COURSE OUTLINE

Course Number	Course Title	Credits
AUT 211	Automotive Emissions and Drivability Diagnosis	3
Hours: Lecture/Lab/Other	**Co- or Pre-requisite**	**Implementation Semester & Year**
2/2/0	AUT 112	Spring 2022

Catalog description: Examines the relationship of automotive emissions with engine driveability concerns. Utilizing information presented in AUT111 and AUT112, proper diagnosis of driveability concerns and recommended repair procedures are explored to achieve the best performance and reduced emissions. Emission control devices are examined with an emphasis on operation and emission standards.

General Education Category:
Non GenEd

Course coordinator: Jason Evans, ext. 3776, evansj@mccc.edu

Required texts & Other materials: Halderman, Advanced Engine Performance Diagnosis, 7th edition, Pearson Education, 2020. ISBN-13: 9780134893495

A basic calculator capable of adding, subtracting, multiplying, and dividing numbers. Cell phone calculators are not allowed during quizzes and exams.

Access to a personal laptop computer, tablet, or Chromebook is strongly recommended during class and lab.

Students must purchase safety glasses, work boots, and appropriate clothing to work in the automotive lab. This requirement is reviewed with the students on the first day of class. These items are not needed for the first class meeting of the term.

The following is provided at no charge to the students:
Vehicle service information provided though Stellantis, Subaru of America, Audi of America, or ALLDATA.

Accreditation Statement:
The Automotive Technology, Mopar CAP, Program is Master Automotive Service Technology (MAST) accredited by Automotive Service Excellence Education Foundation.
https://www.aseeducationfoundation.org/

Course Student Learning Outcomes (SLO):

Upon successful completion of this course, the student will be able to:

1. Demonstrate his or her knowledge of principles, terminology, theories of operation, and service procedures associated with modern emissions control systems. [Supports ILG # 1, 3, 4, 10, 11 ; PLO # 1, 3, 4]
2. Analyze the symptoms of drivability concerns using scan tool data and diagnostic functions. [Supports ILG # 4, 11 ; PLO # 1, 3,]
3. Demonstrate the process to perform and analyze diagnostic procedures for misfires and rich/lean DTCs. [Supports ILG # 2, 4, 11 ; PLO # 1, 3]
4. Differentiate the root cause of customer driveability or emissions compliance concerns with the use of electronic service information. [Supports ILG # 4, 10, 11 ; PLO # 1, 2, 3, 4]
5. Explain the purpose, function of the evaporative emissions system, and perform diagnostic procedures using the scan tool, diagnostic flow charts, and leak detection equipment. [Supports ILG # 2, 4, 10, 11 ; PLO # 1,]
6. Identify tailpipe emissions gases, causes of excessive harmful emissions gasses, and diagnostic procedures to determine root cause of emissions control system failure. [Supports ILG # 3, 4, 10, 11 ; PLO # 1]
7. Describe the purpose, function of the diesel after treatment system, and demonstrate his or her ability to use service information and the scan tool to perform system tests to determine the root cause of failures. [Supports ILG # 2, 3, 11 ; PLO # 1, 3, 4]
8. Explain the function and purpose of emissions control system components including PCV, EVAP, EGR, SAI, MIL, VVT, catalytic converter, and oxygen sensors. [Supports ILG # 1, 4, 10 ; PLO # 1, 4]
9. Classify CARB, OBDI and OBDII emissions control systems. [Supports ILG # 1, 4, 10 ; PLO # 1, 4]
10. Demonstrate the process to diagnose drivability concerns and no start concerns caused by fuel system and ignition system failures. [Supports ILG # 4, 10, 11 ; PLO # 1, 3]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Automotive Technology (PLO)

1. Diagnose, service, and repair current automotive technologies.
2. Demonstrate desirable attitudes and work habits while working individually or with others.
3. Obtain service repair information and procedures from online websites and electronic databases.
4. Communicate effectively and professionally with customers and fellow technicians.

Units of study in detail – Unit Student Learning Outcomes:

Unit I **Procedures in Identifying Causes of Driveability Concern [Supports Course SLO # 1, 2, 4]**

Learning Objectives

The student will be able to…

- Explain how to approach a customer's driveability concern using the 6-step troubleshooting method.
- Indicate methods that are effective in duplicating intermittent or hard to verify engine performance concerns.
- Analyze freeze frame data to determine proper or faulty operation of components before component replacement.
- Distinguish between normal operation and system malfunctions.
- Use the six step troubleshooting procedure to verify a repair made to a vehicle's system.

Unit II **Enhanced Inspection and Maintenance Procedures [Supports Course SLO # 6]**

Learning Objectives

The student will be able to:

- Compare differences between standard and enhanced vehicle emission testing.
- Point out the advantages and disadvantages of enhanced emissions inspections.
- Summarize why enhanced testing is becoming more common in the United States.

Unit III **Emissions Control Systems [Supports Course SLO # 1, 2, 5, 6, 8, 9]**

Learning Objectives

The student will be able to:

- Explain the function and purpose of emissions control system components including PCV, EVAP, EGR, SAI, MIL, VVT, catalytic converter and oxygen sensors.
- Classify CARB, OBDI and OBDII emissions control systems.
- Explain the purpose, function of the evaporative emissions system, and perform diagnostic procedures using the scan tool, diagnostic flow charts and leak detection equipment.
- Analyze an emission control system and determine if the system is performing as designed.
- Identify vehicle performance concerns related to emissions control system malfunctions.
- Give examples of how each emissions control system reduces or eliminates emissions output.

