outcomes. The instructor will also hold weekly, scheduled office hours 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. Note: For hybrid classes, face-to-face class time will provide opportunities for students to discuss amongst themselves (in groups or pairs) and ask questions about the material to facilitate SLOs and course outcomes.
Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools andFaculty 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: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o OC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.) media integrated within the learning management system to help students reach SLO competency. Tools may include: o Recorded Lectures, Narrated Slides, Screencasts o Instructor created content o OC Online Library Resources o Canvas Peer Review Tool o Canvas Student Groups (Assignments, Discussions) o 3rd Party (Publisher) Tools (MyOpenMath) o Websites and Blogs o 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

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

### Hybrid (51%–99% online) Modality:

#### Method of Instruction

#### Document typical activities or assignments for each method of instruction

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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. 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.

## Examinations

### Hybrid (1%–50% online) Modality

Online  
On campus

### Hybrid (51%–99% online) Modality

Online  
On campus

## Primary Minimum Qualification

AUTOMOTIVE TECHNOLOGY

## Review and Approval Dates

### Department Chair

12/02/2020

### Dean

12/02/2020

### Technical Review

12/09/2020

### Curriculum Committee

12/09/2020

### CCCCO

MM/DD/YYYY

### Control Number

CCC000613468

### DOE/accreditation approval date

MM/DD/YYYY