



South Portland, Maine 04106

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Title: **Automotive HVAC**

Catalog Number: **AUTO-170**

Credit Hours: **3**

Lecture (or Lab): **2 hours lecture / 1 hour lab**

Instructor: **Ruth Morrison**

Total Contact Hours: **30 / 30**

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## Course Syllabus

### Course Description

This course is an examination of automotive heating, ventilation, and air conditioning systems, with a focus on identification of malfunctioning parts and the repair of these systems. Students will diagnose the heating and air conditioning system and determine necessary action for unusual operating noises and inoperative conditions. Students will diagnose temperature control problems and failures in the electrical controls of heating, ventilation, and air conditioning systems and determine necessary action. Prerequisite: AUTO-205.

### Course Objectives

After completing this course, the student will be familiar with all tasks listed below. He or she must perform all high priority tasks to manufacturer's specifications and document the completion of each task.

### NATEF 2017 MAST Standards TASKS FOR THIS COURSE:

#### **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

**For every task in Heating, Ventilation, 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. General: A/C System Diagnosis and Repair

1. Identify and interpret heating and air conditioning problems; determine needed action. P-1
2. Research vehicle service information including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1
3. Performance test A/C system; identify problems. P-1
4. Identify abnormal operating noises in the A/C system; determine needed action. P-2
5. Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings. P-1
6. Leak test A/C system; determine needed action. P-1
7. Inspect condition of refrigerant oil removed from A/C system; determine needed action. P-2
8. Determine recommended oil and oil capacity for system application. P-1
9. Using a scan tool, observe and record related HVAC data and trouble codes. P-3

## B. Refrigeration System Component Diagnosis and Repair

1. Inspect, remove, and/or replace A/C compressor drive belts, pulleys, tensioners and visually inspect A/C components for signs of leaks; determine needed action. P-1
2. Inspect, test, service and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed. P-2
3. Remove, inspect, reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity. P-2
4. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions. P-2
5. Determine need for an additional A/C system filter; perform needed action. P-3
6. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform needed action. P-2
7. Inspect for proper A/C condenser airflow; determine needed action. P-1
8. Remove, inspect, and replace receiver/drier or accumulator/drier; determine recommended oil type and quantity. P-2
9. Remove, inspect, and install expansion valve or orifice (expansion) tube. P-1
10. Inspect evaporator housing water drain; perform needed action. P-1
11. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action. P-2
12. Determine procedure to remove and reinstall evaporator; determine required oil type and quantity. P-2
13. Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity. P-2

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

1. Inspect engine cooling and heater systems hoses and pipes; perform needed action. P-1
2. Inspect and test heater control valve(s); perform needed action. P-2
3. Diagnose temperature control problems in the HVAC system; determine needed action. P-2
4. Determine procedure to remove, inspect, reinstall, and/or replace heater core. P-2

## D. Operating Systems and Related Controls Diagnosis and Repair

1. Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action. P-1
2. Diagnose A/C compressor clutch control systems; determine needed action. P-2
3. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine needed action. P-2
4. Inspect and test HVAC system control panel assembly; determine needed action. P-3
5. Inspect and test HVAC system control cables, motors, and linkages; perform needed action. P-3
6. Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; perform needed action. P-1
7. Identify the source of HVAC system odors. P-2
8. Check operation of automatic or semi-automatic HVAC control systems; determine needed action. P-2

## E. Refrigerant Recovery, Recycling, and Handling

1. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards. P-1
2. Identify A/C system refrigerant; test for sealants; recover, evacuate, and charge A/C system; add refrigerant oil as required. P-1
3. Recycle, label, and store refrigerant. P-1

## **Topical Outline of Instruction**

- Cooling System Purposes
- Cooling System Operation
- Cooling System Components and Diagnosis
- Air Conditioning Theory and Operation
- Air Conditioning Components, Identification and Operation
- Air Conditioning Servicing and Testing
- Air Distribution
- Climate Control Electrical/Electronic Systems

## **Course Requirements**

- Students will check their SMCC email account regularly
- Students will develop a three-ring binder or portfolio of all hand outs, quizzes and tests.
- Students will successfully complete homework, quizzes and tests.
- Students will successfully complete shop projects as assigned and approved by instructors and maintain documentation of completion.

## **ASE Student Certification Test**

The final week of this course will consist of an ASE Student Certification Test. It will be administered at the Testing Center, located in the Campus Center building. Students will be responsible for taking the test at their convenience during the normal operating hours of the Testing Center. A photo ID is required. For information about the Testing Center, please see [www.smccme.edu/tests](http://www.smccme.edu/tests)

## **Student Evaluation and Grading**

10%: Attendance and Participation

10%: Homework

20%: Quizzes

30%: Tests

30%: Practice of Safety and Shop Participation and Portfolio

## **Assignments**

A list of assignments and a schedule of due dates are available on Blackboard. The schedule has been organized as well as possible in advance of the semester, but it may be adjusted at the instructor's discretion due to unforeseen circumstances. In addition to the list of assignments posted on Blackboard, pop quizzes may be assigned to evaluate students' comprehension, and they may or may not be included in the students' cumulative grades. Be aware that attendance and punctuality are critical to passing this course.

