



Heating and Air Conditioning

SYLLABUS

Your Course Learning Plan

UAWLETC EK 4-13-06

A. General Course Information

Course description: The Heating and Air Conditioning students of UAW-LETTC will successfully complete a series of activities that will meet the needs of Automotive Dealerships while following guidelines of the National Automotive Training and Education Foundation (NATEF). These activities will consist of, but not limited to; diagnostics, repair and/or replacement, and adjustment to factory specifications. These activities will take place in the classroom and shop, consisting of written and hands-on exercises. Each phase will have its guidelines and time period. We will cover some areas with more detail than other's depending on the demand for that area.

Prerequisites: Technical Introduction to Dealerships: Module 13 HVAC systems, Module 12 HVAC systems. (*Refer to TID Curriculum for more information*)
Electrical Fundamentals.

Organization: This is a lecture / shop course in which topics are presented by the instructor, shop assignments are explained and assigned projects are completed by students both during class and shop time. Objective quizzes are given at the completion of each section and there is a comprehensive final exam. When students have completed this course they generally have the same level of expertise as those who have experience in the automotive industry. Initial emphases are on the use of equipment and fundamental procedures.

Textbooks / Software:

1. Toyota HVAC Course 752, Technician Handbook
2. Automotive Heating and Air Conditioning Technology ISBN 1-56637-786-2
3. ASE refrigerant recovery and recycling booklet and quiz.

B. Course Content and Outcomes

Course content:

1. Introduction to HVAC
2. Refrigerants, Refrigerant Oils, and Related Chemicals
3. Principles of Refrigeration
4. A/C System Components
5. Engine Cooling Systems
6. Heater Systems, Liquid and Air-Cooled Engines
7. A/C System Controls
8. Air Delivery System
9. Refrigerant Recovery, Recycling and Handling
10. Refrigeration System Diagnosis and Leak Detection
11. Hoses, Lines, Fitting, and O-Ring Service
12. Compressor and Clutch Service
13. Valve, Evaporator, Condenser, and Related Parts Service
14. Air Delivery and Manual HVAC Control Service

15. Diagnosis of Automatic A/C System
16. Automatic A/C System Repair and Service
17. Air Conditioning: Hybrid Vehicles
18. Air Conditioning Retrofitting
19. Review
20. ASE Preparation

Learning outcomes:

Upon successful completion of this course the student will:

1. Demonstrate and practice personal responsibility skills required at the workplace.
2. Practice interpersonal communication and problem solving skills.
3. Utilize social and personal management skills.
4. Implement a diagnostic strategy that will aid in identification and location of faults in HVAC systems.
5. Demonstrate the skill to follow proper procedures in the repair of HVAC systems
6. Possess the skills necessary to perform HVAC service and repair in line with the highest quality standards in the automotive industry.

Grading (credit) criteria:

Course will be weighted as follows. Task Worksheets 30%, Quizzes 20%, homework 10%, ASE Recovery and Recycling Exam 10%, Final exam 30%.

Task worksheets will be assigned almost every day. Worksheets will be due at the end of each day. Grading will be based on a performance rating of "2" (Proficient) and "3" (Proficient, able to teach others) with a minimum rating of "2" being required for passing.

There will be many objective quizzes given relating to current topics. Grading will be based on percentage of correctly answered questions. A grade of 80% is required for passing.

ASE Refrigerant Recovery and Recycling is a pass/fail test.

The final exam will be comprehensive relating to all topics covered in the course. Questions are written with heavy emphasis on critical thinking and diagnostic skills. A grade of 80% is required for passing.

C. Class/Shop Policies

Student Expectations:

1. Be on time for the start of class and return to class for final roll call.
2. Wear safety glasses in the shop at all times.
3. Appropriate working attire shall be worn.
4. Access to shop vehicles only as authorized by the instructor.
5. No cell phones or other electronic devices.
6. Participate in classroom discussions.
7. Observe classroom etiquette.
8. Participate in shop clean up.
9. Attendance to shop activities in assigned area.
10. Approval by instructor required prior to being absent from assigned area.
11. Clean all tools prior to returning them to the tool crib.
12. Follow all safety rules; be concerned with your safety and the safety of others.
13. Report all injuries regardless of the nature or severity to the instructor.

