



Wayne County Community College District

COURSE SYLLABUS

AUT 201 Engine Performance IV

CREDIT HOURS: 3.00

CONTACT HOURS: 60.00

COURSE DESCRIPTION:

This advanced course is designed to provide the student with hands-on techniques to inspection, diagnose and repair of complex engine and computer control systems on modern automobiles. Advanced diagnostic procedures will be used to troubleshoot and diagnose the engines electrical, ignition, fuel and emissions systems. An understanding of employment opportunities, "pertaining to engine performance", will be discussed. While utilizing these tasks, ASE certification principles will be highly stressed and applied in this course.

PREREQUISITES: AUT 117 and AUT 200

EXPECTED COMPETENCIES:

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

Shop Safety

For every task in Engine Performance, 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.
- 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.



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- 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.

General Engine Diagnosis

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

- Identify terms and definitions associated with the evaluation and diagnosis of engine performance problems
- Identify important diagnostic information included in driver complaints

- **Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-1**
Objectives

- Identify the components and functions of engine analyzers.
- Identify the purpose of exhaust gas analyzers.
- Identify the types of exhaust gas analyzers.
- Identify exhaust gas analyzer readings.
- Identify the basics of the inspection and maintenance 240 second test
- Identify the procedures for testing the exhaust gases using an exhaust gas analyzer.
- Complete the assignment sheet on exhaust gas analysis.
- Demonstrate the ability to:
 - A. Diagnose drive ability concerns using an exhaust gas analyzer
 - B. Test catalytic converter efficiency using an exhaust gas analyzer
 - C. Test the exhaust system back pressure.
 - D. Service the catalytic converter.

Computerized Engine Controls Diagnosis and Repair

- **Retrieve and record stored OBD I diagnostic trouble codes; clear codes when applicable. P-3**
Objectives

- Identify the basic steps to diagnosing an engine performance problem
- Identify the considerations for studying computerized engine controls
- Identify the terminology associated with computerized engine control systems.
- Identify the prerequisite knowledge needed for studying computerized engine control systems.
- Identify the basic characteristics of computerized engine control systems



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- **Retrieve and record stored OBD II diagnostic trouble codes; clear codes. P-1**
Objectives
 - Identify the basic steps to diagnosing an engine performance problem
 - Identify the terms and definitions associated with on-board diagnostics generation two.
 - Explain the purpose of on-board diagnostics generation two.
 - Explain the development of on-board diagnostics generation two
 - Explain the on-board diagnostics generation two requirements
 - Identify the procedures for diagnosing an on-board diagnostics generation two system.
 - Identify the procedures for diagnosing the on-board diagnostics generation two engine control module.
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.
 - Demonstrate the ability to:
 - A. Diagnose an on-board diagnostics generation two system.

- **Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes. P-1**
Objectives
 - Identify the basic steps to diagnosing an engine performance problem
 - Identify the considerations for studying computerized engine controls
 - Identify the terminology associated with computerized engine control systems.
 - Identify the prerequisite knowledge needed for studying computerized engine control systems.
 - Identify the basic characteristics of computerized engine control systems
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.

- **Diagnose emissions or drive ability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action. P-1**
Objectives
 - Identify the basic steps to diagnosing an engine performance problem
 - Identify the considerations for studying computerized engine controls
 - Identify the terminology associated with computerized engine control systems.
 - Identify the prerequisite knowledge needed for studying computerized engine control systems.
 - Identify the basic characteristics of computerized engine control systems



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- **Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2**

Objectives

- Identify the basic steps to diagnosing an engine performance problem
- Access and interpret diagnostic trouble codes.
- Identify the types of diagnostic equipment.
- Identify the procedures for testing wiring.
- Identify the procedures for checking reference voltage.
- Identify the procedures for checking wiring continuity.
- Identify the procedures for testing wiring with a breakout box
- Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
- Identify the procedures for testing the Hall Effect sensor.
- Identify the procedures for testing the engine coolant temperature sensor
- Identify the procedures for testing the intake air temperature sensor
- Identify the procedures for testing the throttle position sensor
- Identify the procedures for testing the manifold absolute pressure sensor
- Identify the procedures for testing the mass airflow sensor.
- Identify the procedures for testing the knock sensor.
- Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool.
 - D. Diagnose ignition-related sensors using a lab scope.

