# Advanced Engine Performance Diagnosis 6/E

## Chapter 10 ON-BOARD DIAGNOSIS

## Opening Your Class

| KEY ELEMENT | EXAMPLES |
|---|---|
| **Introduce Content** | This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references. |
| **Motivate Learners** | Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money. |
| **State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.** | Explain the chapter learning objectives to the students.<br>1. Understand the purpose and function of on-board diagnostics generation-II (OBD-II) systems.<br>2. List the continuous and non-continuous monitors.<br>3. Understand the information obtained from an on-board diagnostics monitor and the criteria to enable an OBD monitor.<br>4. Discuss the numbering designation of OBD-II diagnostic trouble codes.<br>5. Explain powertrain control module (PCM) tests and the modes of operation of OBD-II vehicles. |
| **Establish the Mood or Climate** | Provide a *WELCOME,* Avoid put downs and bad jokes. |
| **Complete Essentials** | Restrooms, breaks, registration, tests, etc. |
| **Clarify and Establish Knowledge Base** | Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share. |

**NOTE: This lesson plan is based on Advanced Engine Performance Diagnosis 6/E Chapter Images found on Jim's web site @ www.jameshalderman.com**

**LINK CHP 10: Chapter Images**

| ICONS | Ch10 ON-BOARD DIAGNOSIS |
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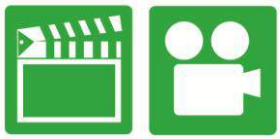
|  | **1. SLIDE 1 CH10 ON-BOARD DIAGNOSIS** |
|  | **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/**<br>**WEB SITE REGULARLY UPDATED** |
|  | **2. SLIDE 2 EXPLAIN Figure 10-1** typical malfunction indicator lamp (MIL) often labeled "check engine" or "service engine soon" (SES). |
|   | **DEMONSTRATION: CONNECT A SCAN TOOL TO OBD-II VEHICLE & SHOW STUDENTS HOW TO ACCESS MONITOR STATUS. THEN DEMONSTRATE COMPREHENSIVE COMPONENT MONITOR OPERATION BY DISCONNECTING A SENSOR SUCH AS ENGINE COOLANT TEMPERATURE WITH THE KEY ON. SHOW ILLUMINATED MIL & STORED DTC.FIGURE 10-1** |
|   | **DISCUSSION: HAVE STUDENTS TALK ABOUT PURPOSE OF ONBOARD DIAGNOSTIC SYSTEMS. HOW DID COMPUTER CONTROL SYSTEMS FUNCTION PRIOR TO OBD-I? HAVE THE STUDENTS DISCUSS OBD-I. WHAT WERE SOME OF SHORTCOMINGS/PROBLEMS OF OBD-I?** |
|  | **HANDS-ON TASK: HAVE THE STUDENTS LOCATE THE DIAGNOSTIC LINK CONNECTOR (DLC) ON SEVERAL OBD-I VEHICLES USING COMPONENT LOCATORS. ASK STUDENTS TO COMPARE VARIOUS LOCATIONS TO STANDARDIZED LOCATIONS ON AN OBD-II VEHICLE** |
|   | **ON-VEHICLE NATEF TASK LOCATE AND INTERPRET VEHICLE AND MAJOR COMPONENT IDENTIFICATION NUMBERS: DIAGNOSE CAUSES OF EMISSIONS OR DRIVEABILITY CONCERNS WITH STORED OR ACTIVE DTCS; OBTAIN, GRAPH, & INTERPRET SCAN TOOL DATA: DESCRIBE IMPORTANCE OF RUNNING ALL OBDII MONITORS FOR REPAIR VERIFICATION** |