D. Other resources

Online resources:

Techinfo.Toyota.Com
ASECert.org
IMACA.org

Tentative Schedule

DAY	TASK	TOPIC/ACTIVITY
1, 2	Crossword Puzzle: Ozone Science	<p>Introduction to HVAC History of HVAC</p> <p>Refrigerants, Refrigerant Oils, and Related Chemicals Types of Refrigerants and Classifications</p> <p>Quiz: Introduction to HVAC and Refrigerants</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 1, Preparation, pages 1-1 through 1-3 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 1, Introduction to Automotive Heating, Air Conditioning, and Ventilation, pages 11-26 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 6, Refrigerants, Refrigerant Oils, and Related Chemicals, pages 97-106</p>
3	Toyota Worksheet 3-1: A/C Principles	<p>Principles of Refrigeration Purpose of Refrigeration</p> <p>Quiz: Refrigeration Principles</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 2, Refrigeration Principles, pages 2-1 through 2-8 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 5, Principles of Refrigeration, pages 81-95</p>
4		<p>A/C System Components Evaporators, Condensers, Accumulators, Receiver-Driers, Control Valves</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 3, A/C Components, pages 3-1 through 3-4 and 3-13 through 3-17 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 9, Evaporators, Condensers, Accumulators, and Receiver-Driers, pages 143-152 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 10, Control Valves and Switches, pages 153-166</p>
5	Toyota Worksheet 3-2: A/C Component Identification	<p>A/C System Components (continued) Compressors, Compressor Clutches, Compressor Drives, Hoses and Fittings</p> <p>Quiz: A/C Components</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 3, A/C Components, pages 3-4 through 3-12 and 3-17 through 3-23 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 9, Evaporators, Condensers, Accumulators, and Receiver-Driers, pages 143-152 Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 7, Hoses, Lines, Fittings, and seals, pages 109-120</p>

<p>6, 7</p>	<p>Worksheet AC-D2: Inspect and Pressure Test a cooling System</p> <p>Worksheet AC-D4: Inspect, Test, and Replace Thermostat</p> <p>Worksheet AC-D3-5-6: Determine Coolant Condition and Type; Drain and Flush System</p> <p>Worksheet AC-D8: Inspect and Test Electric Cooling Fan, Fan Control System, and Circuits</p> <p>Worksheet AC-D10: Remove, Inspect, and Reinstall Heater Core</p>	<p>Engine Cooling Systems Cooling System Operation, Components, Types of Coolants, Recovery Systems</p> <p>Heater Systems, Liquid and Air-Cooled Engines Heating System Components, Operation</p> <p>Quiz: Heater and Cooling Systems</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 11, Engine Cooling Systems and Vehicle Heaters, pages 167-184</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 20, Heater and Engine Cooling System Service, pages 313-336</p>
<p>8</p>	<p>Worksheet AC-E7: Inspect HVAC, Doors, Outlets, and Cabin Filters</p> <p>Worksheet AC-D9: Inspect and Test Heater Control Valve</p>	<p>A/C System Controls Temperature Control System</p> <p>Air Delivery System Air Handling Systems</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 5, A/C System Controls, pages 5-1 through 5-12</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 12, Air Delivery Systems, pages 185-198</p>
<p>9</p>		<p>A/C System Controls (continued) Manual HVAC Controls Automatic Temperature Control Systems</p> <p>Quiz: A/C Control Systems/Air Delivery Systems</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 6, Automatic Temperature Control, pages 6-1 through 6-18</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 13, Manual HVAC Controls, pages 199-212</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 14, Automatic Temperature Control Systems, pages 213-226</p>
<p>10</p>	<p>Toyota Worksheet 4-1: Refrigerant Identification</p> <p>Toyota Worksheet 4-5: TIS Information/Leak Check</p> <p>Worksheet AC-F1: Perform Correct Use and Maintenance of Refrigerant Handling Equipment</p>	<p>Refrigerant Recovery, Recycling and Handling Using Refrigerant Special Tools</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 4, Diagnosis and Repair, pages 4-5 through 4-10 and 4-16 through 4-22</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 16, Refrigerant Recovery, Recycling, and Handling, pages 251-268</p>