Unit IV **Automotive Exhaust Emissions [Supports Course SLO # 1, 4, 6]**

Learning Objectives

The student will be able to…

- Indicate the harmful effects of greenhouse gasses on air quality and the environment.
- Identify potential hazards associated with carbon monoxide emissions.
- Demonstrate his or her knowledge of the relationship between engine temperature and emissions.
- Differentiate the differences between hydrocarbons, carbon monoxide, and oxides of nitrogen.
- Demonstrate the process to diagnose engine condition based on concentration of exhaust gas emissions.
- Analyze exhaust gas emissions to determine emissions control system component failure or degradation.

Unit V **Exhaust Gas Analyzers and Emissions Diagnosis [Supports Course SLO # 1, 6]**

Learning Objectives

The student will be able to…

- Demonstrate the process to operate a 5-gas exhaust analyzer.
- Describe current Federal and State emissions regulations.
- Identify exhaust gas emissions that are over regulation standards.
- Hypothesize possible malfunctions that might be causing emissions readings that are over regulation limits.
- Summarize vehicle emissions laws in the state of New Jersey.

Unit VI **Emissions Regulation and Engine Condition Diagnosis [Supports Course SLO # 1, 3, 4]**

Learning Objectives

The student will be able to…

- Explain how a misfire effects exhaust gas emissions.
- Demonstrate the process to diagnose a misfire.
- Use a scan tool to monitor cylinder misfire count to determine area of misfire.
- Explain how oil consumption effects exhaust emissions.
- Demonstrate his or her ability to follow the diagnostic service procedure to diagnose a rich or lean DTC.
- Interpret oxygen sensor data and fuel trim data to determine drivability issues.

Unit VII **Diagnosis of Fuel Injection Systems and Ignition Systems [Supports Course SLO # 1, 2, 3, 4, 10]**

Learning Objectives

The student will be able to…

- Recognize differences between warm and cold engine operation and how temperature effects the efficiency of emissions control devices.
- Demonstrate the process to diagnose no-start conditions using scan tool data and service information.
- Demonstrate the process to diagnose stop/start system failures by using scan tool data and service information.
- Analyze no-start conditions related to an Auto Start System by checking system inhibitors with the scan tool.
- Use the six step troubleshooting procedure to verify symptoms causing a no-start condition and drivability issues related to the fuel and ignition systems.
- Interpret component failure based on engine condition.

Unit VIII **Diesel Fuel and After Treatment Systems [Supports Course SLO # 1, 2, 4, 7]**

Learning Objectives

The student will be able to…

- Compare fundamental differences between gasoline and diesel engines.
- Recognize common performance symptoms cause by poor fuel quality or fuel contamination.
- Describe the purpose and function of all diesel exhaust system components, including sensors and DEF (diesel exhaust fluid).
- Explain the purpose and function of the diesel emissions systems regeneration process.
- Demonstrate the process to perform the manual regeneration procedure.
- Apply scan tool data to determine root cause of failure in the diesel exhaust after treatment system.

Unit IX **Alternative Fuels [Supports Course SLO # 2, 3, 10]**

Learning Objectives

The student will be able to…

- Summarize the purpose of the alternative fuels technology.
- Compare and contrast different alternative fuel sources.
- Identify possible long-term effects of the different alternative fuel sources.
- Paraphrase the reasons for dependence on foreign oil sources in the United States.

Evaluation of student learning:

Students are evaluated using weekly quizzes, a mid-term exam, a final exam, graded homework assignments, and hands-on work assignments in the automotive laboratory. Students are expected to read the assigned textbook chapters, handouts, and complete vehicle manufacturers' training material (if applicable) outside of class and at appropriate times throughout the course.

Please note that:

- Any student who scores below a 60% (D) on the final exam must repeat the course.
- Students enrolled in the any automotive program option sponsored by a vehicle manufacturer (Mopar CAP, Subaru University, or Audi AEP) must complete all vehicle manufacturer web courses, post-tests, and proctored assessments assigned at the start of the semester. The assigned web courses, post-test, and proctored assessments are in addition to the standard course assignments shown below. Due dates for each assigned web course, post-test, and proctored assessment is discussed in class, but all of them must be finished and passed before the beginning of the last week of the term.

Below is a list of the tools used for assessing student learning outcomes in this course. The percentages shown after each assessment tool refers to the weight each assessment has on a student's final course grade. Percentages are approximate.

Exams 35%
Quizzes 20%
Hands-On Lab Assignments 35%
Homework 10%

Read below for information that applies to all the Automotive Program's on-campus courses.

Policy Statement for Missed Lab Demonstrations:

Due to the concerns for student and staff safety, a student who does not attend tool, equipment, and procedure demonstrations performed by the course instructor, prior to a hands-on learning activity, may be excluded from participating in the hands-on activity. This occurs because the tools, equipment, and chemicals necessary to complete automotive diagnosis and service often present safety hazards for users and observers if the correct handling procedures are not followed.

Reasons for not attending demonstrations may include full or partial absence during the demonstration, or if a student does not give his or her full attention during the demonstration. Enforcement of this classroom policy is at the discretion of the course instructor, and is based largely on the dangers involved with the use of the necessary tools, equipment, and chemicals required to complete the hands-on activity, and the time necessary to complete a make-up demonstration.