LEWIS AND CLARK COMMUNITY COLLEGE
GODFREY, ILLINOIS
AUTO 279 - **ADVANCED ENGINE PERFORMANCE**
Course Syllabus

A. COURSE DESCRIPTION

AUTO 279 ADVANCED ENGINE PERFORMANCE

Studies the various automotive computer control systems. Emphasizes service, diagnosis and repair of OBD I and OBD II automotive computer controlled systems. Shop experience includes utilizing specialty tools and equipment (including scan tools, lab scopes, exhaust and engine analyzers). Diagnosis and repair of foreign and domestic drivability problems is performed. Identification and service of various types of hybrid vehicles is performed following manufacturer's recommended safety precautions. *Prerequisite: AUTO 242 and AUTO 246.* (PCS 1.2, 6 credit hours: 4 hours lecture, 6 hours lab)

B. LEARNING OBJECTIVES

Upon successful completion of the course, a student should be able to:

1. Recognize and apply shop safety procedures.
2. Demonstrate the ability to use various automotive repair and specification manuals and
software
3. Define the various terms used in the discussion of OBD I and OBD II automotive computer
control systems
4. Identify the names and location of various sensors and actuators and describe the primary
function of each
5. Demonstrate the ability to use various specialty tools and equipment including digital multimeters (DMM), scan tools, lab scopes and breakout boxes utilized in the diagnosis, service and repair of automotive computer controlled systems
6. Discuss vehicle problem(s) with vehicle owner and/or instructor and test drive to verify
customer concern and determine needed service and/or repairs
7. Prepare a vehicle work order including customer information, vehicle information, customer
concern, related service history, cause and recommended vehicle service and/or repairs
8. Write a diagnostic and service report containing procedure(s) followed, findings upon the
conclusion of the test(s) and service needed

9. Describe current IM 240 requirements and regulations
10. Perform diagnostic tests on engine mechanical, electrical, electronic, fuel, ignition and
emission control systems with the use of an oscilloscope, 4 or 5 gas analyzer and engine
(performance) diagnostic equipment
11. Retrieve and clear diagnostic trouble codes (on both OBD I and OBD II computer systems)
in accordance with manufacturer's recommended procedures
12. Interpret diagnostic trouble codes and computer data utilizing appropriate scan tools and
diagnostic charts
13. Diagnose emission and driveability concerns resulting from failure of computerized engine
controls, with and/or without diagnostic trouble codes
14. Inspect and test computerized engine control systems including control modules, sensors,
actuators and circuits (power and ground) making necessary repairs and/or adjustments
15. Practice recommended precautions when handling static sensitive devices
16. Diagnose driveability and emission problems resulting from failures of interrelated systems
including cruise controls, security alarms, suspension controls, traction controls, A/C,
automatic transmissions, non-OEM-installed accessories and similar systems
17. Diagnose no-starting, driveability and emission concerns on vehicles with distributorless
electronic ignition (EI/DIS)
18. Diagnose and repair driveability and performance problems on vehicles with computer
controlled injection-type fuel delivery systems
19. Perform fuel pump inspection and tests on mechanical and electrical fuel pumps and pump
control systems including pressure regulation systems and components
20. Test and adjust (where applicable) engine idle speed, fuel mixture and cold enrichment
system and components
21. Inspect, test and clean fuel injectors following manufacturer's recommended procedures.
22. Measure exhaust system back-pressure and determine needed repair(s)
23. Remove, inspect and test vacuum and electrical circuits, components and connections of
the fuel system making repairs as needed
24. Identify the components of turbocharger/supercharger systems describing theory and
operation of each
25. Diagnose emission and driveability problems resulting from failure of the positive
crankcase ventilation (PCV), exhaust gas recirculation (EGR), secondary air injection,

catalytic converter, intake air temperature control and evaporative emissions control systems
26. Inspect and test various components (and circuits where applicable) of the positive crankcase ventilation (PCV), exhaust gas recirculation (EGR), secondary air injection, catalytic converter, intake air temperature control and evaporative emissions control systems
27. Identify and service various types of hybrid vehicle and their components following manufacturer's recommended procedures and safety precautions
28. Demonstrate safety when servicing HEV
29. Isolate HV systems
30. Diagnose HEV powertrain related failures