- **Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1**

Objectives

- Identify the basic steps to diagnosing an engine performance problem
- Access and interpret diagnostic trouble codes.
- Identify the types of diagnostic equipment.
- Identify the procedures for testing wiring.
- Identify the procedures for checking reference voltage.
- Identify the procedures for checking wiring continuity.
- Identify the procedures for testing wiring with a breakout box
- Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
- Identify the procedures for testing the Hall Effect sensor.
- Identify the procedures for testing the engine coolant temperature sensor
- Identify the procedures for testing the intake air temperature sensor
- Identify the procedures for testing the throttle position sensor
- Identify the procedures for testing the manifold absolute pressure sensor
- Identify the procedures for testing the mass airflow sensor.
- Identify the procedures for testing the knock sensor.



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- Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool.
 - D. Diagnose ignition-related sensors using a lab scope.
- **Obtain and interpret scan tool data. P-1**
Objectives
 - Identify the basic steps to diagnosing an engine performance problem
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.
 - Identify the procedures for checking reference voltage.
 - Identify the procedures for checking wiring continuity.
 - Identify the procedures for testing wiring with a breakout box
 - Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
 - Identify the procedures for testing the Hall Effect sensor.
 - Identify the procedures for testing the engine coolant temperature sensor
 - Identify the procedures for testing the intake air temperature sensor
 - Identify the procedures for testing the throttle position sensor
 - Identify the procedures for testing the manifold absolute pressure sensor
 - Identify the procedures for testing the mass airflow sensor.
 - Identify the procedures for testing the knock sensor.
 - Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool.
 - D. Diagnose ignition-related sensors using a lab scope.
- **Access and use service information to perform step-by-step diagnosis. P-1**
Objectives
 - Identify the basic steps to diagnosing an engine performance problem
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.
 - Identify the procedures for checking reference voltage.
 - Identify the procedures for checking wiring continuity.
 - Identify the procedures for testing wiring with a breakout box
 - Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
 - Identify the procedures for testing the Hall Effect sensor.
 - Identify the procedures for testing the engine coolant temperature sensor
 - Identify the procedures for testing the intake air temperature sensor
 - Identify the procedures for testing the throttle position sensor
 - Identify the procedures for testing the manifold absolute pressure sensor
 - Identify the procedures for testing the mass airflow sensor.
 - Identify the procedures for testing the knock sensor.



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- Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool
 - D. Diagnose ignition-related sensors using a lab scope.
- **Diagnose drivability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action. P-3**

Objectives

 - Identify the basic steps to diagnosing an engine performance problem
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.
 - Identify the procedures for checking reference voltage.
 - Identify the procedures for checking wiring continuity.
 - Identify the procedures for testing wiring with a breakout box
 - Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
 - Identify the procedures for testing the Hall Effect sensor.
 - Identify the procedures for testing the engine coolant temperature sensor
 - Identify the procedures for testing the intake air temperature sensor
 - Identify the procedures for testing the throttle position sensor
 - Identify the procedures for testing the manifold absolute pressure sensor
 - Identify the procedures for testing the mass airflow sensor.
 - Identify the procedures for testing the knock sensor.
 - Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool.
 - D. Diagnose ignition-related sensors using a lab scope.
- **Perform active tests of actuators using scan tool; determine necessary action. P-1**

Objectives

 - Identify the basic steps to diagnosing an engine performance problem
 - Access and interpret diagnostic trouble codes.
 - Identify the types of diagnostic equipment.
 - Identify the procedures for testing wiring.
 - Identify the procedures for checking reference voltage.
 - Identify the procedures for checking wiring continuity.
 - Identify the procedures for testing wiring with a breakout box
 - Identify the procedures for testing the crankshaft position sensor and other magnetic position sensors.
 - Identify the procedures for testing the Hall Effect sensor.
 - Identify the procedures for testing the engine coolant temperature sensor
 - Identify the procedures for testing the intake air temperature sensor
 - Identify the procedures for testing the throttle position sensor
 - Identify the procedures for testing the manifold absolute pressure sensor
 - Identify the procedures for testing the mass airflow sensor.



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- Identify the procedures for testing the knock sensor.
- Demonstrate the ability to:
 - A. Diagnose and service computerized engine control systems
 - B. Diagnose ignition-related sensors using a digital multi-meter
 - C. Diagnose ignition-related sensors using a scan tool
 - D. Diagnose ignition-related sensors using a lab scope.

