SYLLABUS FOR AUMT 1445
Automotive Climate Control Systems
Semester Hours Credit: 4
Instructor: Daniel Joubert

Book for class: Today’s Technician

Automotive Heating & Air Conditioning

I. INTRODUCTION

A. Theory of automotive air conditioning and heating systems. Emphasis on the basic refrigeration cycle and diagnosis and repair of system malfunctions. Covers EPA guidelines for refrigerant handling and new refrigerant replacements.

B. Automotive Climate Control Systems (AUMT 1445) is a required course for the completion of a two-year Associate of Applied Science degree in Automotive Mechanic/Technician or a Level I or Level II certificate or completion in the Automotive Technician Program.

C. This course is occupationally related and serves as a preparation for a career in the Automotive Service and Repair field.

D. Prerequisites: This course has a prerequisite or corequisite of AUMT 2437 or consent of the department chair.

II. LEARNING OUTCOMES

Upon successful completion of this course, Engine Performance and Analysis I, the student will:
A. Discuss what industry is doing about the ozone depletion problem.
B. Identify potential safety hazards in the automotive shop.
C. Recognize the hazards associated with the automotive repair industry.
D. Describe safe and unsafe tools and discuss the philosophy regarding health and safety.
E. Discuss the fundamentals of temperature and pressure.
F. Describe the difference between sensible, latent, and specific heat values.
G. Explain the effects of radiation, conduction, and convection on personal comfort.
H. Identify required and alternative services and the special tools required.
I. Discuss how to use and interpret service information procedures and specifications.
J. Explain the operation of the basic refrigeration cycle.
K. Understand the basic function of the various air conditioning components.
L. Describe the nomenclature and function of the manifold gauge set.
M. Utilize appropriate safety procedures while inspecting and connecting a manifold and gauge set to an automotive air conditioning system.
N. Explain the engine cooling system and its components.
O. Discuss the requirements for a closed cooling system.
P. Identify the major components of the automotive engine cooling system and comfort heating system.
Q. Understand and utilize the procedures to test various cooling system components.
R. Explain the purpose and operation of an automotive air conditioner compressor.
S. Discuss the two changes of state of the refrigerant in the automotive air conditioning system.

T. Compare the function of the thermostatic expansion valve (TXV) to the fixed orifice tube (FOT).

U. Diagnose air conditioning system malfunctions based on customer complaints.

V. Identify the different types of automotive air conditioning systems.

W. Utilizing appropriate safety procedures remove and replace automotive air conditioning system components, such as hoses and fittings, metering devices, driers and accumulators, compressors, condensers and evaporators, and pressure switches.

X. Describe the leak test procedures for an automotive air conditioning system using soap trace solutions, electronic leak detectors, halogen leak detectors and dye solutions.

Y. Leak test an air conditioning system using soap solution, dye solution, and using a halogen leak detector.

Z. Evacuate an air conditioning using the single evacuation method.

AA. Demonstrate the proper procedures for handling refrigerant while charging a system with refrigerant HFC-134a (R134-a).

BB. Diagnose six system malfunctions by gauge readings.

CC. Read and understand temperature-pressure charts.

DD. Understand the proper handling of refrigerant oil.

EE. Discuss and explain the operating principals of various types of A.C. compressors.

FF. State the purpose and describe the function and operation of a magnetic clutch in an air conditioning system.
GG. Compare fixed and variable-displacement compressors.

HH. Identify and troubleshoot various makes and models of compressors used in automotive air conditioning service.

II. Troubleshoot and make mechanical repairs to clutch coils and rotor assemblies.

JJ. Diagnose and discuss the air flow through the air distribution system for the defrost, heat, and the cool modes.

KK. Understand Mode Door Actuator operation; cable; vacuum, and electric.

LL. Describe the operation of controlling the air conditioning system using pressure and temperature actuated controllers.

MM. Recognize and understand the components of an automatic temperature control system.

NN. Understand and demonstrate the methods used to diagnose and repair compressor clutch malfunctions.

OO. Understand the function of and be able to demonstrate the ability to troubleshoot the components of the automatic temperature control system.

PP. Discuss the various refrigerants approved to replace R-12 in automotive air conditioning systems.

QQ. Understand the problems associated with contaminated refrigerant.

RR. Compare components used in R-134a systems with those used in R-12 systems.

SS. Recognize the difference between pure and impure refrigerant by interpreting gauge pressures relating to ambient temperature.

