

COURSE OUTLINE **Engine Performance I**

Course Description:

AT101 Engine Performance I. 4 Credit Hours. This course will enable the student to be introduced to the engine performance field. Engine design and operation, combustion control methods, engine support systems, basic automotive science, measuring systems and tools will be covered as a part of this course.

Course Relevance:

The principles underlying the operation of the internal combustion engine must be understood before a proper diagnosis and repair can be implemented. This course represents the foundation for all other engine performance courses.

Required Materials:

Halderman and Mitchell (2006). *Automotive Engine Performance*. Columbus, OH: Prentice Hall Career & Technology.

Learning Outcomes: Successful completion of this course will allow the student to:

1. Apply the “outside-in” approach to automotive diagnostics
2. Comprehend engine principles and systems and operations
3. Follow a fixed sequence in his/her diagnosis allowing them to repair the “cause” not the symptom

Learning PACT

Through the student involvement in this course, the student will develop and document his/her achievement of the following PACT skills:

Primary skills (developed and documented):

1. Problem Solving
 - Through comprehension of engine principles and system operation, the student should be capable of diagnosing the cause of a particular symptom.
2. Critical Thinking
 - Through researching the procedures and specifications to implement the repair, the student will utilize critical thinking to select the proper diagnostic tool(s).
3. Internet Use
 - Through utilizing online information services, the student will develop Internet skills.
4. Reading Skills

- Through referencing written documents in support of the repair procedure, the student will develop reading skills.
5. Interpersonal Communication
- Through working with his/her fellow team members in the successful completion of the assigned repair problem, the student will develop the communication skills.

Secondary skills (developed but not documented):

- Listening
- Non-verbal communication
- Computer Literacy
- Reading
- Time Management

Assessment Tasks:

These learning outcomes and primary Learning PACT skills will be demonstrated by:

1. In a field related environment, demonstrating the comprehension of engine operating principles, engine systems interrelationship, and the use of task appropriate tools in the diagnosis and repair of assigned tasks.
2. Demonstrating the ability to research information relative to the assigned task.
3. Demonstrating critical thinking skills through the utilization of the systems approach to analysis and repair of assigned tasks.
4. Demonstrating interpersonal communication skills through working as a member of a repair “team”.

Course Content:

- I. Themes - Key recurring concepts that run throughout this course:
 - A. Safety in the workplace
 - B. Quality of workmanship
 - C. Time analysis/management
 - D. Work ethic
- II. Issues - Key issues that will be addressed in this course: areas of conflict that must be understood in order to achieve the intended outcome:
 - A. Time management for effective repair
 - B. Quality of repair
 - C. The need for a “systems approach” for repairs
 - D. Historical perspective: Does the vehicle have a “history” of problems
 - E. Research skills
- III. Concepts – Key concepts that must be understood to address the issues:

The 4-stroke principle

 - A. Valve timing
 - B. Compression ratio
 - C. Understanding engine vacuum
 - D. Fluid flow principles

- E. Hydrodynamic lubrication
 - F. Heat transfer
 - G. Combustion theory
 - H. Ignition timing
 - I. Exhaust gas analysis
- IV. Skills / Competencies - Actions that are essential to achieve the course outcomes:
- A. Interpret and verify complaint; determine needed repairs
 - B. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed repairs
 - C. Diagnose unusual engine noise or vibration problems; determine needed repairs
 - D. Diagnose unusual exhaust color, odor, and sound; determine needed repairs
 - E. Perform engine absolute (vacuum/boost) manifold pressure tests; determine needed repairs
 - F. Perform cylinder balance tests; determine needed action
 - G. Perform cylinder compression tests; determine needed action
 - H. Perform cylinder leakage tests; determine needed action
 - I. Diagnose engine mechanical, electrical, electronic, fuel and ignition problems with oscilloscope and engine diagnostic equipment; determine needed action
 - J. Prepare 4 or 5 gas analyzer, obtain and interpret readings; determine needed repairs
 - K. Diagnose oil leaks, emissions, and drive-ability problems resulting from failure if the p.c.v. system
 - L. Inspect and test p.c.v. filter/breather cap, valve, tubes, orifices, and hoses; service as needed
 - M. Adjust valves on engines with mechanical or hydraulic lifters
 - N. Verify correct camshaft timing; determine needed action
 - O. Verify engine operating temperature; determine needed action.
 - P. Perform cooling system pressure tests; check coolant condition, inspect and test radiator, pressure cap, coolant recovery tank and hoses; service and replace as necessary
 - Q. Inspect and test thermostat, bypass, and housing; service as necessary
 - R. Inspect and test mechanical/electric fans, fan clutch, fan shroud, ducting, air dams, and fan control devices; service as necessary

Learning Units:

- I. Demonstrate comprehension of engine theory through the execution of assigned tasks
- II. Demonstrate proper diagnostic procedures through the selection and utilization of task appropriate tools and equipment
- III. Demonstrate safe work practices in the execution of assigned tasks

- IV. Demonstrate the ability to research task appropriate information and service bulletins
- V. Demonstrate the ability to perform in a team environment
- VI. Demonstrate ethical work practices

Learning Activities:

Independent and collaborative learning activities will be assigned within the classroom and lab environment to assist the student in achieving the desired outcomes. Class discussion, lecture, reading assignments and supportive lab activities will also contribute to the learning process.

Grade Determination:

Grade determination will be based on the student's performance of assigned tasks within the classroom/lab environment. Attendance, group participation, attitude towards fellow students and assigned tasks will be reflected in the final grade. Lab tasks (competencies) will be evaluated (rated) on the competency profile.