

JEFFERSON COLLEGE

COURSE SYLLABUS

AUT251

AUTOMOTIVE HEATING AND AIR CONDITIONING SYSTEMS

2 Credit Hours

Prepared by: Gary Boyher
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Revised by: Brad Berrey
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AUT251 Automotive Heating and Air Conditioning Systems

I. CATALOGUE DESCRIPTION

- A. Pre-requisite: AUT221 Advanced Electrical/Electronics Systems with a Grade of “C” or Better
 AUT222 Advanced Electrical/Electronics Systems Lab with a Grade of “C” or Better
 Reading Proficiency
 Co-requisite: AUT252 Automotive Heating and Air Conditioning Systems Lab
- B. 2 Credit Hours
- C. Automotive Heating and Air Conditioning Systems involves the theory and operation of the heating systems, the mechanical refrigeration systems, and the electrical and vacuum control systems used on automobiles. Completion of this course will prepare the student for employment in the automotive field and take the National Institute for the Heating & Air Conditioning test (A7). (S)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

A. A/C System Diagnosis and Repair		
Demonstrate understanding of completing a work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of identifying and interpreting heating and air conditioning concern; determine necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of researching applicable vehicle and service information, such as heating and air conditioning system operation, vehicle service history, service precautions, and technical service bulletins	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of locating and interpreting vehicle and major component identification numbers	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

Demonstrate understanding of performance testing an A/C system; identify A/C system malfunctions	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of identifying abnormal operating noises in the A/C system; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of identifying refrigerant type; selecting and connecting proper gauge set; record temperature and pressure readings	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of leak testing A/C system; determine necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting the condition of refrigerant oil removed from the system; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of determining recommended oil and oil capacity for system application	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of using a scan tool, observe and record related HVAC data and trouble codes	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

B. Refrigeration System Component Diagnosis and Repair

Demonstrate understanding of diagnosing A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
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Demonstrate understanding of inspecting and replacing A/C compressor drive belts, pulleys, and tensioners; determine necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting, testing, and/or replacing A/C compressor clutch components and/or assembly; check compressor clutch air gap and adjust as needed	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing, inspecting, and reinstalling A/C compressor and mountings; determine required oil quantity	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of the need for an additional A/C system filter; perform necessary action	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing and inspecting A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting A/C condenser for airflow restrictions; perform necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing, inspecting, and reinstalling receiver/drier or accumulator/drier; determine required oil quantity	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing, inspecting, and installing expansion valve or orifice (expansion) tube	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting evaporator housing water drain; perform necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

Demonstrate understanding of removing, inspecting, and reinstalling evaporator; determine required oil quantity	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing, inspecting, and reinstalling condenser; determine required oil quantity	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair		
Demonstrate understanding of diagnosing temperature control problems in the heater/ventilation system; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of performing cooling system pressure tests; check coolant condition, inspect and test radiator, cap (pressure/vacuum), coolant recovery tank, and hoses; perform necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting engine cooling and heater system hoses and belts; perform necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting, testing, and replacing thermostat and gasket/seal	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of determining coolant condition and coolant type for vehicle application; drain and recover coolant	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of flushing system; refilling system with recommended coolant; bleeding system	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting and testing cooling fan, fan clutch, fan shroud, and air dams; perform necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

Demonstrate understanding of inspecting and testing electric cooling fan, fan control system and circuits; determine necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding inspecting and testing heater control valve(s); perform necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of removing, inspecting, and reinstalling heater core	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

D. Operating Systems and Related Controls Diagnosis and Repair

Demonstrate understanding of diagnosing malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting and testing A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of testing and diagnosing A/C compressor clutch control systems; determine necessary action	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting and testing A/C-heater control panel assembly; determine necessary action	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

Demonstrate understanding of inspecting and testing A/C-heater control cables, motors, and linkages; perform necessary action	P-3	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of inspecting A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of identifying the source of A/C system odors	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of checking operation of automatic or semi-automatic heating, ventilation, and air- conditioning (HVAC) control systems; determine necessary action	P-2	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

E. Refrigerant Recovery, Recycling, and Handling

Demonstrate understanding of performing correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of identifying and recovering A/C system refrigerant	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of recycling, labeling, and storing refrigerant	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests
Demonstrate understanding of evacuating and charging A/C system; add refrigerant oil as required	P-1	Classroom Discussions Lectures Classroom Exercises Reading Assignments Written Tests

III. OUTLINE OF TOPICS

- A. AC System Diagnosis and Repair
 - 1. Explain how to complete a work order properly
 - 2. Explain locating proper vehicle service information
 - 3. Explain proper procedures for routine service and maintenance of an AC system

- B. Refrigeration System Component Diagnosis and Repair
 - 1. Describe the proper procedures for diagnosis and repair of an AC system
 - 2. Explain the procedures for replacing AC components
 - 3. Describe different customer concerns regarding an AC system

- C. Heating, Ventilation, and Engine Cooling System Diagnosis and Repair
 - 1. Explain the process of diagnosing ventilation and cooling systems
 - 2. Describe locating proper diagnostic/service procedures
 - 3. Explain inspection and testing of the cooling system
 - 4. Describe the procedures used in replacing cooling system components

- D. Operating System and Related Controls Diagnosis and Repair
 - 1. Describe locating the proper diagnostic procedures for heater controls
 - 2. Explain the process of diagnosing heater controls
 - 3. Describe the procedures used in replacing/repairing heater control components

- E. Refrigerant Recovery, Recycling, and Handling
 - 1. Describe the correct usage of approved recovery/recycling equipment
 - 2. Describe identifying the type of refrigerant used in a vehicle
 - 3. Explain proper procedures for labeling and storing refrigerant
 - 4. Describe evacuation and recharge of an AC system

IV. METHOD(S) OF INSTRUCTION

- A. Lectures

- B. Electude/Argo Online Curriculum

- C. Classroom Exercises

- D. Classroom Discussion

V. REQUIRED TEXTBOOK(S)

None

VI. REQUIRED MATERIALS

- A. Jefferson College Automotive Technology or Approved Sponsoring Shop Workshirt
- B. Safety Glasses
- C. Work Boots

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHODS OF EVALUATION

- A. 33 1/3% Student Participation
- B. 33 1/3% Tests
- C. 33 1/3% Class Assignments

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College Website <http://www.jeffco.edu>).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.