



CENTRAL PIEDMONT COMMUNITY COLLEGE

Course Syllabus AUT 181 Engine Performance - 1 GENERAL CURRICULUM (H.S.)

Syllabus Contents:

- Course Description
- Course Objectives
- Weekly Outline
- Student Evaluation
- Safety Regulations
- Tool List

Time Requirements:

- 16 Weeks
- 2 Class Hours/Week
- 3 Lab Hours/Week
- 3 Semester Hours Credit

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AUT 181
GENERAL CURRICULUM (H.S.)
ENGINE PERFORMANCE - 1

Prerequisite: None

Course Description:

This course covers the introduction, theory of operation, and basic diagnostic procedures required to restore engine performance to vehicles equipped with complex engine control systems. Topics include an overview of engine operation, ignition components and systems, fuel delivery, injection components and systems as well as emission control devices. Upon completion, students should be able to describe operation and diagnose/repair basic ignition, fuel and emission related drivability problems using appropriate test equipment/service information.

Core Competency:

CPCC has identified a set of core competencies that help each student apply their knowledge in practical ways in order to meet class goals and standards. This course will address the communication competency, both written and oral by having students write a research paper on the topic of Alternative Fuels to gasoline. Upon completion, the student is required to submit his or her paper to the instructor by the required due date for a grade. Students are also required to participate in an oral class discussion about Alternative fuels and are encouraged to share their opinions as to which fuel they feel will be the best long term replacement for gasoline.

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ENGINE PERFORMANCE - 1

For every task in Engine Performance the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

A. General Engine Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
2. Identify and interpret engine performance concern; determine necessary action. P-1
3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. P-1
4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). P-1
5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. P-2
6. Diagnose abnormal engine noise or vibration concerns; determine necessary action. P-2
7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. P-2
8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1
9. Perform cylinder power balance test; determine necessary action. P-1
10. Perform cylinder cranking compression tests; determine necessary action. P-1
11. Perform engine running compression test; determine necessary action. P-2
12. Perform cylinder leakage test; determine necessary action. P-1
13. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment; determine necessary action. P-1
14. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. P-1
15. Verify engine operating temperature; determine necessary action. P-1
16. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. P-1
17. Verify correct camshaft timing. P-2

B. Computerized Engine Controls Diagnosis and Repair

1. Retrieve and record stored OBD I diagnostic trouble codes; clear codes. P-3
2. Retrieve and record stored OBD II diagnostic trouble codes; clear codes when applicable. P-1

3. Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes. P-1
4. Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action. P-1
5. Check for module communication (including CAN/BUS systems) errors using a scan tool. P-2
6. Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1
- 7 Obtain and interpret scan tool data. P-1
8. Access and use service information to perform step-by-step diagnosis. P-1
9. Diagnose driveability 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
10. Perform active tests of actuators using scan tool; determine necessary action. P-1

C. Ignition System Diagnosis and Repair

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action. P-1
2. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action. P-1
3. Inspect and test ignition primary circuit wiring and solid state components; perform necessary action. P-2
4. Inspect, test and service distributor. P-3
5. Inspect and test ignition system secondary circuit wiring and components; perform necessary action. P-2
6. Inspect and test ignition coil(s); perform necessary action. P-1
7. Check and adjust ignition system timing and timing advance/retard (where applicable). P-3
8. Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action P-1

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

1. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, and stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine necessary action. P-1
2. Check fuel for contaminants and quality; determine necessary action. P-3
3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1

4. Replace fuel filters. P-1
5. Inspect and test cold enrichment system and components; perform necessary action. P-3
6. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2
7. Inspect and test fuel injectors. P-1
8. Check idle speed. P-2
9. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action. P-2
10. Perform exhaust system back-pressure test; determine necessary action. P-1
11. Test the operation of turbocharger/supercharger systems; determine necessary action P-3

