

## **AUTO ENGINES**

Grade Level:	10-11-12
Prerequisite:	Successful completion of Small Engines
Length:	1 Semester
Period(s) Per Day:	1
Credit:	1/2
Credit Requirement Fulfilled:	Vocational/Elective

### **Course Description:**

Automotive Engines is an introductory course to motor vehicle gas engines. It will cover the study of shop safety and tools used for engine overhaul. The students will also learn about the cooling and lubrication systems and proper maintenance of these systems. Students will explore the charging and starting systems for these engines. It also teaches some machine work and measuring instruments used during the machining process. Each student will disassemble and assemble one automotive engine in the lab environment. Students will also rebuild an engine starting motor in the lab.

### **Course Objectives and Expectations:**

1. Perform operations of tools and equipment in the shop safely and efficiently.
2. Describe the basic principles of automotive engines.
3. Identify all the parts of an automotive engine.
4. Perform an overhaul of an automotive engine.
5. Precisely measure and inspect the engine for any signs of damage.
6. Learn to maintain and service engines.
7. Learn some machine shop techniques commonly used on auto engines.
8. Troubleshoot and diagnose problems with the automotive engine to determine the necessary repairs and do what is necessary to correct the problems the first time.
9. Learn how to order and pay for engine parts in a timely manner.
10. Maintain and clean the Auto Engine shop.
11. Maintain and clean the tools related to Auto Engines.
12. Learn about current automotive engine trends.

**Student Objectives:**

1. Students will learn to work safely in the automotive shop.
2. Students will learn to use tools and equipment common to automotive engine service and repair.
3. Students will learn the construction and operation of an automotive engine.
4. Students will learn to identify engine parts and their functions.
5. Students will learn basic measurement and math used in the automotive repair industry.
6. Students will learn procedures to disassemble, inspect, and rebuild automotive engines.
7. Students will learn maintenance and repair techniques common to automotive engines.
8. Students will learn common diagnostic processes and testing related to automotive engines.
9. Students will learn to maintain tools, equipment, and environment of the automotive repair shop.
10. Students will learn about new and different designs of automotive engines.

***Pacing******Montana Common Core Standard*****Quarter 1 & 2**

Unit 1 – Safety in the automotive shop	1.II.1, 4.II.2, 4.II.3, 4.II.4, 5.II.3
Unit 2 – Tools/equipment used in industry	1.II.1, 4.II.2, 4.II.3, 4.II.4, 5.II.3
Unit 3 – Starting and charging systems	1.II.1, 2.II.2, 2.II.3, 2.II.4, 3.III.1, 3.III.2, 3.III.3, 4.II.1, 4.II.2, 4.II.3, 4.II.4, 4.II.5, 5.II.1, 5.II.3, 5.II.4
Unit 4 – Engine design and classification	1.II.1, 4.II.3, 5.II.3
Unit 5 – Engine rebuilding	1.II.1, 2.II.2, 2.II.3, 2.II.4, 3.III.1, 3.III.2, 3.III.3, 4.II.1, 4.II.2, 4.II.3, 4.II.4, 4.II.5, 5.II.1, 5.II.3, 5.II.4
Unit 6 – Engine size and performance	1.II.1, 4.II.3, 5.II.3
Unit 7 – Engine top end construction and operation	1.II.1, 4.II.3, 5.II.3
Unit 8 – Engine bottom end construction and operation	1.II.1, 4.II.3, 5.II.3

Unit 9 – Engine front end construction and operation	1.II.1, 4.II.3, 5.II.3
Unit 10 – Engine bottom end service	1.II.1, 4.II.3, 5.II.3
Unit 11 – Engine top end service	1.II.1, 4.II.3, 5.II.3
Unit 12 – Engine cooling system construction and operation	1.II.1, 4.II.3, 5.II.3
Unit 13 – Engine cooling system service	1.II.1, 4.II.3, 5.II.3
Unit 14 – Engine lubrication system construction and operation	1.II.1, 4.II.3, 5.II.3

### 1<sup>st</sup> Quarter

#### Safety in the automotive shop

- A. Shop safety
- B. Keep work area clean
- C. Use tools properly
- D. Operate engines safely

#### Tools/equipment used in industry

- A. Basic hand tools
- B. Measuring tools
- C. Power tools
- D. Specialty tools and shop equipment

#### Starting and charging systems

- A. Basic construction and operation
- B. Rebuild starting motor
- C. Testing starting motor

#### Engine design and classification

- A. Cylinder configuration
- B. Fuel type
- C. 4 stroke, 2 stroke, rotary
- D. Valve train layout

#### Engine rebuilding

- A. Disassembly
- B. Cleaning and inspection
- C. Measurement and failure analysis
- D. Short block assembly
- E. Cylinder head reconditioning
- F. Top end assembly
- G. Installation to run stand
- H. Preparations for starting
- I. Final checks and tuning