Emissions Control Systems Diagnosis and Repair

Exhaust Gas Recirculation

- **Diagnose emissions and drive ability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action. P-1**
Objectives

- Identify the basics of the exhaust gas recirculation system.
- Identify the operation of a conventional-ported vacuum exhaust gas recirculation system.
- Identify the characteristics of a positive back pressure exhaust gas recirculation system.
- Identify the characteristics of a negative back pressure exhaust gas recirculation system.
- Identify the characteristics of a single-solenoid exhaust gas recirculation system controlled by the engine control module.
- Identify the characteristics of an exhaust gas recirculation system that uses two solenoids controlled by the engine control module.
- Identify the characteristics of an exhaust gas recirculation system that uses a transducer controlled by the engine control module.
- Identify the characteristics of an exhaust gas recirculation system that uses an integrated electronic valve controlled by the engine control module
- Identify the basics of an on-board diagnostics generation two exhaust gas recirculation valve flow rate monitor.
- Complete the assignment sheet on the exhaust gas recirculation system
- Identify the procedures for performing basic tests on the exhaust gas recirculation system.
- Identify the procedures for diagnosing the electronic components on the exhaust gas recirculation system.
- Demonstrate the ability to:
 - A. Diagnose the exhaust gas recirculation system.
 - B. Remove and install exhaust gas recirculation system components

- **Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1**
Objectives

- Identify the basics of the exhaust gas recirculation system.
- Identify the operation of a conventional-ported vacuum exhaust gas recirculation system.
- Identify the characteristics of a positive back pressure exhaust gas recirculation system.



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- Identify the characteristics of a negative back pressure exhaust gas recirculation system.
 - Identify the characteristics of a single-solenoid exhaust gas recirculation system controlled by the engine control module.
 - Identify the characteristics of an exhaust gas recirculation system that uses two solenoids controlled by the engine control module.
 - Identify the characteristics of an exhaust gas recirculation system that uses a transducer controlled by the engine control module.
 - Identify the characteristics of an exhaust gas recirculation system that uses an integrated electronic valve controlled by the engine control module
 - Identify the basics of an on-board diagnostics generation two exhaust gas recirculation valve flow rate monitor.
 - Complete the assignment sheet on the exhaust gas recirculation system
 - Identify the procedures for performing basic tests on the exhaust gas recirculation system.
 - Identify the procedures for diagnosing the electronic components on the exhaust gas recirculation system.
 - Demonstrate the ability to:
 - A. Diagnose the exhaust gas recirculation system.
 - B. Remove and install exhaust gas recirculation system components
-
- **Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2**
Objectives
 - Identify the basics of the exhaust gas recirculation system
 - Identify the operation of a conventional-ported vacuum exhaust gas recirculation system.
 - Identify the characteristics of a positive back pressure exhaust gas recirculation system.
 - Identify the characteristics of a negative back pressure exhaust gas recirculation system.
 - Identify the characteristics of a single-solenoid exhaust gas recirculation system controlled by the engine control module
 - Identify the characteristics of an exhaust gas recirculation system that uses two solenoids controlled by the engine control module
 - Identify the characteristics of an exhaust gas recirculation system that uses a transducer controlled by the engine control module
 - Identify the characteristics of an exhaust gas recirculation system that uses an integrated electronic valve controlled by the engine control module.
 - Identify the basics of an on-board diagnostics generation two exhaust gas recirculation valve flow rate monitor.
 - Complete the assignment sheet on the exhaust gas recirculation system
 - Identify the procedures for performing basic tests on the exhaust gas recirculation system.
 - Identify the procedures for diagnosing the electronic components on the exhaust gas recirculation system.
 - Demonstrate the ability to:
 - A. Diagnose the exhaust gas recirculation system.
 - B. Remove and install exhaust gas recirculation system components



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Exhaust Gas Treatment

- **Diagnose emissions and drivability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action.**

P-2

Objectives

- Identify the purpose of the air injection system.
- Identify the basics of air pump systems.
- Identify the basics of the electronic secondary air injection system
- Identify the basics of the exhaust-pulse air injection system.
- Complete the assignment sheet on the air injection system.
- Identify the procedures for testing the air pump air injection system
- Identify the procedures for servicing the air pump air injection system
- Identify the procedures for testing the exhaust-pulse air injection system
- Identify the procedures for servicing the exhaust-pulse air injection system
- Demonstrate the ability to:
 - A. Test and service the air pump air injection system.
 - B. Test and service the exhaust-pulse air injection system.