## **Tardiness Policy**

- **Late homework assignments will not be accepted. A course schedule is available at the beginning of the semester, so due dates should be clear, and homework can be submitted electronically.**
- **Tardy quizzes and tests will receive a grade reduction of 10 points for each day late.**
- **Missed quizzes and tests must be made up by 5 PM Friday of the week the work was missed, unless other arrangements are made.**

## **Department Attendance Policy**

**Students missing 15 % of the total hours for the course, tardy or absent, will result in an administrative failure for the class. This equals 9 hours for this 3 credit course. This is a “no fault” policy, which means the reason(s) for absence are not considered in implementation of the policy.**

## **Attendance Grade**

Out of 100 possible points, 10 points will be deducted for each class absence and 5 points will be deducted for each time tardy.

## **Text, Tools and/or Supplies**

- Automotive Heating and Air Conditioning, 7<sup>th</sup> Edition by Tom Birch and James Halderman
- Electude Argo E Learning Software subscription
- Each student must supply and maintain his or her own set of tools as listed on the “SMCC Automotive Technology Required Student Tool List.”
- Personal protective equipment must be worn at all times in lab. Leather, steel-toe work boots; clear safety glasses with side shields; and a uniform are required for this course.
- Highlighters and a clipboard are required for lab.
- Students must use their tool tags when they remove tools from the tool room.

**Please note: The following items are required to participate in lab:**

- 1. Leather steel-toe work boots**
- 2. Clear safety glasses with side shields**
- 3. Uniform**
- 4. Tool tags**
- 5. Tools listed on the “SMCC Automotive Technology Required Student Tool List”**
- 6. Clipboard and highlighters**

**If a student does not bring or use the items on the above list, the following consequences will result:**

- **The student can not participate in lab.**
- **The student will be marked absent.**
- **The attendance grade will reflect the absence.**
- **The hours missed will be counted towards a student’s Administrative Failure for 15% absence.**
- **The student will earn a grade of 0 for the assignments during that lab session.**

## **Telephones and Computers**

The use of computers, cell phones, smart phones, or other mobile communication devices is prohibited during lecture, unless the instructor indicates a special circumstance. In case of emergency, phones should be silenced, and answered outside the classroom. Special requests to use a computer for note taking will be considered by the instructor on a case by case basis. Violations of this policy will result in dismissal from the class period and an absence recorded. Repeat problems may result in a sanction from the Dean of Students.

## **Office Hours**

Appointments can be made to accommodate student needs. Please call or email for an appointment.

## **Learning Outcomes**

1. When necessary, utilize information–literacy skills, including evaluation of information from a variety of media and proper MLA and/or APA documentation.
2. Use critical thinking and listening skills in written and oral communication as a tool for learning.
3. Read and demonstrate understanding of complex ideas by identifying key concepts.
4. Apply theory to practice using problem solving techniques and data analysis.
5. Solve problems using algebraic techniques.
6. Interpret information presented in charts and graphs or illustrate a scenario using graphic techniques.
7. Utilize quantitative methods to solve and/or assess complex problems to support decision making, forecasting, and recommendations.
8. Participate in a direct experience of scientific inquiry of the natural world using the scientific method.
9. Find and evaluate credible sources of scientific information using a variety of media to support a research need.
10. Demonstrate the capacity to make informed and ethical judgments about the impact of science and technology on the self, the environment, and the practice of sustainability.

## **End-of-Course Evaluation**

In order to gain access to final course grades, students must complete evaluations for each course attended at SMCC. Evaluations are submitted online and can be accessed through the student portal site. Students can access the course evaluation report beginning two weeks before the end of classes. The deadline for submission of evaluations occurs 24 hours after the last day of classes each semester. Instructors will announce when the online course evaluation is available.

## **ADA Syllabus Statement**

Southern Maine Community College is an equal opportunity/affirmative action institution and employer. For more information, please call [207-741-5798](tel:207-741-5798). If you have a disabling condition and wish to request accommodations in order to have reasonable access to the programs and services offered by SMCC, you must register with the Disability Services Coordinator, Sandra Lynham, who can be reached at 741-5923. Further information about services for students with disabilities and the accommodation process is available upon request at this number. Course policies about online testing are modified to suit each individual's accommodations.

