COURSE OUTLINE

Course Number
AUT 211

Course Title
Automotive Emissions and Driveability Diagnosis

Credits
3

Hours: 2/3

Co- or Pre-requisite
AUT 110, AUT 111, and AUT 112

Implementation
Sem/Year
Spring 2021

Catalog description (as it appears in 2020-2021 edition):
Examines relationships between gasoline and diesel emissions and engine performance. Information from AUT 111 and AUT 112 used to properly diagnose driveability concerns. Recommended repair procedures are explored to achieve the best performance and reduced emissions. Electronic engine controls examined with an emphasis on operation and emission standards.

Is course New, Revised, or Modified? Revised

Required texts/other materials: Halderman, James D. Advanced Engine Performance Diagnosis, (current edition), Pearson Education

Revision date: Spring 2020

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

Information resources: DealerConnect web-site, service manuals, Subaru of America resources, online and self-study courses and the AllData online service information database

Other learning resources: (Describe any other student learning resources that are specific to this course, including any special tutoring or study group support, learning system software, etc.)

Course Competencies/Goals:

The student will be able to:
1. Demonstrate his/her knowledge of principles, terminology, theories of operation, and service procedures associated with current electronic engine control systems by answering test questions
2. Use the six-step troubleshooting procedure as a guide in the diagnosis and repair of emissions and driveability concerns
3. Use published service information to seek data related to repairs, specifications, or special tools and equipment
4. Identify the proper tools and equipment needed to test and repair systems related to vehicle emissions and driveability
5. Understand proper combustion of fuel in an internal combustion engine and highlight excessive emissions production as a result of improper combustion
6. Understand the differences between electronic engine controls found in OBD I and OBD II vehicles as they apply to the use of alternative fuel sources
7. Use an electronic diagnostic scan tool to diagnosis and repair driveability and emissions concerns
8. Identify the differences in the combustion processes for gasoline and diesel engine

Course-specific Institutional Learning Goals (ILGs)/General Education Goals.

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
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.

Units of study in detail.

Unit I: Review of Electronic Engine Controls
The student will be able to:
- Explain how electronic engine controls monitor powertrain sensors to calculate and adjust fuel delivery (Course Competency 1; ILG 1)
- Explain the differences in types of electronic engine controls and why the performance of some systems is superior to the performance of others (Course Competency 1; ILG 1)
- Use a diagnostic scan tool to check engine computers for diagnostic trouble codes (Course Competency 7; ILG 4)

Unit II: Internal Combustion of Gasoline, Diesel, and Alternative Fuels
The student will be able to:
- Explain the fundamental differences between the combustion of gasoline, diesel, and alternative fuels (Course Competency 8; ILG 1)
- Describe common engine performance symptoms associated with poor fuel quality or fuel contamination (Course Competency 5; ILG 1)
- Explain how electronic engine controls react to improper fuel combustion in the engine (Course Competency 1; ILG 1)
- Describe test procedures and necessary equipment needed to properly assess combustion quality (Course Competencies 3 & 4; ILG 10)
- Explain the advantages and disadvantages to the environment, infrastructure, engine performance, and cost of using alternative fuel sources (Course Competency 6; ILGs 1 & 10)
- Explain how turbo chargers and superchargers influence fuel delivery, engine power, and tailpipe emissions (Course Competencies 1 & 5; ILG 10)
Unit III: Gasoline Engine Emissions and Emissions Regulations

The student will be able to:
- Explain how gasoline engine tailpipe emissions can negatively affect the environment (Course Competencies 1 & 5; ILG 1)
- Identify potential sources of excessive emissions (Course Competency 5)
- Explain the difference between hydrocarbons, carbon monoxide, oxides of nitrogen, carbon dioxide, and oxygen (Course Competency 5; ILG 1)
- Locate and explain the Pennsylvania and New Jersey emissions cut points for tailpipe emission testing (Course Competency 3; ILGs 1, 4, & 10)
- Explain the passenger vehicle emissions testing procedures in Pennsylvania and New Jersey (Course Competency 3; ILGs 1 & 10)

Unit IV: Gasoline Engine Emissions Control Systems

The student will be able to:
- Explain how mechanical engine design influences tailpipe emissions output (Course Competencies 5 & 8)
- Locate vehicle emissions control systems on a real vehicle (Course Competency 3; ILG 10)
- Perform an emissions systems inspection and check for missing or modified emissions control devices (Course Competency 3; ILG 10)
- Use a diagnostic scan tool to check emission system monitor status (Course Competency 7; ILG 4)
- Check published service procedures for emissions related recalls and technical service bulletins (Course Competency 3; ILG 4)

Unit V: Light-Vehicle Diesel Engine Emissions and Emissions Regulations

The student will be able to:
- Explain how diesel engine tailpipe emissions can negatively affect the environment (Course Competency 5)
- Explain how diesel emissions regulations are tiered by vehicle weight class (Course Competency 5; ILG 10)
- Identify potential sources of excessive emissions (Course Competencies 5 & 8)
- Explain the difference between hydrocarbons, carbon monoxide, oxides of nitrogen, carbon dioxide, oxygen, and particulate matter (Course Competency 5; ILG 1)
- Locate and explain the Pennsylvania and New Jersey emissions cut points for diesel tailpipe emission testing (Course Competency 3; ILG 1, 4, & 10)
- Explain the light-vehicle diesel emissions testing procedures in Pennsylvania and New Jersey (Course Competency 3; ILG 1)