- **Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3**

Objectives

- Identify the purpose of the air injection system.
- Identify the basics of air pump systems.
- Identify the basics of the electronic secondary air injection system
- Identify the basics of the exhaust-pulse air injection system.
- Complete the assignment sheet on the air injection system.
- Identify the procedures for testing the air pump air injection system
- Identify the procedures for servicing the air pump air injection system
- Identify the procedures for testing the exhaust-pulse air injection system
- Identify the procedures for servicing the exhaust-pulse air injection system
- Demonstrate the ability to:
 - A. Test and service the air pump air injection system.
 - B. Test and service the exhaust-pulse air injection system.

- **Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3**

Objectives

- Identify the purpose of the air injection system.
- Identify the basics of air pump systems.
- Identify the basics of the electronic secondary air injection system
- Identify the basics of the exhaust-pulse air injection system.
- Complete the assignment sheet on the air injection system.
- Identify the procedures for testing the air pump air injection system
- Identify the procedures for servicing the air pump air injection system
- Identify the procedures for testing the exhaust-pulse air injection system
- Identify the procedures for servicing the exhaust-pulse air injection system



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- Demonstrate the ability to:
 - A. Test and service the air pump air injection system.
 - B. Test and service the exhaust-pulse air injection system.
- **Inspect and test catalytic converter performance. P-1**
Objectives
 - Identify the purpose and basics of the catalytic converter.
 - Explain the construction and operation of the catalytic converter
 - Explain the legal requirements for servicing the exhaust system and catalytic converter.
 - Complete the lesson assignment sheet on the catalytic converter
 - Identify the procedures for testing the catalytic converter.
 - Identify the procedures for servicing the catalytic converter.
 - Demonstrate the ability to:
 - A. Test catalytic converter efficiency using an exhaust gas analyzer
 - B. Test the exhaust system back pressure.
 - C. Service the catalytic converter.

Evaporative Emissions Controls

- **Diagnose emissions and drive ability problems resulting from malfunctions in the evaporative emissions control system; determine necessary action. P-1**
Objectives
 - Identify the purpose of the evaporative emission control system
 - Identify the purpose of fuel tank expansion area.
 - Identify the purpose of the charcoal canister.
 - Identify the purpose of the carburetor fuel bowl vent.
 - Identify the basics of charcoal canister purge control system
 - Identify the purpose of the air filter carbon element.
 - Identify the purpose of the enhanced evaporative emission control system
 - Identify the procedures for inspecting the evaporative emission control system.
 - Demonstrate the ability to:
 - A. Test the evaporative emission control system on a carbureted vehicle
 - B. Test the evaporative emission control system on a fuel-injected vehicle with an engine control module.
- **Inspect and test components and hoses of evaporative emissions control system; perform necessary action. P-2**
Objectives
 - Identify the purpose of the evaporative emission control system
 - Identify the purpose of fuel tank expansion area.
 - Identify the purpose of the charcoal canister.
 - Identify the purpose of the carburetor fuel bowl vent.
 - Identify the basics of charcoal canister purge control system
 - Identify the purpose of the air filter carbon element.
 - Identify the purpose of the enhanced evaporative emission control system



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- Identify the procedures for inspecting the evaporative emission control system.
- Demonstrate the ability to:
 - A. Test the evaporative emission control system on a carbureted vehicle
 - B. Test the evaporative emission control system on a fuel-injected vehicle with an engine control module.
- **Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action. P-1**
 - **Objectives**
 - Identify the purpose of the evaporative emission control system
 - Identify the purpose of fuel tank expansion area.
 - Identify the purpose of the charcoal canister.
 - Identify the purpose of the carburetor fuel bowl vent.
 - Identify the basics of charcoal canister purge control system
 - Identify the purpose of the air filter carbon element.
 - Identify the purpose of the enhanced evaporative emission control system
 - Identify the procedures for inspecting the evaporative emission control system.
 - Demonstrate the ability to:
 - A. Test the evaporative emission control system on a carbureted vehicle
 - B. Test the evaporative emission control system on a fuel-injected vehicle with an engine control module.

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.

GRADING SCALE:

90%-100% = A
80%-89.9% = B
70%-79.9% = C
60%-69.9% = D
<60% = E