TT. Determine the purity of refrigerant in an air conditioning system or container.

III. INSTRUCTIONAL MATERIALS
A. The instructional materials identified for this course are viewable through http://www.ctcd.edu/im/im_main.asp (Please list the title, author, & edition here when you get the text from your Field Rep.)

**IV. COURSE REQUIREMENTS**

A. This course is 96 hours in length. This syllabus is designed to inform you of the sequence in which this course will be presented. You must follow the instructor’s directions and the syllabus. It contains reading assignments, written assignments, presentations and lab assignments that you must complete. Written assignments will be turned in as directed by the instructor. Late assignments may be accepted for partial credit.

B. The student must take notes during lectures and demonstrations. Exams may be taken from lectures, demonstrations, reading and lab assignments. If instructor notes or handouts are given to you, you must study them, and exams may be taken from these notes also.

C. The student must complete the written assignments to receive a grade. Written assignments for each unit will be turned into the instructor prior to taking chapter and performance exams for that section.

**V. ADDITIONAL COURSE REQUIREMENTS**

A. Your first responsibility is scholarship. The grade you receive for this course will not be the grade of the instructor, but rather the grade you and you alone make.

B. You should attend class regularly and be prepared to participate in classroom discussions and to take unannounced quizzes relating to text assignments and lecture material presented from the beginning of the course. Please refer to ‘Class Attendance and Course Progress’ under the Academic Policies section in our
current CTC Course Catalog:
http://www.ctcd.edu/academics/catalogs/catalog-continentalinternational/
academic-policies/.

C. You are encouraged to give your best effort throughout the course. From the beginning, you should plan for a steady, organized, and continuous effort, which in the long run will prove more effective for your final grade than a last minute crash-cram policy. Your course grade is not determined solely by exam grade. Such factors as class participation, initiative, attendance, and individual research papers or projects will be considered in grade computation.

D. From time to time, special library and/or outside assignments will be made to members of the class individually and/or in groups. You are expected to read all assignments and fulfill your responsibilities to any group assignment.

E. You are expected to read all assigned material and bring your textbook/reading materials to class. Keep informed on all assignments, especially after an absence.

F. Good class notes are indispensable for earning a good grade, since both the material assigned and that discussed in class will be the basis for examination material.

G. Scholastic Honesty: All students are required and expected to maintain the highest standards of scholastic honesty in the preparation of all coursework and during examinations. The following are considered examples of scholastic dishonesty:

Plagiarism: The taking of passages from the writing of others without giving proper credit to the sources.

Collusion: Using another’s work as one’s own, or working together with another person in the preparation of work, unless such joint preparation is
specifically approved in advance by the instructor.

Cheating: Giving or receiving information on examinations.

H. Special Work: A term paper or other project, per requirements of the instructor, will be required. The subject must be appropriate for the course material. Check with the instructor when you have made a selection. The value is indicated in the semester grade computation and has considerable weight on your final average.

VI. EXAMINATION & GRADING

A. There will be a minimum of 2 major examinations as follows:

1. Chapter exams on (dates)

2. Final exam on (date)

B. The instructor may give written assignments or pop quizzes as he/she deems necessary.

C. Performance Exams:

Each student will clean all tools and equipment that they use and properly store them and clean their work area after the completion of each task.

Laboratory tasks (performance exam) will be completed on an individual basis except when limited by tools and/or materials. The maximum lab grade is 40 points. The instructor will deduct points from each lab task score for failure to follow safety precautions and/or a failure to complete the project to industry standards. The instructor will date, initial, and post the points earned for each performance exam as it is completed.

D. The following is part of the course requirements: Each student will assist in lab cleanup at the close of the evening classes.

E. There will be written chapter examinations as well as a comprehensive final
exam. Chapter exams must be completed before taking the performance exam for each section. The Final exam is a comprehensive exam that covers the entire course.

VII. SEMESTER GRADE COMPUTATIONS

1. 
   A. Mid term is 20%
   B. Final exam is 20%
   C. Class and Lab is 20%
   D. Class and Lab participation is 30%
   E. Attendance is 10%

2. 
   A 90-100%
   B 80-89%
   C 70-79%
   D 60-69%
   F 59% or less

VIII. NOTES & ADDITIONAL INSTRUCTIONS FROM COURSE INSTRUCTOR

A. Tuition refunds are made only in the case of class cancellation or official and timely withdrawal from CTC or from course. Please refer to the current course catalog for more details at http://europe.ctcd.edu/library/catalog.php.

