

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**AUT212**

**ADVANCED ENGINE PERFORMANCE LAB**

3 Credit Hours

Prepared by: Gary Boyher  
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Revised by: Brad Berrey  
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## AUT212 Advanced Engine Performance Lab

### I. CATALOGUE DESCRIPTION

- A. Pre-requisite: AUT201 Basic Electrical/Electronic Systems with a Grade of “C” or Better  
 AUT202 Basic Electrical/Electronic Systems Lab with a Grade of “C” or Better  
 Reading Proficiency  
 Co-requisite: AUT 211 Advanced Engine Performance
- B. 3 Credit Hours
- C. This course includes testing, diagnosis, and repair of fuel systems and emission control devices. Testing procedures will include fuel pressure and volume testing. It will also include testing fuel pump rpm and waveform testing. Fuel injector waveform analysis and service will be included in this course. Completion of this course will prepare the student for employment in the automotive field and take the National Institute for Automotive Service Excellence (ASE) Electrical/Electronic Systems Test (A6), Engine Performance Test (A8), and Advanced Engine Performance Specialist Certification Test (L1). (F)

### II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

<b>A. General Engine Diagnosis</b>		
Demonstrate knowledge of completing a work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of identifying and interpreting engine performance concern; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of researching applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

Demonstrate knowledge of locating and interpreting vehicle and major component identification numbers	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing excessive oil consumption abnormal exhaust color, odor, and sound; determine necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of performing engine absolute (vacuum/boost) manifold pressure tests; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of performing cylinder power balance test; determine necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of preparing a 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of verifying engine operating temperature; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge verify correct camshaft timing.	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

### **B. Computerized Engine Controls Diagnosis and Repair**

Demonstrate knowledge of retrieving and recording diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
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Demonstrate knowledge of diagnosing the causes of emissions or drivability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing emissions or drivability concerns without stored diagnostic trouble codes; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of checking for module communication (including CAN/BUS systems) errors using a scan tool	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing computerized engine control system sensors, power train/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of accessing and using service information to perform step-by-step diagnosis	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing drivability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of performing active tests of actuators using a scan tool; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of describing the importance of running all OBDII monitors for repair verification	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

<b>C. Ignition System Diagnosis and Repair</b>		
Demonstrate knowledge of diagnosing ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing ignition primary and secondary circuit wiring and solid state components; test ignition coil(s); perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing crankshaft and camshaft position sensor(s); perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting, testing, and/or replacing ignition control module, power train/engine control module; reprogram as necessary	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge remove and replace spark plugs; inspect secondary ignition components for wear and damage.	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

<b>D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair</b>		
Demonstrate knowledge of diagnosing hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of checking fuel for contaminants and quality; determine necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

Demonstrate knowledge of inspecting throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of how to replace fuel filter(s)	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge Inspect, service, or replace air filters, filter housings, and intake duct work	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing fuel injectors	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of verify idle control operation	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of performing exhaust system back-pressure test; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of testing the operation of turbocharger/supercharger systems; determine necessary action	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of how to Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
<b>E. Emissions Control Systems Diagnosis and Repair</b>		
Demonstrate knowledge of diagnosing oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

Demonstrate knowledge of inspecting, testing and servicing positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting, testing, servicing and replacing components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing emissions and drivability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing mechanical components of secondary air injection systems; perform necessary action	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing electrical/electronically- operated components and circuits of air injection systems; perform necessary action	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of inspecting and testing catalytic converter efficiency	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of diagnosing emissions and drivability concerns caused by the evaporative emissions control system; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

Demonstrate knowledge of inspecting and testing components and hoses of the evaporative emissions control system; perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of interpreting diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback

<b>F. Engine Related Service</b>		
Demonstrate knowledge of inspecting and testing mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of identifying hybrid vehicle internal combustion engine service precautions	P-3	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge of Perform cooling system pressure tests and dye tests to identify leaks; check coolant condition and level: inspect and test radiator, pressure cap, coolant recovery tank, and heater core and galley plugs; determine necessary action	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge Identify causes of engine overheating.	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
Demonstrate knowledge Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams	P-1	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback



Demonstrate knowledge Inspect, test, and replace oil temperature and pressure switches and sensors	P-2	Performance of Task During Lab/Shop Class with 100% Accuracy Lab Exercises Instructor Observation/Feedback
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### III. OUTLINE OF TOPICS

- A. Properly Fill Out a Work Order
- B. Computerized Engine Controls Diagnosis and Repair
  - 1. Perform diagnostics on computerized engine control systems using industry practices
  - 2. Locate and use service information for step by step procedures
  - 3. Perform active tests of actuators using a scan tool
  - 4. Perform running OBD II readiness monitors
- C. Ignition System Diagnosis and Repair
  - 1. Diagnose ignition system related drivability problems
  - 2. Inspect and test ignition primary and secondary circuits and components
  - 3. Replace defective ignition related components
- D. Fuel, air induction, and exhaust systems diagnosis and repair
  - 1. Diagnose drivability problems related to fuel, air induction, or exhaust systems
  - 2. Repair/replace defective fuel, air induction, and exhaust system components
  - 3. Verify repairs
  - 4. Verify correct idle control operation
  - 5. Locate correct service procedures
- E. Emissions control systems diagnosis and repair
  - 1. Diagnose emissions related concerns/failures using industry accepted practices
  - 2. Diagnose drivability problems related to emissions control systems
  - 3. Locate proper service information
- F. Engine related service
  - 1. Inspect and test cooling fans, fan clutch, fan shroud, and fan controls
  - 2. Identify hybrid vehicle service precautions

IV. METHOD(S) OF INSTRUCTION

- A. Lab Exercises
- B. A-Tech Diagnostic Boards
- C. Live Vehicle Repair
- D. Electude/Argo Online Curriculum

V. REQUIRED TEXTBOOK(S)

Al Santini, *Automotive Electricity & Electronics*, (Current Edition), Delmar

VI. REQUIRED MATERIALS

- A. Safety Glasses
- B. Jefferson College Automotive Technology or Approved Sponsoring Shop Workshirt
- C. Work Boots

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHODS OF EVALUATION

- A. Student Participation 40%
- B. Shop Work 60%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College Website <http://www.jeffco.edu>).

## XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

## XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.