## **Add-Drop Policy**

Students who drop a course during the one-week “add/drop” period in the fall and spring semesters and the first three days of summer sessions receive a 100% refund of the tuition and associated fees for that course. Please note any course that meets for less than the traditional semester length, i.e., 15 weeks, has a pro-rated add/drop period. There is no refund for non-attendance.

## **Withdrawal Policy**

A student may withdraw from a course only during the semester in which s/he is registered for that course. The withdrawal period is the second through twelfth week of the fall and spring semesters and the second through ninth week of twelve-week summer courses. This period is pro-rated for shorter-length courses. To withdraw from a course, a student must complete and submit the appropriate course withdrawal form, available at the Enrollment Service Center (no phone calls, please). The designation “W” will appear on the transcript after a student has officially withdrawn. A course withdrawal is an uncompleted course and may adversely affect financial aid eligibility. Failure to attend or ceasing to attend class does not constitute withdrawal from the course. There is no refund associated with a withdrawal.

## **Plagiarism Statement**

If an instructor suspects that a student has knowingly committed a violation defined in the Maine Community College System Policy on Student Grade Appeals and Academic Misconduct, the instructor has the authority to review the alleged misconduct and determine the grade that the student should receive for the assignment and the course. The instructor may assign a failing grade for the assignment or course and may require the student to complete additional work for the course. The instructor may consult with the department chair and/or the College's chief academic officer prior to making such decisions. If a student seeks to challenge an instructor's determination, the student should submit a grade appeal. Grade appeal forms are available in the Advising Office on the South Portland Campus or in the administrative offices in the Learning Commons on the Midcoast Campus. An instructor may also refer the matter to the College's disciplinary officer for review under the procedures of the MCCS Student Code of Conduct.

## **Cancellations**

When weather conditions require the College to close, we will:

- Notify you through your SMCC email account and send a text alert
- Post a storm message on the SMCC Storm Line (741-5900)
- Post the closure on a banner at the top of the SMCC website
- Post a message on the SMCC Facebook page
- Notify local media outlets
- Post a message on Twitter

When the weather forces the College to close altogether, open late or close early, the following guidelines are in place:

- When the College closes altogether for the day, all classes are canceled and all offices are closed.
- When the College closes early at a specific time, all classes beginning at that time and later are canceled. All classes beginning before the closure time will be held as scheduled. All offices will close at the closing time.
- When the College opens late, all classes beginning before the specified scheduled opening time are canceled. Classes beginning at the opening time and later will be held as scheduled. All offices will open at the opening time.

## **Student Printing Policy**

This policy identifies the cost per page for black and white as well as color printing in varying page sizes. Specifics of the policy are outlined below:

### **Per Page Costs**

Each semester students receive a \$20 printing credit. The balance resets at the end of the semester and any remaining credits are removed. The cost varies depending upon page size and whether printing is done in black and white or color.

- a. There is a \$0.10 per page fee for standard 8.5" by 11" black and white documents.
- b. The reverse sides of duplex (double-sided) documents are free.
- c. There is a \$.50 per page fee for standard 8.5" by 11" color documents.
- d. There is a \$.20 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) black and white documents.
- e. There is a \$1.00 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) color documents.

**Duplex charges** (printing on both sides of a page) work in the following fashion: One page is \$0.10, two pages are \$0.10, three pages are \$0.20, and four pages are \$0.20, *etc.* The flipsides are free, but another sheet

of paper is \$0.10. Please be aware that a document with any color at all (when printed to a color printer) will by default be printed in color. You are responsible for setting the print job to print black and white if you do not need color. For directions, please go to the IT Help tab in My SMCC.

### **How does it work?**

The College's pay-for-print system monitors printing on all printers (including those in general access labs, library printers, the Academic Achievement Center, Noisy Lounge and technology labs). Students can check the number of pages they have printed by using the Printing Balance tool available on SMCC computers (located in the lower right corner of the screen, near the clock). Departments with work study students who need to print documents for the department should contact the HelpDesk at 741-5696 to have a special account set up.

### **Refunds**

Print jobs are eligible for a refund in the event of mechanical or electronic error on the part of the printer, print server, or software used to submit the job. Jobs are not eligible for a refund in cases where the job was not set up correctly, was submitted multiple times, or the student is not satisfied with the result. To request a refund, please bring the offending print to the IT Department in the basement of the Ross Technology Center. Refunds will be granted in the form of a credit to the student's account.

### **Why is SMCC charging for printing?**

The pay-for-print system is an effort to control escalating printing costs. Charging for printing helps offset the increasing cost of supplies and encourages students to conserve resources. To find ways to reduce your printing charges, please go to the IT Help tab on My SMCC. If you have questions about the pay-for-printing policy or your printing charges, please contact the HelpDesk at 741-5696 or send an email to [helpdesk@smccme.edu](mailto:helpdesk@smccme.edu).

*Be sure to log OUT of the system when you've finished your printing, to prevent unauthorized access to your account.*