



# Wayne County Community College District

## COURSE SYLLABUS

### AUT 125 Heating, Ventilation, and Air Conditioning I

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**CREDIT HOURS:** 3.00

**CONTACT HOURS:** 60.00

**COURSE DESCRIPTION:**

This course is designed to provide students with the necessary skills and understanding to research, diagnose, repair and maintain the automotive Heating, Ventilation, and Air Conditioning systems. In addition, it will provide the necessary skills to be prepared for the ASE certification exam.

**PREREQUISITES:** AUT 114, AUT 115, AUT 116, AUT 117

**EXPECTED COMPETENCIES:**

Upon completion of this course, the student will be familiar with:

***Industry Information***

- **Identify various career types in the automotive field**  
***Objective***
  - Identify the eight Automotive Service Excellence (ASE) service areas for technicians and the components included in each.
  - Identify career opportunities directly related to the automotive technology field.
  - Identify various methods used to pay automotive technicians.
  - Identify the difference between a union and a non-union shop.

***Shop Safety***

**For every task in Heating, Ventilation, and Air Conditioning, the following safety requirements must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.**

- **Identify protective clothing and equipment and their proper use; proper shop behavior; principles of fire safety; and federal regulations concerning hazardous material and shop safety.**  
***Objective***
  - Describe how to select individual personal protective clothing and equipment.
  - Identify the dangers of improper behavior in the shop.
  - Identify the importance of proper grooming and hygiene.
  - Identify the classes of fires and the types of fire extinguishers.
  - Identify the use of a fire blanket.



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- Identify general fire emergency procedures.
- Identify the Occupational Safety and Health Administration (OSHA) regulations.
- Identify the Environmental Protection Agency (EPA) regulations.
- Identify the safe use of fire protection equipment
- Identify the safe use of shop equipment following Environmental Protection Agency (EPA) and Occupational Safety and Health Act (OSHA) regulations
  
- **Identify and explain the safe and proper use of chemicals**  
*Objective*
  - Identify the types and uses of solvents.
  - Identify the types and uses of soaps and cleaning solutions.
  - Identify the types and uses of oils.
  - Identify the types and uses of greases.
  - Identify the types and uses of specialty additives.
  - Identify the types and uses of specialty chemicals.
  - Describe the five general rules for using automotive chemicals.
  - Complete the assignment sheet on lubricants.
  - Complete the assignment sheet on lubricants.
  - Identify gasses and the hazards they present.
  - Identify the hazards of asbestos dust.
  
- **Identify and explain the safe and proper use of basic hand tools**  
*Objective*
  - Identify the types and uses of common end wrenches.
  - Identify the types and uses of socket set components.
  - Identify the types and uses of wrenches.
  - Identify the types and uses of screwdrivers.
  - Identify the types and uses of pliers.
  - Identify the types and uses of hammers.
  - Identify the types and uses of punches and chisels.
  
- **Identify and explain the safe and proper use of specialty tools, fasteners, and measuring tools**  
*Objective*
  - Identify the types and uses of specialty tools.
  - Describe the procedures for cutting threads onto a rod or into a hole, repairing damaged threads, and removing broken bolts.
  - Identify common nuts and bolts in the English system.
  - Identify common nuts and bolts in the metric system.
  - Identify other types of common fasteners.
  - Identify the types and uses of measuring tools.
  - Identify the procedures for the care and use of measuring tools.



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- **Identify and explain the safe and proper use of power tools and shop equipment**

**Objective**

- Identify the types and uses of pneumatic, hydraulic, and electric power tools.
- Identify the hazards of power tools.
- Identify the types, purposes, and safety considerations of common shop equipment.
- Demonstrate the ability to:
  - A. Lift a vehicle

#### ***A/C System Diagnosis and Repair***

- **Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1**

**Objective**

- Identify procedures for verifying the customer's concern.
- Research applicable vehicle service information such as vehicle service history, VIN, certification labels, and calibration decals.
- Identify procedures for inspecting the external operation of the automotive air conditioning system and determining the system's state-of-charge.
- Identify procedures for diagnosing the automotive air conditioning system.

- **Identify and interpret heating and air conditioning concern; determine necessary action. P-1**

**Objective**

- Identify procedures for verifying the customer's concern.
- Research applicable vehicle service information such as vehicle service history, VIN, certification labels, and calibration decals.
- Identify procedures for inspecting the external operation of the automotive air conditioning system and determining the system's state-of-charge.
- Identify procedures for diagnosing the automotive air conditioning system.