#### Engine size and performance

- A. Displacement
- B. Compression ratio

- C. Performance measurement
- D. Efficiency calculations

Engine top end construction and operation

- A. Cylinder heads
- B. Valve train designs
- C. Intake manifolds
- D. Exhaust manifolds

Engine bottom end construction and operation

- A. Cylinder block
- B. Pistons, piston rings, piston pin
- C. Connecting rods
- D. Crankshaft
- E. Bearing designs
- F. Oil seals

2<sup>nd</sup> Quarter

Engine front end construction and operation

- A. Harmonic balancer
- B. Camshaft drive types
- C. Engine Front Cover

Engine bottom end service

- A. Engine block inspection and measurement
- B. Engine block reconditioning
- C. Piston inspection and measurement
- D. Piston reconditioning
- E. Crankshaft inspection and measurement
- F. Crankshaft reconditioning
- G. Connecting rod inspection and measurement
- H. Connecting rod reconditioning

Engine top end service

- A. Cylinder head inspection and measurement
- B. Cylinder head reconditioning
- C. Camshaft service
- D. Lifter service
- E. Intake and exhaust manifold installation
- F. Valve adjustment

Engine cooling system construction and operation

- A. Cooling system purpose
- B. Cooling system types
- C. Cooling system parts
- D. Cooling system part function
- E. Cooling system instrumentation
- F. Antifreeze properties and functions

Engine cooling system service

- A. Cooling system problems (overcooling, undercooling, leaks)
- B. Diagnostic tools and testing methods
- C. Component service/replacement procedures
- D. Inspection and maintenance

Lubrication system construction and operation

- A. Lubrication system functions
- B. Engine oil properties and functions
- C. Engine oiling methods
- D. Engine oil pump designs
- E. Pressure relief valves
- F. Engine oil filters
- G. Positive crankcase ventilation system
- H. Instrumentation

**Timeline:**

Unit 1 -	Safety in the automotive shop	(1 week to cover)
Unit 2 -	Tools/equipment used in the industry	(1 week to cover)
Unit 3 -	Starting and charging systems	(1 week to cover)
Unit 4 -	Engine design and classification	(1 week to cover)
Unit 5 -	Engine rebuilding	(15 weeks continuous to end)
Unit 6 -	Engine size and performance	(1 week to cover)
Unit 7 -	Engine top end construction and operation	(1 week to cover)
Unit 8 -	Engine bottom end construction and operation	(1 week to cover)
Unit 9 -	Engine front end construction and operation	(1 week to cover)
Unit 10 -	Engine bottom end service	(2 weeks to cover)
Unit 11 -	Engine top end service	(3 weeks to cover)
Unit 12 -	Engine cooling system construction and operation	(1 week to cover)
Unit 13 -	Engine cooling system service	(1 week to cover)
Unit 14 -	Lubrication system construction and operation	(1 week to cover)
Total =		(19 weeks to cover)

***Montana Content Standards/RST***

**Content Standard 1:** Students experience various career opportunities and assess personal career pathways.

Benchmark II. 1. Explore and identify personal interests, aptitudes, and abilities and develop strategies to achieve tentative career goals.

**Content Standard 2:** Students demonstrate an understanding and apply principles of Resource Management (i.e. financial, time, personal management).

Benchmark II.2. Prioritize, allocate time, prepare and follow schedules to complete a project.

Benchmark II.3. Apply appropriate time to task.

Benchmark II.4. Use physical resources wisely to accomplish a goal.

**Content Standard 3:** Students experience various career opportunities and assess personal career pathways.

Benchmark II.1. Demonstrate active leadership skills by participation in group activities and projects.

Benchmark II. 2. Demonstrate positive personal and work ethics.

Benchmark II. 3. Demonstrate skills to be a productive citizen.

**Content Standard 4:** Students acquire and demonstrate current technical skills leading to an occupation.

Benchmark II.1. Practice technical skills and procedures required for an occupation.

Benchmark II.2. Practice safe and appropriate use of technology.

Benchmark II.3. Select the appropriate tools, equipment, and procedures for the task.

Benchmark II.4. Manage and maintain technological tools and follow troubleshooting protocol.

Benchmark II.5. Apply technical information to a variety of sources.

**Content Standard 5:** Students know and demonstrate the requirements of the workplace through authentic application.

Benchmark II.1. Practice and demonstrate academic and technical skills to a workplace setting.

Benchmark II.3. Identify the possible outcomes and consequences of decisions.

Benchmark II.4. Use acceptable industry standard equipment in a school setting.

**Resources:**

<http://opi.mt.gov/Portals/182/Page%20Files/Career%20%26%20Technical%20Education/Docs/Standards%20and%20Guidelines/ContStds-CareerTech.pdf>