C. MATERIALS OF INSTRUCTION

Required and optional student instructional materials must be approved by the department and/or dean.
1. Required student materials:
a. *Today's Technician: Advanced Engine Performance* by Mark Schnubel, Delmar, latest edition
b. Workbook: *Engine Performance - NATEF Standards Job Sheets A8*
second edition, by Jack Erjavec
c. Student Hand Tool Set (Required list will be distributed at the outset of the course.)
d. Safety Glasses (Available in the LCCC Bookstore.)
e. Dress Code Appropriate for Automotive Repair Activities

2. Optional student materials:
a. Uniforms, Lab Coats and/or Coveralls
b. Recommended Additional Hand Tools

3. Miscellaneous instructor and/or student material (films, slides, software, workbooks, etc.):
a. Audio Visual Materials
b. Mitchell Auto Repair Manuals and On-Demand Software
c. Specialty Tools and Equipment
d. Handouts of Current Articles
e. Student progress report sheet
f. Homework assignment and answer sheet
g. Automotive lab safety rules
h. Automotive student information sheet
i. AUTO 279 Course Outline

D. LEARNING RESOURCE CENTER SUPPORT MATERIALS

The Learning Resource Center may have supplemental materials that students can use to access additional information.

E. METHODS OF INSTRUCTION

Instructional methods in this course may include, among others, the following:

1. Lecture including the use of audio visual materials.
2. Demonstrations of the use of auto repair and specification manuals/software.
3. Demonstrations of various diagnostic and repair procedures.
4. Demonstrations of the use of various specialty tools and equipment.
5. Question and discussion.
6. Individual and group laboratory instruction.
7. Industry field trips (as appropriate).
8. Industry sponsored clinics (when available).

F. EVALUATION OF STUDENT ACHIEVEMENT

The instructor's policies on evaluation will be distributed to students and the division office at the outset of the course.

The methods of evaluating student achievement will include, at minimum, the following:

1. Lab assignments (including the completion of job sheets and required NATEF tasks
2. Eighteen homework assignments
3. Two written exams and two quizzes
4. Department of Labor SCAN Skills (Secretary's Commission on Achieving Necessary Skills)
5. Attendance and classroom/lab participation

Additional methods of evaluation may be used and described in the course outline.

G. ATTENDANCE POLICY

Regular attendance is expected. The instructor's policies on attendance will be distributed to students and the division office at the outset of the course.

H. COURSE CONTENT

The following topics are to be covered during the instructional process:

1. Shop Safety Procedures
2. Automotive Service and Repair Information
a. Mitchell Software (On-Demand)
b Service Manuals
1. Factory
2. General
3. Specialized

3. Engine Diagnostic Equipment
a. Oscilloscope
b. Engine Performance Analyzer
c. Exhaust Gas Analyzer
d. Volt/Ohm Meter
1. Digital
2. Analog
e. Scan Tool
f. Charging/Starting System Tester
g. Vacuum Gauge
h. Vacuum Pump
i. Timing Light
j Tach/Dwell Meter
k. Computer Memory Retaining Tool
l. Spark Tester
m. Breakout Box
n. Fuel Pressure Gauge
o. Cylinder Compression Gauge
p. Cylinder Leakage Tester
q. Noid Light
r. Exhaust System Backpressure Gauge
4. Computer Control System Diagnosis and Repair
a. Electronic Control Module (Computer)
1. Memory
a. ROM (Read Only Memory)
b. RAM (Random Access Memory)
c. PROM (Programmable ROM)
d. EPROM (Eraseable PROM)
e. EEPROM (Electronically Eraseable PROM)
2. Processors
a. Input
b. Output
c. Central
3. Assembly Line Data Link (ALDL)
4. Modes of Operation
5. Computer Parameters
6. Retrieval and Interpretation of Diagnostic Codes
7. Retrieval and Interpretation of Data Stream Information
8. Malfunction Indicator Light (MIL)
a. Sensors (Inputs) (Including But Not Limited to the Following)
1. Thermistors
2. Signal Generators
3. Potentiometers
4. Switches
b. Controls/Actuators (Outputs) (Including But Not Limited to the Following)
1. Solenoids

