

AUT 183 (A8)
ENGINE PERFORMANCE II

COURSE DESCRIPTION:

Prerequisites: TRN 120 and AUT 181

Corequisites: None

This course covers an in-depth study of the electronic engine control systems used on today's complex vehicles, the diagnostic process used to locate engine performance concerns and the procedures used to restore normal operation. Topics will include currently used fuels and fuel systems, exhaust gas analysis, emission control components and systems, OBD II On-Board Diagnostics and inter-related electrical/electronic systems and emerging engine performance technologies. Upon completion students should have the ability to diagnose and repair complex engine performance concerns using appropriate test equipment and service information. Course Hours per Week: Class Hours, 2; Lab, 6. Semester Credit Hours, 4.

SAFETY DISCLAIMER:

Automotive work presents many hazards. A moment's carelessness can cause injury to oneself or to others. Such mishaps can occur quickly due, in part, to the nature of the industrial tools used in automotive work. The weight of automobiles and the equipment used to fix them can even cause fatal injuries. Therefore, great care must always be taken in checking out equipment before use, and in using that equipment to work on automobiles.

As we work to insure the safety of everyone in the Durham Tech automotive lab, it is the instructor's responsibility to introduce students to equipment and to advise them on its safe operation. Those health and safety procedures are also presented in each textbook for each course in the automotive program. **Students are responsible for mastery of that safety information.** Durham Tech holds each student in every class responsible for reading and applying all of the information regarding personal and public safety and personal and public health in the required text.

While working in the Durham Tech automotive lab, safety glasses must be worn by everyone. However, safety glasses are only one small requirement so that students remain injury free. All safety recommendations in the text book and from the instructor must be followed. A student with any questions about a safety procedure should immediately ask an instructor for clarification.

Any student using equipment in the automotive lab must be responsible for using that equipment in a safe manner. Durham Tech holds each student in automotive classes responsible for acting to ensure a safe environment and to ensure both the student's own safety and the safety of his classmates.

LEARNING OUTCOMES:

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

- a. Utilize technical specifications and troubleshooting procedures.
- b. Locate circuit components using wiring diagrams.
- c. Select and set up test equipment.
- d. Troubleshoot driveability problems and determine needed repairs.
- e. Inspect, test and repair engine fuel systems.
- f. Test and replace faulty components
- g. Analyze and interpret exhaust emissions values.
- h. Perform on-board computer diagnostics (OBD 1 and OBD 2).
- i. Perform circuit and connector repairs.
- j. Perform emission control systems diagnostics and repair.

OUTLINE OF INSTRUCTION:

I. Internal Combustion Engine Operation

A. Review of Operating Principles

- 1) 4 Stroke
- 2) 2 Stroke

B. The Combustion Process

C. Chemistry of Combustion

D. Ignition Timing and Synchronization

E. Variable Valve Timing

F. Engine Operation and Air Pressure

- 1) "NA" Naturally Aspirated
- 2) Turbochargers
- 3) Superchargers
- 4) "NOS" Nitrous Oxide Systems

II. The Diagnosis Process (Review)

A. Verify the Problem

B. Gather Customer Information and Vehicle History

C. Visual Inspection and Basic Tests

D. Retrieve and Record DTCs

E. Scan Tool Data (including freeze frame)

F. Identify the Problem Cylinder or System

G. Repair Problem and Determine Root Cause

H. Verify Repair and Clear Codes

III. Engine Fuels

A. Gasoline

- 1) Volatility
- 2) Volatility Problems

- 3) Normal and Abnormal Combustion
 - 4) Air/Fuel Ratios
 - 5) Gasoline Grades and Octane
 - 6) Oxygenated Fuels
 - 7) Testing Gasoline
- B. Diesel
 - C. Alcohol and Blends
 - D. CNG, LPG
 - E. Hydrogen
 - F. Others

IV. Exhaust Gas Analysis

- A. Hydrocarbons
- B. Carbon Monoxide
- C. Carbon Dioxide
- D. Oxygen
- E. NO_x
- F. 4 and 5 Gas Analyzers
- G. Diagnosis

V. Emission Control Systems (Operation and Testing)

- A. Positive Crankcase Ventilation
- B. Air Pumps and Pulse-Air
- C. Evaporative Control
- D. Exhaust Gas Recirculation
- E. Catalytic Converters

VI. OBD II On-Board Diagnostics Gen II

- A. Generic Requirements and Features
- B. Readiness Modes
 - 1) Warm Up Cycle
 - 2) Trip
 - 3) Drive Cycle
- C. Enable Criteria and Monitoring
 - 1) Catalyst Efficiency Monitor
 - 2) Misfire Monitor
 - i. Type "A"
 - ii. Type "B"
 - 1) Fuel System Monitor
 - 2) Oxygen Sensor Monitor
 - 3) EGR Monitor
 - 4) EVAP System Monitor
 - 5) Secondary Air Monitor
 - 6) Comprehensive Monitor
- D. Manufacturers Specific Features

- VII. Diagnosis Equipment
 - A. Scan Tool Recording and Output Controls
 - B. “DSO” Digital Storage Oscilloscopes
 - C. “GMM” Graphing Multimeter
 - D. Breakout Boxes
 - E. Smoke Machines

- VIII. Manufacturers Specific Ignition Systems (adapt as required)
 - A. General Motors
 - B. Ford
 - C. Chrysler
 - D. Asian
 - E. European

- IX. Manufacturers Specific Fuel Systems (adapt as required)
 - A. General Motors
 - B. Ford
 - C. Chrysler
 - D. Asian
 - E. European

- X. New Engine Performance Technologies

REQUIRED TEXTBOOKS AND MATERIALS:

To be announced by the instructor.

NATEF:

This course fulfills 128 hours of the 220 hours required by NATEF for A8. See COE 111.