Unit VI: Light-Vehicle Diesel Engine Emissions Control Systems

The student will be able to:
- Explain the components of the exhaust and aftertreatment systems (Course Competencies 1, 5, & 8; ILGs 1)
- Explain the difference between passive and active regeneration (Course Competency 1; ILG 1)
- Explain how temperature sensors are used to monitor component operation (Course Competency 1; ILG 1)
- Check diesel exhaust fluid level using procedures found in published service information (Course Competencies 3 & 4; ILGs 4 & 10)
• Describe the function of diesel exhaust fluid (DEF) in the selective catalyst reduction (SCR) system (Course Competency 1; ILG 1)

Unit VII: Exhaust Gas Analyzers and Enhanced Emissions Testing
The student will be able to:
• Evaluate tailpipe emissions using a 5-gas analyzer and compare the readings to federal and state emissions cutpoints (Course Competencies 3 & 4)
• Identify tailpipe emissions gases over federal or state cut points and recommended steps necessary to correct the high emissions levels (Course Competencies 3; ILGs 4 & 10)
• Compare different emissions testing procedures and explain advantages and disadvantages of each (Course Competency 3; ILGs 4, 10)
• Explain how improper vehicle preparation could cause false emissions test results (Course Competency 3; ILGs 1, 4, 10 & 11)

Unit VIII: Driveability Diagnosis for Gasoline Engines
The student will be able to:
• Operate the vehicle in the service bay to verify the vehicle has a driveability concern (Course Competencies 2 & 3)
• After concern verification, describe possible causes for the vehicle malfunction (Course Competency 3; ILG 1)
• Use a diagnostic can tool to access diagnostic data in the engine controller (Course Competencies 3 & 7; ILGs 4 & 10)
• Follow published service procedures to locate the cause of the vehicle malfunction (Course Competencies 2 & 3; ILGs 4 & 10)
• Follow published service procedures to properly repair the malfunction and return the vehicle to normal operation (Course Competencies 1, 2, & 3: ILGs 4, 10, & 11)
• Clear diagnostic trouble codes and reset keep alive memory (KAM) (Course Competencies 7; ILG 4)
• Verify the fault is corrected by operating the vehicle under similar conditions that set the fault codes (Course Competencies 2 & 7; ILG 4)

Unit IX: Driveability Diagnosis for Light-Duty Diesel Engines
The student will be able to:
• Operate the vehicle in the service bay to verify the vehicle has a driveability concern (Course Competencies 2 & 3)
• After concern verification, describe possible causes for the vehicle malfunction (Course Competency 3; ILG 1)
• Use a diagnostic can tool to access diagnostic data in the engine controller (Course Competencies 3 & 7; ILGs 4 & 10)
• Follow published service procedures to locate the cause of the vehicle malfunction (Course Competencies 2 & 3; ILGs 4, 10, & 11)
• Follow published service procedures to properly repair the malfunction and return the vehicle to normal operation (Course Competencies 1, 2, & 3: ILGs 4 & 10)
• Clear diagnostic trouble codes and reset keep alive memory (KAM) (Course Competencies 7; ILG 4)
• Verify the fault is corrected by operating the vehicle under similar conditions that set the fault codes (Course Competencies 2 & 7; ILG 4)
Policy Statement for Missed Lab and Equipment Demonstrations:

Due to the technical nature of the Automotive Program and hazards involved with the use of specialty tools and equipment, a student that is absent from lab instruction, where demonstrations are performed by the course instructor, will not be permitted to complete the related lab work upon their return. This includes full-day absences and partial-day absences that result in missing the lab demonstration(s). Enforcement of these policies will be at the discretion of the course instructor.

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 manufacturers’ training material (if applicable) 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 Mopar Career Automotive Program (Mopar CAP) must complete all course-related Fiat Chrysler Automobiles (FCA) web courses and post-tests assigned at the start of the semester. The Mopar CAP requirements are in addition to the requirements stated above.

Academic Integrity Statement:

A student who knowingly represents the work of others as his/her own, uses or obtains unauthorized assistance in the execution of any academic work, gives fraudulent assistance to another student, or inappropriately or unethically uses technological means for academic gain is guilty of cheating. Submitting your own work from a previous course without the permission of your current course instructor is also deemed an academic integrity violation (See Student Handbook). Any student who violates this policy is subject to receive a failing grade for the assignment and will be reported to the Office of Student Affairs for further disciplinary action. Possible dismissal from the course could result.

Reasonable Accommodations for Students with Documented Disabilities

Mercer County Community College is committed to supporting all students in their academic and co-curricular endeavors. Each semester, a significant number of students document disabilities, which may require learning, sight, hearing, manual, speech, or mobility accommodations to ensure access to academic and co-curricular activities. The college provides services and reasonable accommodations to all students who need and have a legal entitlement to such accommodations.

For more information regarding accommodations, you may visit the Office of Academic Support Services in FA129 or contact them at 609.570.3422

Mercer County Community College is in compliance with both the ADA and section 504 of the Rehabilitation Act. If you have, or believe you have, a differing ability that is protected under the law, please see Arlene Stinson in LB216, at 609-570-3525 or at stinsona@mccc.edu for information regarding support services.