2. Motors
3. Relays
4. Servos
5. Modules
5. Fuel Injection
a. History of Fuel Injection
1. Mechanical vs Electrical
2. Advantages of Fuel Injection
a. Emissions
b. Fuel Economy
b. Fuel Control Systems Terminology
c. Types of Fuel Injection Systems
1. Direct Injection (Diesel)
2. Intake Manifold Injection (Gasoline)
a. Throttle Body Injection
b. Port Fuel Injection
d. Methods of Fuel Injection Delivery
1. Timed Injection
2. Continuous Injection
e. Fuel Control Components
1. Electric High Pressure Pump
2. Fuel Filter
3. Fuel Rail and Injector(s)
4. Fuel Pressure Regulator
5. Supply and Return Lines
f. Fuel Injection Diagnosis and Repair
1. Fuel System Tests
a. Injector Balance Test
b. Fuel System Pressure Test
c. Fuel System Electrical Circuit Test(s)
2. Component Replacement
a. Fuel Injectors
b. Fuel Filter
c. Fuel Pump and/or Sending Unit
d. Fuel Rail
e. Fuel Pressure Regulator
3. Use of Specialty Tools and Equipment
a. Fuel System Pressure Gauge
b. Fuel Injector Cleaner
c. Specialty Tools and Equipment
6. Distributorless (EI) Ignition System
a. History of the Ignition System
1. Electronic Distributor (DI)Type
2. Electronic Distributorless (EI)Type
3. Advantages of Distributorless (EI) Ignition
a. Fewer Moving Parts

b. Remote Mounting Capability
c. Less Maintenance
d. Higher Voltage Capabilities
b. Distributorless (EI) Ignition Systems Terminology
c. Distributorless (EI) Ignition Systems Theory
1. Conventional Current Flow (Positive to Negative)
2. Electron Current Flow (Negative to Positive)
3. Waste Spark Theory
d. Types of Distributorless Ignition Systems
e. Distributorless Ignition Components
1. Crankshaft\Camshaft Sensors
a. Magnetic Sensor and Reluctor
b. Hall Effect Switch
2. Interrupter
3. Ignition Module
4. Ignition Coils (Coil Packs)
f. Distributorless (EI) Ignition System Diagnosis and Repair
1. Oscilloscope
a. Misfire
1. Under Load
2. Idle
b. Low Voltage
c. No-Spark Condition
2. Component Replacement
a. Crankshaft\Camshaft Sensors
1. Crankshaft Sensor Adjustment
2. Camshaft Sensor Adjustment
b. Interrupter
c. Ignition Module
d. Ignition Coils (Coil Packs)
3. Use of Specialty Tools and Equipment
a. Scan Tool
b. Oscilloscope
c. Specialty Tools and Equipment
7. Methods of Diagnosis
a. General Motors
b. Ford
c. Chrysler
d. Imports
8. On-Car Diagnosis
X. HEV Systems
a. Series
b. Parallel
c. Series-Parallel
d. Power Controls
e. Safety/PPE

1. PPE Inspection/Service
f. HEV Circuitry Service
1. Isolation/HV verification
2. Insulation Testing
3. Hev terminology
4. HEV Familiarization
5. Diagnosis of HEV system faults
6. Technician safety features

I. ACCOMMODATION STATEMENT

If you need an accommodation based on the impact of a disability, please inform me as soon as possible. An appointment will be arranged where we will discuss the course format, anticipate your needs and explore potential accommodations. I rely on Mary Hough, Special Learning Needs Counselor, for assistance in verifying the need for accommodations and accommodation strategies. If you have not previously contacted her, I encourage you to do so at 468-4128 or 468-4121. This does not apply to High School dual credit students.

J. ACADEMIC DISHONESTY

Assignments that have been copied from another student or another source will not be scored. "Academic dishonesty including, but not limited to, cheating, plagiarism, and forgery, violates the STUDENT CONDUCT CODE and will lead to disciplinary action up to and including expulsion" (*2004-2005 LCCC Catalogue*, page 14). The following website will give you in-depth information on the definition of plagiarism and more: **http://www.turnitin.com/research_site/e_what_is_plagiarism.html** . Please visit this site if you need clarification.
PERSONAL TECHNOLOGY DEVICES IN THE CLASSROOM In an effort to preserve the integrity of the academic environment, extraneous use of personal electronic devices (cell phones, bluetooth, PDAs, iPods, etc.) is prohibited during all class meetings. The instructor reserves the right to examine the device in instances where allegations of academic dishonesty are suspected. In emergency situations students must inform the instructor to receive permission to leave the classroom when their cellular phones vibrate(do not have cell phone ring or otherwise disturb the class).

The attachments below, if any, represent Form 13 Articulation Exhibits from various universities.