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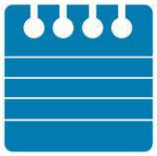
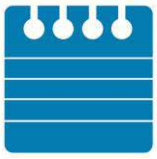
|   | **DISCUSSION:** HAVE THE STUDENTS DISCUSS EXAMPLES OF **OBD-II MONITORS** AND HOW THEY OPERATE. WHAT IS A MONITOR? |
|  | CERTAIN 1996 & 1997 OBD-II VEHICLES COULD SET A MISFIRE DTC FROM OPERATION ON ROUGH ROADS. MISFIRE MONITOR WAS VERY SENSITIVE ON THESE VEHICLES & COULD MISINTERPRET SLIGHT CRANKSHAFT SPEED VARIATIONS CAUSED BY ROUGH ROADS AS IGNITION MISFIRES |
|   | **DEMONSTRATION:** DEMONSSTRATE OPERATION OF **MISFIRE MONITOR** BY CLOSING ELECTRODE GAP ON SPARK PLUG AND OPERATING THE ENGINE. ONCE MISFIRE HAS BEEN DETECTED, CONNECT SCAN TOOL & SHOW DTC |
|  | DEPENDING ON PCM'S DETERMINATION OF MISFIRE'S SEVERITY, MISFIRE MONITOR MAY SET PENDING CODE UNTIL IGNITION IS CYCLED OFF & ENGINE IS OPERATED 2ND TIME. AFTER 2ND FAILURE, MATURED DTC SETS, WITH MIL ON |
|   | **DISCUSSION:** DISCUSS **ENABLING CRITERIA** AND WHY THEY ARE IMPORTANT. WHAT ARE CONDITIONS THAT MUST BE MET FOR EACH MONITOR TO RUN? |
|   | **DISCUSSION:** DISCUSS CRITERIA FOR A **TRIP** AND WHY THEY ARE IMPORTANT FOR THE OBD-II SYSTEM. WHAT IS A TRIP? |
|   | **DISCUSSION:** HAVE THE STUDENTS TALK ABOUT **DRIVE CYCLES.** WHAT IS A DRIVE CYCLE AND HOW DOES IT DIFFER FROM A TRIP? |
|  | **DTC (VIEW) (DOWNLOAD)** |
|   | **DISCUSSION:** HAVE STUDENTS DISCUSS **NUMBERING OF DTCS.** WHAT ARE MAJOR CATEGORIES OF OBD-II DESIGNATED DTCS? EXPLAIN NUMBERING FOR OBD-II DTCS & GIVE SOME EXAMPLES & EXPLANATIONS (E.G., P0301-CYLINDER #1 MISFIRE DETECTED; P0441-INCORRECT EVAPORATIVE PURGE FLOW |

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|  | DETECTED) **FIGURE 3-2**<br>3. **SLIDE 3 EXPLAIN Figure 10-2** OBD-II DTC identification format. |
|  | **ON-VEHICLE NATEF TASK RETRIEVE AND RECORD DIAGNOSTIC TROUBLE CODES, OBD MONITOR STATUS, AND FREEZE FRAME DATA; CLEAR CODES WHEN APPLICABLE** |
|  | **ON-VEHICLE NATEF TASK DIAGNOSE EMISSIONS OR DRIVEABILITY CONCERNS W/O STORED DIAGNOSTIC TROUBLE CODES; DETERMINE NECESSARY ACTION** |
|  | **DISCUSS FREQUENTLY ASKED QUESTION** |
|  | **EXPLAIN CHART 102–1** PCM Determination of Faults Chart |
|  | **DISCUSSION: HAVE THE STUDENTS TALK ABOUT TYPES OF DTCS. HOW ARE OBD-II DTCS CLASSIFIED FOR IMPORTANCE? CHART 10-1** |
|  | **DEMONSTRATION: CREATE A ONE-TRIP FAILURE OF A TWO-TRIP CODE; FOR EXAMPLE, CREATE A TYPE B MISFIRE BY CLOSING SPARK PLUG ELECTRODES & OPERATING ENGINE ONE TIME. SHOW STUDENTS HOW TO FIND PENDING DTCS WITH SCAN TOOL CHART 10-1** |
|  | **DISCUSSION: HAVE THE STUDENTS DISCUSS PENDING CODES. WHAT ARE PENDING CODES AND WHERE ARE THEY STORED?** |
|  | **HANDS-ON TASK: HAVE THE STUDENTS CREATE PENDING DTCS ON LAB VEHICLES THEIR OWN CARS. HAVE THEM RETRIEVE THE PENDING CODES AND FREEZE-FRAME DATA.** |

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|  | **DISCUSSION:** DISCUSS **PCM TESTS.**<br>WHAT IS **RATIONALITY TESTING**?<br>WHAT IS **FUNCTIONALITY TESTING**?<br>**DEMONSTRATION: ON OBD-II VEHICLE**<br>DISCONNECT A SENSOR, SUCH AS A COOLANT TEMPERATURE SENSOR, TO SHOW STUDENTS HOW PCM TESTS FUNCTIONALITY. SHOW STUDENTS DTC AND CREATE AN OPPOSING DTC BY SHORTING CONNECTOR TERMINALS TOGETHER. |