B. Go Army Ed students should contact their education counselor before withdrawing and are required to withdraw through the GoArmyEd portal.

Please note: a military withdrawal does not override CTC’s grading policy. For self-pay students, refunds are computed from the date the
Application for Withdrawal or Refund is filed with the CTC field representative or designated Student Services Officer. Special conditions apply to students who receive federal, state, and/or institutional financial aid.

Tuition and fees paid directly to the Institution by the Veterans Administration, Title IV (Financial Aid Programs, a sponsor, donor, or scholarship shall be refunded to the source rather than directly to the students.

C. Course Withdrawals, Student Responsibilities: It is the student’s responsibility to officially withdraw from a course. The instructor cannot initiate a withdrawal based upon a student’s request. Rather, student’s must initiate the withdrawal with the designated Education Center Representative, through the CTC Field Representative or the Student Services Officer for that region.

Applications for Withdrawal will be accepted at any time before the completion of 75% of the course, after which time the student will be assigned an “FN” – “Failure for Non-attendance.”

D. Incomplete / Course in Progress Grade Policy: An “IP” or “Incomplete” grade may be assigned by an instructor if a student has made satisfactory progress in a course with the exception of a major quiz, final exam, or other project. The “IP” grade may also be assigned based on circumstances beyond a student’s control, such as personal illness, death in the immediate family, or military orders. Notice of absences, with supporting documentation, may be required by the instructor. The instructor makes the final decision concerning the granting of the incomplete grade. With an “Incomplete” grade, students are required to complete a set amount of work before the instructor will submit an official letter grade. This date can be determined
by the instructor but must be within 45 days of the course end date. After completion of the work the instructor can then change the grade of “IP” to the appropriate letter grade. If this work is not completed by the specified date the instructor will change the grade to “F”.

E. Cellular phones, beepers, and other electronic devices will be turned off while the student is in the classroom or laboratory unless the student is using the device for class purposes. No texting or social networking is allowed during class.

F. Instructor Discretion: The instructor reserves the right of final decision in course requirements.

G. Civility: Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

IX. INITIAL & WEEKLY CLASS MEETINGS

A. The instructor will introduce the course and discuss textbook.

B. The instructor will verify the class roster.

C. The instructor will discuss the following topics with the student:

1. Course requirements, objectives and how the course works

2. Policy letters

3. Student handouts

4. Lab sheet and lab work, written assignments, scheduled lectures and demonstrations, chapter exams, performance exams.

5. Exam, grading, reading and written assignments.
6. Hazardous communications/MSDS information
7. Shop safety

X. COURSE OUTLINE

Note:
The instructor has the right to change the course schedule. Any changes will be announced in class. If the student misses a class period and changes are announced, it is the student’s responsibility to receive the missed information from a classmate or the instructor.

Introduction, Safety, Tools, Procedures, Temperature and Pressure

Fundamentals

A. Dates -

B. Learning Outcomes: Upon completion of this section the student will:

1. Discuss what industry is doing about the ozone depletion problem.
2. Identify potential hazards in the automotive shop.
3. Recognize the hazards associated with the automotive repair industry.
4. Describe safe and unsafe tools and discuss the philosophy regarding health and safety.
5. Discuss the fundamentals of temperature and pressure.
6. Describe the differences between sensible, latent, and specific heat values.
7. Explain the effects of radiation, conduction, and convection on personal comfort.
8. Identify required and alternative services and the special tools required.
9. Discuss how to use and interpret service information procedures and specifications.

C. Read Chapters 1, 2 and the Glossary in the classroom manual and answer all
questions at the end of each chapters.

D. Read Chapters 1, 2 and the Appendix in the shop manual and answer all questions at
the end of each chapter.

E. Attend lectures on the listed chapters.

F. See your instructor and ask him to explain any part of the reading assignment that
you do not understand.

G. Take the written exam for the above chapters.

H. Perform lab performance exams with the instructor

**History and Purpose, Engine Cooling and Comfort Systems, Manifold Gauge Sets**

A. Dates -

B. Learning Outcomes: Upon completion of this section the student will:

1. Explain the operation of the basic refrigeration cycle.

2. Understand the basic function of the various air conditioning components.

3. Describe the nomenclature and function of the manifold and gauge set.

4. Utilize appropriate safety procedures while inspecting and connecting a
   manifold and gauge set to an automotive air conditioning system

