



CENTRAL PIEDMONT COMMUNITY COLLEGE

Course Syllabus AUT-171-10 Automotive Heating and Air Conditioning GM-ASEP

Syllabus Contents:

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Time Requirements:

- **16 Weeks**
- **6 Hours Minutes Class/Lab Hours per Week**
- **3 Semester Hours Credit**

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Office hours: By appointment

**GM ASEP
AUTOMOTIVE HEATING AND AIR CONDITIONING**

Prerequisites: None

Course Description:

This course covers the theory of refrigeration and heating, electrical/electronic/pneumatic controls, and diagnosis/repair of climate control systems. Topics include diagnosis and repair of climate control components and systems, recovery/recycling of refrigerants, and safety and environmental regulations. Upon completion, students should be able to describe the operation diagnose, and safely service climate control systems using appropriate tools, equipment, and service information.

This Course Requires The Taking Of The Air Conditioning Refrigerant Handling Test. The Test Is Provided By MACS. This Is In Compliance With Section 609 Of The Clean Air ACT. The Cost For The Test Is \$15.00 for Students.

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AUT 171-10
GM ASEP
AUTOMOTIVE HEATING AND AIR CONDITIONING

For every task in Heating and Air Conditioning, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

A. A/C System Diagnosis and Repair

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
12. Identify and interpret heating and air conditioning concern; determine necessary action. P-1
23. Research applicable vehicle and service information, such as heating and air conditioning system operation, vehicle service history, service precautions, and technical service bulletins P-1
34. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). P-1
45. Performance test A/C system; diagnose A/C system malfunctions using principles of refrigeration. P-1
56. Diagnose abnormal operating noises in the A/C system; determine necessary action. P-2
67. Identify refrigerant type; select and connect proper gauge set; record pressure readings. conduct a performance test of the A/C system; determine necessary action. P-1
78. Leak test A/C system; determine necessary action. P-1
89. Inspect the condition of discharged oil; determine necessary action. P-2
910. Determine recommended oil for system application. P-1
1011. Using scan tool, observe and record related HVAC data and trouble codes. P-1

B. Refrigeration System Component Diagnosis and Repair

1. Compressor and Clutch

1. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action. P-2
2. Inspect and replace A/C compressor drive belts; determine necessary action. P-2P-1
3. Inspect, test, and/or replace A/C compressor clutch components and/or assembly. P-2
4. Remove, inspect, and reinstall A/C compressor and mountings; measure determine required oil quantity.; determine necessary action. P-1
5. Identify hybrid vehicle AC system electrical circuits, service and safety precautions. P-3

2. Evaporator, Condenser, and Related Components

1. Determine need for an additional A/C system filter; perform necessary action. P-3

2. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action. P-2
3. Inspect A/C condenser for airflow restrictions; perform necessary action. P-1
4. Remove, inspect, and reinstall receiver/drier or accumulator/drier; measure determine required oil quantity.; determine necessary action. P-1
5. Remove and install expansion valve or orifice (expansion) tube. P-2P-1
6. Inspect evaporator housing water drain; perform necessary action. P-3
7. Remove, inspect, and reinstall evaporator; measure determine required oil quantity.; determine necessary action. P-3
8. Remove, inspect, and reinstall condenser; measure determine required oil quantity.; determine necessary action. P-3

C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

1. Diagnose temperature control problems in the heater/ventilation system; determine necessary action. P-2
2. Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action. Perform cooling system pressure tests; check coolant condition, inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1
3. Inspect engine cooling and heater system hoses and belts; perform necessary action. P-1
4. Inspect, test, and replace thermostat and housing gasket. P-1
5. Determine coolant condition and coolant type for vehicle application; drain and recover coolant. P-1
6. Flush system; refill system with recommended coolant; bleed system. P-1
7. Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action. P-1
8. Inspect and test electric cooling fan, fan control system and circuits; determine necessary action. P-1
9. Inspect and test heater control valve(s); perform necessary action. P-2
10. Remove, inspect, and reinstall heater core. P-3

D. Operating Systems and Related Controls Diagnosis and Repair

1. Diagnose malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action. P-2
2. Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action. P-1
3. Test and diagnose A/C compressor clutch control systems; determine necessary action. P-1
4. Diagnose malfunctions in the vacuum, and mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action. P-2
5. Inspect and test A/C-heater control panel assembly; determine necessary action. P-3
6. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action. P-3

7. Inspect A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action. P-3

8. Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action. P-3

E. Refrigerant Recovery, Recycling, and Handling

1. Perform correct use and maintenance of refrigerant handling equipment. P-1

2. Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant. P-1

3. Recycle refrigerant. P-1

4. Label and store refrigerant. P-1

5. Test recycled refrigerant for non-condensable gases. P-1

6. Evacuate and charge A/C system. P-1

WEEKLY OUTLINE
AUT 171-10
AUTOMOTIVE HEATING AND AIR CONDITIONING
GM ASEP

**REQUIRED TEXT: Today's Technician – Automotive Heating and Air Conditioning
4th Edition**

BY: MARK SCHNUBEL

WEEK 1 Orientation: Review course syllabus, grading policy, and safety regulations.

