COURSE OUTLINE

Course Number	Course Title	Credits
AUT 213	Engine Service	4
Hours: Lecture/Lab/Other	**Co- or Pre-requisite**	**Implementation Semester & Year**
2/5	AUT 110 and AUT 111	Spring 2022

Catalog description: Diagnosis, failure analysis, and rebuilding procedures for automobile engines. Topics include engine operating principles, component measurement techniques, engine removal, installation, and service information usage for diagnosis. Each student is required to completely disassemble, diagnose, and assemble several four-stroke gasoline and diesel engines. Involves extensive use of special tools and equipment.

General Education Category: Non GenEd

Course coordinator: Jason Evans, 609-570-3776, evansj@mccc.edu

Required texts & Other materials: Halderman, James D., Automotive Engines: Theory and Servicing, 9th edition, Pearson Education, 2018. ISBN-13: 9780134654003

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 ability to adhere to safety procedures while working on or near a running four-stroke gasoline or diesel engine. [Supports ILG # 1, 11; PLO # 1, 2, 3, 4]
2. Understand and demonstrate how to perform a comprehensive engine condition analysis using electrical and mechanical instrument tools. [Supports ILG # 2, 3, 4, 10; PLO # 1, 2, 3]
3. Formulate diagnostic techniques to pinpoint engine noise concerns. [Supports ILG # 4, 11; PLO # 1, 3]
4. Define the function and operation of a four-stroke gasoline and diesel engine. [Supports ILG # 1, 10, 11; PLO # 1, 3]
5. Analyze engine component condition by taking measurements of engine components and identify abnormalities in excessive clearances and wear. [Supports ILG # 2, 3, 4, 11; PLO # 1, 2, 3, 4]
6. Demonstrate his or her ability to gather data and perform diagnostic procedures to determine the root cause of engine component failure. [Supports ILG # 1, 2, 3, 4, 10, 11; PLO # 1, 2, 3, 4]
7. Demonstrate his or her ability to fully disassemble and assemble a gasoline and diesel engine assembly. [Supports ILG # 1, 4, 10, 11; PLO # 1, 2, 3]
8. Use service information for torque specifications, clearances, component diameters, and other diagnostic information. [Supports ILG # 1, 2, 10; PLO # 3]
9. Analyze an engine's valve timing system to determine purpose, function, and causes of failure in camshaft and crankshaft correlation. [Supports ILG # 1, 4, 10, 11; PLO # 1, 3,]
10. Demonstrate industry acceptable techniques to properly handle, store, and inspect components of a gasoline and diesel four-stroke engine. [Supports ILG # 1, 4, 10, 11; PLO # 1, 2, 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 **Review of Engine Operation Theory and Engine Construction [Supports Course SLOs # 1, 4]**

Learning Objectives

The student will be able to:

- Explain the operation of all four-stroke gasoline and diesel engines.
- Evaluate possible causes for a poorly operating four-stroke gasoline and diesel engines.
- Identify and explain different components in a cam-in-block engine and an overhead cam engine.
- Describe the purpose and function of the camshaft and crankshaft and all supporting components used in an engine's valve timing system.
- Demonstrate safety procedures while working on or near a running four-stroke gasoline or diesel engine.
- Discuss the timing relationship between the camshaft and crankshaft.

Unit II **Engine Mechanical Systems Diagnosis [Supports Course SLOs # 1, 2, 3, 6]**

Learning Objectives

The student will be able to:

- Formulate a comprehensive engine condition analysis using electrical and mechanical instruments.
- Show proficiency in the use of a compression gauge, cylinder leak down tester, vacuum gauge, and oil presser gauge.
- Analyze engine test data to determine possible causes of failure.
- Locate the cause(s) of abnormal engine noise(s).

Unit III **Measurement Techniques and Equipment, and Engine Component Inspection [Supports Course SLOs # 5, 6, 7]**

Learning Objectives

The student will be able to:

- Compare actual measurements from engine components to measurement specifications and determine cause of component failure.
- Use appropriate tools to measure engine components such as pistons, piston rings, main bearing clearance, cylinder bore diameter, valve stem diameter, valve guide diameter, crankshaft endplay, and oil pump rotor clearances.
- Determine causes of wear patterns on upper and lower engine components.
- Demonstrate his or her ability to convert, analyze, and evaluate data achieved by measuring engine components.
- Demonstrate his or her ability to complete all engine measurements with the use of industry acceptable techniques, tools, and equipment.

Unit IV **Engine Removal from Vehicle – General Procedure [Supports Course SLOs # 1, 7, 8]**

Learning Objectives

The student will be able to:

- Locate the proper engine removal procedure in the service manual.
- Identify potential hazards associate with engine removal in various vehicle makes and models.
- Determine proper engine lifting points for the engine removal procedure.
- Summarize safety procedures necessary while performing engine removal.

Unit V **Lower Engine (Short-Block) Construction, Design, and Service [Supports Course SLOs # 3, 5, 6, 7, 8]**

Learning Objectives

The student will be able to:

- Show industry acceptable methods for piston removal and installation.
- Demonstrate his or her ability to remove and analyze piston rings purpose and function.
- Demonstrate his or her ability to inspect main bearings and connecting rod bearings for wear and explain reasons for failure.
- Classify how excessive bearing clearances effect engine oil pressure.
- Demonstrate his or her ability to remove an engine crankshaft and demonstrate proper storage techniques.
- Explain the importance of maintaining the order of all disassembled parts.
- Analyze the purpose and function of honing and boring procedures.

Unit VI **Upper Engine Construction, Design, and Reconditioning [Supports Course SLOs # 3, 5, 6, 7, 8]**

Learning Objectives

The student will be able to:

- Use industry acceptable techniques to recondition a cylinder head.
- Demonstrate his or her ability to operate a valve grinding machine and valve seat cutting machine.
- Explain the operation of different cylinder head designs and applications.
- Determine the necessity of cylinder head reconditioning or replacement.
- Evaluate a damaged cylinder head and pinpoint potential causes for the damage.
- Demonstrate his or her ability to disassemble and assemble various types of cylinder heads, using the proper tools, equipment, and procedures.

Unit VII **Variable Valve Timing Systems, Service and Diagnosis [Supports Course SLOs # 1, 2, 6, 7, 9]**

Learning Objectives

The student will be able to:

- Analyze the engine's valve timing system to determine purpose, function, and causes of failure.
- Determine valve timing using appropriate service information and tools.
- Determine how oil level and pressure effect the variable valve timing system.
- Identify the fundamental design differences of overhead valve (OHV) and overhead cam (OHC) valve timing systems.
- Demonstrate his or her ability to diagnose engine concerns related to improper valve timing.
- Explain the operational relationship between the camshaft and crankshaft.
- Compare the problems associated with improper valve timing on freewheeling and non-freewheeling engines.

Unit VIII **Engine Assembly Procedures [Supports Course SLOs # 7, 8]**

Learning Objectives

The student will be able to:

- Demonstrate his or her ability to adhere to industry acceptable techniques to assemble a gasoline and diesel four-stroke engine.
- Explain and demonstrate the importance of proper gasket sealing surface preparation.
- Demonstrate his or her ability to set and verify correct engine valve timing.
- Recognize the importance of following proper torque sequence and specifications for all fasteners used in an engine.
- Evaluate problems often caused during the engine assembly procedure.

- Recognize the importance of the correct orientation of gaskets, necessary for proper sealing of cylinder heads, intake manifolds, exhaust manifolds, timing covers, rear and front main seals, valve covers, and other engine components.

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 30%
Quizzes 15%
Hands-On Lab Assignments 40%
Homework 15%

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.