11, 12	<p>Toyota Worksheet 4-6: A/C Pressure Gauge Diagnosis</p> <p>Toyota Worksheet 4-2: Touch and Feel Diagnosis</p> <p>Toyota Worksheet 4-4: HFC-134a Recovery</p> <p>Worksheet AC-F2: Inspect System Perform Electronic Leak Check, Identify Refrigerant</p> <p>Worksheet AC-F3-4-5: Identify, Recover, and Recycle Refrigerant</p> <p>Worksheet AC-F6: Evacuate and Recharge A/C System</p>	<p>Refrigeration System Diagnosis and Leak Detection</p> <p>Six – Step Diagnosis Process</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 4, Diagnosis and Repair, pages 4-1 through 4-4 and 4-11</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 15, Refrigeration System Diagnosis and Leak Detection, pages 227-250</p>
13, 14	<p>Toyota Worksheet 4-3: Compressor Clutch Replacement</p> <p>Worksheet AC-C2b: Inspect, R&R Hoses, Lines, Fittings and Seals</p> <p>Worksheet AC-C1d: Remove, Inspect and Reinstall A/C Compressor, and Inspect Condition of Discharged Oil</p> <p>Worksheet AC-C1b: Inspect and Replace A/C Compressor Drive Belts</p> <p>Worksheet AC-B6: Diagnose Abnormal Operating Noises and Performance Test</p>	<p>Hose, Lines, Fitting, and O-Ring Service</p> <p>Fitting Disassembly and Reassembly</p> <p>Compressor and Clutch Service</p> <p>Common Compressor and Clutch Problems</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 4, diagnosis and Repair, pages 4-11 through 4-15</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 17, Hose, Line, Fitting, and O-Ring Service, pages 269-278</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 18, Compressor and Clutch Service, pages 279-285</p>
15, 16	<p>Worksheet AC-C2e: Remove, Inspect, and Install Expansion Valve or Orifice Tube</p> <p>Worksheet AC-E3: Test and Diagnose A/C Compressor Clutch Control Systems</p>	<p>Valve, Evaporator, Condenser, and Related Parts Service</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 19, Valve, evaporator, Condenser, and Related Parts Service, pages 297-302</p>
17, 18	<p>Worksheet AC-C2f: Remove, Inspect, and Reinstall Evaporator and Inspect Evaporator Housing Water Drain</p>	<p>Valve, Evaporator, Condenser, and Related Parts Service (continued)</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 19, Valve, Evaporator, Condenser, and Related Parts Service, pages 300 and 304-307</p>
19, 20	<p>Worksheet AC-C2d: Remove, Inspect and Reinstall Receiver-Drier or Accumulator</p> <p>Worksheet AC-C2c: Inspect A/C Condenser for Air Flow Restrictions</p> <p>Worksheet AC-C2h: Remove, Inspect and Reinstall Condenser</p>	<p>Valve, Evaporator, Condenser, and Related Parts Service (continued)</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 19, Valve, Evaporator, Condenser, and Related Parts Service, pages 300-301 and 307-312</p>

21, 22	<p>Worksheet AC-D1: Diagnose Heater/Ventilation System Temperature Control Problems</p> <p>Worksheet AC-E1: Inspect, Test, and Diagnose Electrical HVAC Controls and Components</p> <p>Worksheet AC-E2: Inspect and Test A/C Heater Blower, Motors, Resistors, Switches, Relays, Wiring and Protective Devices</p> <p>Worksheet AC-E4: Diagnose HVAC Vacuum Controls</p> <p>Worksheet AC-E5-6: Inspect and Test A/C Heater Control Panel</p>	<p>Air Delivery and Manual HVAC Control Service</p> <p>Air Delivery and Manual Control System Problems</p> <p>Air Delivery and Control System Service</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 21, Air Delivery and Manual HVAC Control Service, pages 337-352</p>
23	<p>Toyota Worksheet 7-1: ATC Sensors and Controls</p> <p>Toyota Worksheet 7-2: Automatic Air Conditioning "Self-Diagnosis" Testing</p> <p>Toyota Worksheet 7-3: C-Best Settings Using the Hand-Held Tester</p>	<p>Diagnosis of Automatic A/C Systems</p> <p>Reading Codes Using Scan Tools</p> <p>Automatic A/C System Repair and Service</p> <p>Computer Reprogramming</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 7, Automatic Temperature Control Diagnosis and Repair, pages 7-1 through 7-9</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook , Chapter 22, Automatic Temperature Control System Service, pages 353-356</p>
24	<p>Toyota Worksheet 8-1: Hybrid Air Conditioning System Familiarization</p>	<p>Air Conditioning: Hybrid Vehicles</p> <p>A/C Components</p> <p>Air Conditioning Retrofitting</p> <p>Performing a Complete Retrofit</p> <p>Text: Toyota Course 752, Air Conditioning and Climate Control, Technician Handbook, Section 8, Air Conditioning: Hybrid Vehicles, pages 8-1 through 8-12</p> <p>Text: Auto Heating and Air Conditioning Technology Textbook, Chapter 23, Air Conditioning Installation and Retrofitting, pages 375-380</p>
25, 26, 27		<p>Review All Previous Material Covered</p>
28, 29, 30		<p>ASE Preparation</p>