5. Explain the engine cooling system and its components.

6. Discuss the requirements for a closed cooling system.

7. Identify the major components of the automotive engine cooling and
   comfort heating system.

8. Understand and utilize the procedures to test various cooling system
   components.

C. Read chapters 3 and 4 in textbook and answer all questions at the end of the
   chapters.

D. Attend chapters 3 and lecture.
E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. Take written chapter exam.

G. Perform lab performance exam with the instructor.

**System Components, Servicing and Testing**

A. Dates -

B. Learning Outcomes: Upon completion of this module the student will:

1. Explain the purpose and operation of an automotive air conditioner compressor.

2. Discuss the two changes of state of the refrigerant in the automotive air conditioning system.

3. Compare the function of the thermostatic expansion valve (TXV) to the fixed orifice tube (FOT).

4. Diagnose air conditioning system malfunctions based on customer complaints.

5. Identify the different types of automotive air conditioning systems.

6. Utilizing appropriate safety procedures, remove and replace automotive air conditioning system components, such as hoses and fittings, metering devices, driers and accumulators, compressors, condensers and evaporators, and pressure switches.

7. Describe the leak test procedures for an automotive air conditioning system using soap trace solutions, electronic leak detectors, halogen leak detectors and dye solutions.

8. Leak test an air conditioning system using soap solution, dye solution, and using a halogen leak detector.
9. Evacuate an air conditioning system using the single evacuation method.

10. Demonstrate the proper procedures for handling refrigerant while charging a system with refrigerant HFC-134a (R134a).

C. Read chapters 5 and 6 in textbook and answer all questions at the end of the chapters.

D. Attend chapters 5 and 6 lecture.

E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. Take written chapter exam.

G. Perform lab performance exam with the instructor.

**Automotive Refrigeration systems, Compressors and Clutches**

A. Dates -

B. Learning Outcomes: Upon completion of this module the student will:

1. Diagnose six system malfunctions by gauge readings.

2. Read and understand temperature-pressure charts.

3. Understand the proper handling of refrigeration oil.

4. Discuss and explain the operating principals of various types of A.C. compressors.

5. State the purpose and describe the function and operation of a magnetic clutch in an air conditioning system.

6. Compare fixed-and variable-displacement compressors.

7. Identify and troubleshoot various makes and models of compressors used in automotive air conditioning service.

8. Troubleshoot and make mechanical repairs to clutch coils and rotor assemblies.
C. Read chapters 7 and 8 in textbook and answer all questions at the end of the chapters.

D. Attend chapters 7 and 8 lecture.

E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. Take written chapter exam.

G. Perform lab performance exam with the instructor.

**Air Conditioning Case and Duct Systems and System Controls**

A. Dates -

B. Learning Outcomes: Upon completion of this module the student will:

1. Diagnose and discuss the air flow through the air distribution system for the defrost, heat, and the cool modes.

2. Understand Mode Door Actuator operation: cable, Vacuum, and electric.

3. Describe the operation of controlling the air conditioning system using pressure-and temperature–actuated controllers.

4. Recognize and understand the components of an automatic temperature control system.

5. Understand and demonstrate the methods used to diagnose and repair compressor clutch malfunctions.

6. Understand the function of and be able to demonstrate the ability to troubleshoot the components of the automatic temperature control system.

C. Read chapters 9 and 10 in textbook and answer all questions at the end of the chapters.

D. Attend chapters 9 and 10 lecture.
E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. Take written chapter exam.

G. Perform lab performance exam with the instructor.

**Retrofitting Automotive Air Conditioning Systems from CFC-12 to HFC-134a**

A. Dates

B. Learning Outcomes: Upon completion of this module the student will:

1. Discuss the various refrigerants approved to replace R-12 in automotive air conditioning systems.

2. Understand the problems associated with contaminated refrigerant.

3. Compare components used in R-134a systems with those used in R-12 systems.

4. Recognize the difference between pure and impure refrigerant by interpreting gauge pressures relating to ambient temperature.

5. Determine the purity of refrigerant in an air conditioning system or container.

C. Read chapter 11 in textbook and answer all questions at the end of the chapters.

D. Attend chapters 11 lecture.

E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. Take written chapter exam.

G. Perform lab performance exam with the instructor.

**Reviews and Final Exam**
A. Dates -

B. Review all material covered in the course.

C. Review your course grade to date with the instructor.

D. Attend final lecture (open question format)

E. Take final exam with instructor.

F. Complete final course paperwork with site representative.

G. All assignments and exams must be taken by the end of the term