- **Reading Assignment: Chapter 1 and 2 Classroom and shop manual**

Week 2 **Test Chapter 1 and 2 Reading Assignment: MACS Booklet**

- A/C Certification

Week 3 History, Refrigerants and the Environment
Shop

Reading Assignment: Chapter 3 Classroom and shop manual

Week 4 Test on chapter 3 –

Week 5 Temperature and Pressure fundamental

Reading Assignment: Chapter 4 Classroom

MACS TEST

Engine cooling and heating

1. Sources of Heat
2. Ventilation
3. Heating

Week 6 Test on chapter 4

Week 7 Reading Assignment: Chapter 5 Classroom

Week 8 Test on Chapter 5

Week 9 Air Conditioning Components

Reading Assignment: Chapter 6 Classroom

Class A/C System Testing

1. Testing A/C Efficiency
2. Air Discharge Temperature
3. Clutch Cycling Times

4. Pressure Testing
5. Static Pressure Reading
6. Operating Performance Test

Week 10 Test on chapter 6

Week 11 Reading Assignment: Chapter 7 Classroom

Week 12 Test on Chapter 7

Week 13 Reading Assignment: Chapter 10 Classroom

Week 14 Test on Chapter 10

Week 15 A/C System Diagnoses and Leak Detection

1. Common A/C component problems
2. Refrigerant Oils
3. Evaporator, Restriction device and Compressor Problems
4. Tools for leak detection
5. Location of Leaks

Week 16 A/C case and ducts chapter 9

Shop Finalize all repairs, Clean shop



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STUDENT GRADE POINT AVERAGE

Students will be graded according to the following grade point system.

Grade	Point Value	Description
A	4	Excellent
B	3	Very Good
C	2	Satisfactory
D	1	Poor
F	0	Failing

The following grades will not be used in computing the grade point average.

I = Incomplete		W = Withdrawal
S = Satisfactory		U = Unsatisfactory
AUD = Audit		N = Never Attended
X = Credit by Examination		

- **Since this course is preparatory to entering the automotive service industry, job attitude, neatness, promptness and care of equipment will be considered part of the final grade. The final grade on these items will be determined by the instructor and based upon accepted industry standards.**

GRADING

1. FOR A GRADE OF "A":

- Complete all written tests with an average of 93% to 100%.
- Attend 90% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined EXCELLENT in an actual shop.

2. FOR A GRADE OF "B":

- Complete all written test with an average of 85% to 92%.
- Attend 85% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined VERY GOOD in an actual shop.

3. FOR A GRADE OF "C":

- Complete all written tests with an average of 77% to 84%.
- Attend 80% of scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined SATISFACTORY in an actual repair shop.

4. FOR A GRADE OF "D":

- Complete all written tests with an average of 70% to 76%.
- Attend 80% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined POOR in an actual repair shop.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Department Student Dress Code Effective August 2005

All automotive students will have and wear safety glasses at all times in shop or lab areas. Failure to adhere to safety glasses rules may result in disciplinary action.

1. All students are required to wear their dealer sponsored uniform to school each day. If a student has not been sponsored by a dealer, the student may purchase approved CPCC shirts from Mr. Nicky Teeter. All shirts must be clean and tucked in. Rips and tears must be mended in a timely manner.
2. Dark colored work-style pants are recommended or **Proper fitting jeans** that meet the following requirements (length above the shoes, jeans above the hip with belt). No oversized jeans will be permitted. **Shorts are not allowed.** Rips and tears must be mended in a timely manner.
3. Facial jewelry of any type is **NOT** permitted. This includes ear, nose, lip, eyebrow, and cheek rings and/or studs. We also suggest that you refrain from wearing necklaces, rings, or bracelets of any kind as these items may pose a safety hazard.
4. No keys, chains or wallets hanging out of pockets. These maybe purchased from Mr. Nicky Teeter.
5. Hats are permitted in the shop area only! If a hat has a brim, it must be worn with it facing forward.
6. Students must wear shoes. We highly recommend oil resistant soles with steel toes. Tennis shoes, open toed shoes, or dress shoes are not permitted.
7. Other appearance issues not directly covered by these rules will be considered on a case-by-case basis. CPCC staff will decide what is professional in appearance and what is not.

