

**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 a usR Tw/22s us

## **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<sub>x</sub>
- 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.