- **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**

**Objective**

- Identify procedures for verifying the customer's concern.
- Research applicable vehicle service information such as vehicle service history, VIN, certification labels, and calibration decals.
- Identify procedures for inspecting the external operation of the automotive air conditioning system and determining the system's state-of-charge.
- Identify procedures for diagnosing the automotive air conditioning system.



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- **Locate and interpret vehicle and major component identification numbers. P-1**  
*Objective*
  - Identify procedures for verifying the customer's concern.
  - Research applicable vehicle service information such as vehicle service history, VIN, certification labels, and calibration decals.
  - Identify procedures for inspecting the external operation of the automotive air conditioning system and determining the system's state-of-charge.
  
- **Performance test A/C system; identify A/C system malfunctions. P-1**  
*Objective*
  - Demonstrate the ability to:
    - Identify and interpret a heating and air conditioning system concern
    - Make preliminary inspections of an air conditioning system
    - Analyze the refrigerant in the air conditioning system
    - Performance test the air conditioning system
    - Leak test an air conditioning system
    - Diagnose abnormal operating noises in the air conditioning system
    - Inspect, check, and replace the compressor oil
  
- **Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings. P-1**  
*Objective*
  - Identify procedures for servicing the automotive air conditioning system.
  - Identify proper labeling and storage of refrigerants.
  - Identify the procedures for checking recycled refrigerant stored in portable containers for non-condensable gases.
  - Recover air conditioning system refrigerant
  - Evacuate and charge an air conditioning system
  - Label and store refrigerant
  - Properly dispose of a non-reusable refrigerant container
  - Check a recycled refrigerant stored in a portable container for non-condensable gases
  
- **Leak test A/C system; determine necessary action. P-1**  
*Objective*
  - Identify procedures for servicing the automotive air conditioning system.
  - Identify proper labeling and storage of refrigerants.
  - Identify the procedures for checking recycled refrigerant stored in portable containers for non-condensable gases.
  - Recover air conditioning system refrigerant
  - Evacuate and charge an air conditioning system
  - Label and store refrigerant
  - Properly dispose of a non-reusable refrigerant container



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- **Inspect the condition of refrigerant oil removed from the system; determine necessary action. P-2**  
*Objective*
  - Identify procedures for servicing the automotive air conditioning system.
  - Identify proper labeling and storage of refrigerants.
  - Identify the procedures for checking recycled refrigerant stored in portable containers for non-condensable gases.
  - Recover air conditioning system refrigerant
  - Evacuate and charge an air conditioning system
  - Label and store refrigerant
  - Properly dispose of a non-reusable refrigerant container
  - Check a recycled refrigerant stored in a portable container for non-condensable gases
  
- **Determine recommended oil and oil capacity for system application. P-1**  
*Objective*
  - Identify procedures for servicing the automotive air conditioning system.
  - Identify proper labeling and storage of refrigerants.
  - Identify the procedures for checking recycled refrigerant stored in portable containers for non-condensable gases.
  - Recover air conditioning system refrigerant
  - Evacuate and charge an air conditioning system
  - Label and store refrigerant
  - Properly dispose of a non-reusable refrigerant container
  - Check a recycled refrigerant stored in a portable container for non-condensable gases
  
- **Using scan tool, observe and record related HVAC data and trouble codes. P-1**  
*Objective*
  - Identify procedures for servicing the automotive air conditioning system.
  - Identify proper labeling and storage of refrigerants.
  - Identify the procedures for checking recycled refrigerant stored in portable containers for non-condensable gases.
  - Recover air conditioning system refrigerant
  - Evacuate and charge an air conditioning system
  - Label and store refrigerant
  - Properly dispose of a non-reusable refrigerant container
  - Check a recycled refrigerant stored in a portable container for non-condensable gases



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#### ***Refrigeration System Component Diagnosis and Repair***

- **Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. P-1**

##### ***Objective***

- Identify terms and definitions associated with servicing an air conditioning compressor and compressor clutch
- Identify various types of air conditioning hoses and seals
- Demonstrate the ability to diagnose and service compressor protection devices.
- Demonstrate the ability to inspect compressor drive belts

- **Inspect A/C condenser for airflow restrictions; perform necessary action. P-1**

##### ***Objective***

- Identify procedures for removing and replacing a compressor
- Identify procedures for inspecting and servicing a compressor
- Identify procedures for inspecting and serving an air conditioning compressor clutch assembly
- Demonstrate the ability to diagnose and service compressor protection devices.
- Demonstrate the ability to service the compressor clutch components and assembly
- Demonstrate the ability to remove and reinstall a compressor
- Replace the shaft seal on an air conditioning compressor
- Replace the compressor reed valves and valve plate

- **Remove, inspect, and install expansion valve or orifice (expansion) tube. P-1**