Any Student Not Following These Guidelines Will Be Dismissed From Class And Attendance Credit For That Day Will Not Be Given. No Excuses Will Be Considered.

- Students will bring tools required for class with them at class time.
 - **No Tools, No Lab Credit.**
- **Remember how you act and present yourself will reflect on the department and presentations to prospective employers.**



Automotive Department Student Guidelines / Expectations

- No tobacco products usage is allowed inside any college building at any time.
- Eating or drinking in classrooms is with permission of instructor only; **there will be no eating or drinking in shop or lab or lab areas.**
- Students are expected to be in class on time and will be held responsible for any information covered by instructor, even if late or absent. Tests and quizzes missed may be made up only with instructor permission.
- Missed or late assignments will affect student's course grade.
- Tardiness is a problem; any student who is over 15 minutes late for a class will be counted as absent. CPCC attendance policy is in the on line student handbook.
- Students are expected to conduct themselves in a mature manner at all times. Students caught cheating, fighting, stealing, spinning tires, vandalizing or purposely damaging a vehicle or equipment will be **EXPELLED** from the automotive program. Care should be shown to college vehicles and property.
- Leaving class or shop/lab early without instructor permission will not be tolerated.
- Students are expected to come prepared for class. This means with paper, textbook, pens, pencils or other required material.
- Cell phones and pagers must be turned off during all class or lab times. Cell phones may only be used outside of the automotive buildings. Cell phones which ring during class will be subject to forfeiture or may result in student loss of privilege.
- The area in front of the main lab is not a parking area for students. The laneway must remain open for emergency vehicles. Vehicles inappropriately parked will be ticketed and towed. No parking means No Parking.
- All students are expected to clean up and put away all tools and equipment used during class or lab before leaving. Housekeeping is very important and will be part of your grade.
- Whenever you are unsure about anything ask your instructor! It is your responsibility to make sure that no physical damage occurs to any vehicle that you are working on or driving. Students are responsible for their actions!
- **Safety glasses** and student tools are mandatory in all shop/lab areas, no exceptions.
- All vehicles brought into the main lab will have a CPCC work order filled out and visible on windshield.



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Automotive Technology, Tool List

Safety Glasses or Goggles Mandatory in Labs

- Toolbox
- Common slotted screwdrivers, 4"x3/16, 6"x1/4, 8"x1/4
- Phillips screwdrivers number 1 and number 2
- Torx bit set T10 to T60
- Standard combination wrench set 5/16 to 1 1/4"
- Metric combination wrench set 6mm to 22mm
- 16 oz ball peen hammer
- 6" needle nose pliers
- Regular slip joint pliers
- 10 or 12" Channel Lock pliers
- 6 or 7" side cutting pliers
- Set of punches and chisels
- Feeler gauge set
- 3/8 "drive socket set, including ratchet, extensions, standard and metric sockets,
 - 3/8 to 7/8 and 8mm to 17mm
- 3/8" to 1/2" socket adapter, 1/2" to 3/8" socket adapter
- 1/2" drive socket set with extensions and ratchet,
- 1/2" drive flex handle at least 18" long (breaker bar)
- 1/2" drive sockets, 7/16 to 1 1/4 and 10mm to 22mm
- 1/2" inch drive torque wrench
- Spark plug sockets 5/8" and 13/16" 3/8" drive
- Gasket scraper
- Set of Allen wrenches
- 12-volt test light
- 1/4" drive socket set, standard and metric sockets, including ratchet
- Non-sparking drift punch, brass or aluminum
- Digital Volt, Ohm and Ammeter DVOM, with Leads Example Fluke model 83

You may wish to purchase additional tools for the specific program you are enrolled in such as ASEP, BMW, T-TEN, CAP. Check with your instructor for a list.



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Automotive Technology Safety Regulations

- An Instructor must be present any time a class or session is working in the lab

Use of safety glasses is required/mandatory in lab areas.

- Any safety hazard will be reported to the instructor immediately. Floor will be kept clear of all liquids and tripping hazards.
- No equipment will be operated by students until they have received instruction on proper and safe operation of same equipment.
- Vehicle lifts must be secured with mechanical locks prior to working under vehicle
- Jack stands will be used when jacking up a vehicle for service.
- Brake asbestos "dust" will be controlled any time work is done which could lead to asbestos exposure.
- Floor exhaust system will be used anytime an engine is running in the lab.
- Use of tobacco is not permitted in any lab or classroom.
- Use of audio equipment is not permitted during class/lab hours.
- Students and faculty must follow OSHA rules concerning exposure to blood borne diseases.
- Proper disposal of automotive waste products, including hazardous wastes, is required.