COURSE DESCRIPTION:

Prerequisites: AUT 183
Co-requisites: None

This course utilizes service information and specialized test equipment to diagnose and repair power train control systems. Topics include computerized ignition, fuel and emission systems, related diagnostic tools and equipment, data communication networks, and service information. Upon completion, students should be able to perform diagnosis and repair. Course Hours per Week: Class, 2; Lab, 2. Semester Hours Credits 3.

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 DTCC 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. DTCC 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 DTCC 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 Technical Community College 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. Explain the operation of computerized engine controls to monitor, adjust, and control various engine functions.
b. Locate relevant service information.
c. Research system operation using technical information to determine diagnostic procedure
d. Use appropriate diagnostic procedures based on available vehicle data and service information
e. Use appropriate test equipment to diagnose problems with electronic sensors, controllers, and circuits.
f. Differentiate between powertrain mechanical and electrical/electronic problems.
g. Determine root cause of failures.
h. Differentiate between communication protocols.
i. Interpret scan tool data and lab scope patterns to determine system condition.
j. Establish relative importance of displayed scan tool data.
k. Diagnose and service emission control components and circuits using established and recommended test procedures.
l. Verify effectiveness of repairs.

OUTLINE OF INSTRUCTION:

I. Class orientation
   A. Class routine and lab policy
   B. Required materials
   C. Automotive lab safety
   D. Lab equipment use/operation

II. Diagnostic Procedures
   A. 8-step diagnostic procedure
      1) Verify the problem
      2) Visual inspection
      3) Retrieve diagnostic trouble codes
      4) Check for TSBs
      5) Analyze scan tool data
      6) Isolate problem system or cylinder, determine root cause.
      7) Make the repair
      8) Verify the repair
   B. Symptom Based Diagnostics
   C. Root Cause
   D. Diagnostic Charts
   E. Non computerized problems

III. Diagnostic Trouble Code Retrieval
   A. Computer precautions
   B. DTC's
      1) how codes are set
      2) hard vs. soft codes
      3) code retrieval
         i. flash codes
         ii. scan tool
   C. Communication
      1) Multiplexing
      2) Bus Classes
      3) CAN

IV. Service Data
   A. TSBs
   B. Electronic Data
   C. Manuals
D. Fuel trim cells
   1) integrator/short term
   2) block learn/long term

V. OBD II
   A. Diagnostic Executive
   B. Monitors
   C. Enabling Criteria
   D. Trouble Codes
   E. Drive Cycles
   F. Freeze Frame

VI. Diagnostic Tools
   A. Digital Multimeters
      1) Measurements
      2) RMS vs. Average
      3) AC and DC coupling
   B. Lab oscilloscopes
      1) setup
      2) pulse trains
   C. Logic Probe

VII. Advanced Starting and Charging Systems
   A. Batteries
      1) function and purpose
      2) symptoms of a weak battery
      3) safety considerations
      4) testing and service
   B. Starter diagnosis
      1) current draw
      2) volt drop testing
   C. Charging system diagnosis
      1) output
      2) volt drop testing
      3) AC ripple test

VIII. Ignition System Diagnosis
   A. Operation
   B. Coils
   C. Mutual Induction
   D. Troubleshooting and testing
      1) ignition coil
      2) pickup coil
      3) Hall-effect sensors
      4) Optical sensors
      5) modules
   E. Spark plugs
   F. Timing
   G. Scope testing
   H. Power balance testing
IX. Engine Fuels and Driveability
   A. Gasoline
      1) grades/volatility/octane
      2) blending
      3) RVP
   B. Oxygenated gasoline
   C. Alcohol additives
   D. Reformulated gasoline
   E. Diesel
      1) Clean Diesel
   F. Alternative fuels
      1) Compressed Natural Gas
      2) Propane
      3) Biodiesel
      4) Ethanol
      5) Electric/Hybrid

X. Computer Sensor Diagnosis
   A. Sensor parameters
      1) Testing
         i. multimeter
         ii. oscilloscope
   B. False readings
   C. DTCs

XI. Electronic Fuel Injection Diagnosis
   A. Fuel Delivery
   B. Electrical Circuits
   C. Diagnostics/testing
   Fuel pump pressure
   D. Oscilloscope testing
   E. Idle speed control

XII. Emission Control Diagnosis
   A. Positive crankcase ventilation
   B. Air injection systems
   C. Evaporative emissions
   D. Exhaust gas recirculation valves
   E. Catalytic converters
   F. Testing and diagnosis

XIII. Exhaust Emission Testing
   A. Combustion efficiency
      1) hydrocarbons
      2) carbon monoxide
      3) carbon dioxide
      4) oxides of nitrogen
      5) oxygen
   B. Photochemical and smog formation
   C. Base lining/diagnosis
D. Carbon cleaning procedures
E. Five Gas Exhaust Analysis

XIV. Engine Condition Diagnosis
A. Smoke and noise
B. Vacuum testing
C. Compression testing
D. Cylinder leakage
E. Power balance testing
F. Oil analysis

XV. New Automotive Technologies

**REQUIRED TEXTBOOKS AND MATERIALS:**

To be announced by the instructor.

**NATEF:**

This course fulfills 64 hours of the 220 hours required by NATEF for A8. See COE 111.