##### ***Objective***

- Identify procedures for inspecting and serving an air conditioning compressor clutch assembly
- Identify various types of air conditioning hoses and seals
- Demonstrate the ability to diagnose and service compressor protection devices.
- Demonstrate the ability to inspect compressor drive belts
- Demonstrate the ability to service the compressor clutch components and assembly
- Demonstrate the ability to remove and reinstall a compressor
- Replace the shaft seal on an air conditioning compressor
- Replace the compressor reed valves and valve plate

- **Inspect evaporator housing water drain; perform necessary action. P-2**

##### ***Objective***

- Identify procedures for inspecting and serving an air conditioning compressor clutch assembly
- Identify various types of air conditioning hoses and seals
- Demonstrate the ability to diagnose and service compressor protection devices.
- Demonstrate the ability to inspect compressor drive belts
- Demonstrate the ability to service the compressor clutch components and assembly
- Demonstrate the ability to remove and reinstall a compressor



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- Replace the shaft seal on an air conditioning compressor
- Replace the compressor reed valves and valve plate

#### ***Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair***

- **Diagnose temperature control problems in the heater/ventilation system; determine necessary action. P-2**

#### ***Objective***

- Identify terms and definitions associated with heating system
- Identify how the heater core operates
- Identify systems that control air temperature in the heating system
- Identify engine cooling system components and heating system component operation
- Identify procedures for diagnosing a heating system that produces little or no heat
- Identify procedures for diagnosing leaks with the heating system
- Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
- Demonstrate the ability to diagnose temperature control problems in the heating system
- Demonstrate the ability test the cooling system
- Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
- Demonstrate the ability to inspect, test, and service the thermostat and housing

- **Perform cooling system pressure test; check coolant condition, inspect and test radiator, cap (pressure/vacuum), coolant recovery tank, and hoses; perform necessary action. P-1**

#### ***Objective***

- Identify terms and definitions associated with heating system
- Identify how the heater core operates
- Identify systems that control air temperature in the heating system
- Identify engine cooling system components and heating system component operation
- Identify procedures for diagnosing a heating system that produces little or no heat
- Identify procedures for diagnosing leaks with the heating system
- Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
- Demonstrate the ability to diagnose temperature control problems in the heating system
- Demonstrate the ability test the cooling system
- Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
- Demonstrate the ability to inspect, test, and service the thermostat and housing

- **Inspect engine cooling and heater system hoses and belts; perform necessary action. P-1**

#### ***Objective***

- Identify terms and definitions associated with heating system
- Identify how the heater core operates
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- Identify systems that control air temperature in the heating system Identify engine cooling system components and heating system component operation
  - Identify procedures for diagnosing a heating system that produces little or no heat
  - Identify procedures for diagnosing leaks with the heating system
  - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
  - Demonstrate the ability to diagnose temperature control problems in the heating system
  - Demonstrate the ability test the cooling system
  - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
  - Demonstrate the ability to inspect, test, and service the thermostat and housing
- **Inspect, test, and replace thermostat and gasket/seal. P-1**  
**Objective**
    - Identify terms and definitions associated with heating system
    - Identify how the heater core operates
    - Identify systems that control air temperature in the heating system
    - Identify engine cooling system components and heating system component operation
    - Identify procedures for diagnosing a heating system that produces little or no heat
    - Identify procedures for diagnosing leaks with the heating system
    - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
    - Demonstrate the ability to diagnose temperature control problems in the heating system
    - Demonstrate the ability test the cooling system
    - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
    - Demonstrate the ability to inspect, test, and service the thermostat and housing
- **Determine coolant condition and coolant type for vehicle application; drain and recover coolant. P-1**  
**Objective**
    - Identify terms and definitions associated with heating system
    - Identify how the heater core operates
    - Identify systems that control air temperature in the heating system
    - Identify engine cooling system components and heating system component operation
    - Identify procedures for diagnosing a heating system that produces little or no heat
    - Identify procedures for diagnosing leaks with the heating system
    - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
    - Demonstrate the ability to diagnose temperature control problems in the heating system
    - Demonstrate the ability test the cooling system
    - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
    - Demonstrate the ability to inspect, test, and service the thermostat and housing





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- **Flush system; refill system with recommended coolant; bleed system. P-2**  
**Objective**
  - Identify terms and definitions associated with heating system
  - Identify how the heater core operates
  - Identify systems that control air temperature in the heating system
  - Identify engine cooling system components and heating system component operation
  - Identify procedures for diagnosing a heating system that produces little or no heat
  - Identify procedures for diagnosing leaks with the heating system
  - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
  - Demonstrate the ability to diagnose temperature control problems in the heating system
  - Demonstrate the ability test the cooling system
  - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
  - Demonstrate the ability to inspect, test, and service the thermostat and housing
  
- **Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action. P-1**  
**Objective**
  - Identify terms and definitions associated with heating system
  - Identify how the heater core operates
  - Identify systems that control air temperature in the heating system
  - Identify engine cooling system components and heating system component operation
  - Identify procedures for diagnosing a heating system that produces little or no heat
  - Identify procedures for diagnosing leaks with the heating system
  - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
  - Demonstrate the ability to diagnose temperature control problems in the heating system
  - Demonstrate the ability test the cooling system
  - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
  - Demonstrate the ability to inspect, test, and service the thermostat and housing
  
- **Inspect and test electric cooling fan, fan control system and circuits; determine necessary action. P-1**  
**Objective**
  - Identify terms and definitions associated with heating system
  - Identify how the heater core operates
  - Identify systems that control air temperature in the heating system
  - Identify engine cooling system components and heating system component operation
  - Identify procedures for diagnosing a heating system that produces little or no heat
  - Identify procedures for diagnosing leaks with the heating system
  - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
  - Demonstrate the ability to diagnose temperature control problems in the heating system



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- Demonstrate the ability test the cooling system
  - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
  - Demonstrate the ability to inspect, test, and service the thermostat and housing
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- **Inspect and test heater control valve(s); perform necessary action. P-2**  
**Objective**
    - Identify terms and definitions associated with heating system
    - Identify how the heater core operates
    - Identify systems that control air temperature in the heating system
    - Identify engine cooling system components and heating system component operation
    - Identify procedures for diagnosing a heating system that produces little or no heat
    - Identify procedures for diagnosing leaks with the heating system
    - Identify procedures for pressure testing the engine cooling system and inspecting and servicing the belts and hoses
    - Demonstrate the ability to diagnose temperature control problems in the heating system
    - Demonstrate the ability test the cooling system
    - Demonstrate the ability to inspect the service the cooling and heating system belts and hoses
    - Demonstrate the ability to inspect, test, and service the thermostat and housing

#### ***Operating Systems and Related Controls Diagnosis and Repair***

- **Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action. P-3**  
**Objective**
  - Identify terms and definitions associated with the electrical components of heating and air conditioning systems.
  - Identify air distribution principals.
  - Identify how vacuum switches, solenoids, and reservoirs operate.
  - Identify the various types of automotive air conditioning switches and the procedure for testing the switches
  - Identify various types of automotive air conditioning load devices and how they operate
  - Identify the air conditioning sensor and control devices
  - Diagnose and repair a switch circuit
  
- **Inspect A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action. P-2**  
**Objective**
  - Identify terms and definitions associated with the electrical components of heating and air conditioning systems.
  - Identify air distribution principals.



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- Identify how vacuum switches, solenoids, and reservoirs operate.
- Identify the various types of automotive air conditioning switches and the procedure for testing the switches
- Identify various types of automotive air conditioning load devices and how they operate
- Identify the air conditioning sensor and control devices
- Diagnose and repair a switch circuit

#### ***Refrigerant Recovery, Recycling, and Handling***

- **Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards. P-1**  
***Objective***

- Identify proper labeling and storage of refrigerants.
- Label and store refrigerant
- Properly dispose of a non-reusable refrigerant container
- Check a recycled refrigerant stored in a portable container for non-condensable gases

- **Identify and recover A/C system refrigerant. P-1**  
***Objective***

- Identify proper labeling and storage of refrigerants.
- Label and store refrigerant
- Properly dispose of a non-reusable refrigerant container
- Check a recycled refrigerant stored in a portable container for non-condensable gases

- **Recycle, label, and store refrigerant. P-1**  
***Objective***

- Identify proper labeling and storage of refrigerants.
- Label and store refrigerant
- Properly dispose of a non-reusable refrigerant container
- Check a recycled refrigerant stored in a portable container for non-condensable gases

- **Evacuate and charge A/C system; add refrigerant oil as required. P-1**  
***Objective***

- Identify proper labeling and storage of refrigerants.
- Label and store refrigerant
- Properly dispose of a non-reusable refrigerant container
- Check a recycled refrigerant stored in a portable container for non-condensable gases

#### **ASSESSMENT METHODS:**

Student performance may be assessed by examination, quizzes, case studies, oral conversation, group discussion, oral presentations. The instructor reserves the option to employ one or more of these assessment methods during the course.



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### **GRADING SCALE:**

90%-100% = A

80%-89.9% = B

70%-79.9% = C

60%-69.9% = D

<60% = E