E. Emissions Control Systems Diagnosis and Repair

1. Positive Crankcase Ventilation
 1. Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action. P-2
 2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2
2. Exhaust Gas Recirculation
 1. Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action. P-1
 2. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1
 3. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2
3. Exhaust Gas Treatment
 1. Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action. P-2
 2. Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3
 3. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3
 4. Inspect and test catalytic converter performance. P-1
4. Evaporative Emissions Controls
 1. Diagnose emissions and driveability problems resulting from malfunctions in the evaporative emissions control system; determine necessary action. P-1
 2. Inspect and test components and hoses of evaporative emissions control system; perform necessary action. P-2
 3. Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action. P-1

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters. P-1
2. Remove and replace timing belt; verify correct camshaft timing. P-1
3. Remove and replace thermostat and gasket. P-1
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1
5. Perform common fastener and thread repair to include, remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-1
6. Perform oil and filter changes. P-1
7. Demonstrate proficiency in using oxy-acetylene torch to heat and cut metal. P-3
8. Identify hybrid vehicle internal combustion engine service precautions. P-3

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ENGINE PERFORMANCE - 1
WEEKLY OUTLINE

Required Textbook:

Today's Technician - Automotive Engine Performance
5th Edition Ken Pickerill
2-volume set

WEEK 1

Orientation: Review course syllabus, grading policy, and safety regulations.

- Reading Assignment: Chapter 3, Pages 39-53

WEEK 2

A. Review principles of Basic Engine Operation

B. Review engine classification.

Assign research paper on alternative fuels

- Reading Assignment: Chapter 10: Pages 285 -298

WEEK 3

QUIZ: Basic Engine Operation

A. Discuss automotive fuels and combustion characteristics

B. Octane

C. Abnormal combustion

D. Fuel additives

E. Diesel fuel

F. Alternative Fuels

G. Video: Fuels and Drivability

- Reading Assignment: Chapter 10: Pages 309-262

WEEK 4

QUIZ: Fuels, Octane, Abnormal Combustion

A. Discuss Fuel delivery systems and testing

B. Discuss Fuel Tanks, Lines, and Filters

WEEK 5

- A. Discuss Fuel delivery systems and testing (Cont.)
- B. Discuss Fuel Pumps, Mechanical and Electric.
- C. Discuss Electric Fuel Pump circuits.
 - Reading Assignment: Chapter 5:

WEEK 6

QUIZ: Fuel delivery systems and testing

- A. Discuss Intake and Exhaust systems.
- B. Discuss Air Cleaners, Intake and Exhaust manifolds, Forced Induction Types.
 - Reading Assignment: Chapter 12

WEEK 7

QUIZ: Intake and Exhaust systems

- A. Discuss Distributor type Ignition Systems.
- B. Discuss Types of Distributor Systems.
- C. Discuss Distributor system components and operation.
 - Reading Assignment: Chapter 13

WEEK 8

- A. Discuss Distributorless type Ignition Systems.
- B. Discuss types of Distributorless Systems: Waste Spark and Coil on Plug.
- C. Discuss Distributorless system components and operation.
 - Reading Assignment: Chapters 6 and 7

WEEK 9

QUIZ: Ignition systems.

- A. Discuss Inputs and Outputs
- B. Discuss types of Input sensors and Output actuators
 - Reading Assignment: Chapter 11

WEEK 10

- Reading Assignment: Chapter 11 and Chapter 8 pages 211-220

WEEK 11

- A. Computers, Input sensors and Output actuators
- B. Discuss Types of Fuel Injection.
- C. Fuel Injection Components
- D. Throttle Body Injection.
- E. Lab: Identify and inspect components of the Fuel Injection system.

Alternative Fuels Paper DUE

WEEK 12

- A. Fuel Injection systems (cont)
- B. Types of Fuel Injection (cont).
- C. Port Fuel Injection and Sequential Fuel Injection.
- D. Scan tool usage relating to the fuel system
- E. Scan tool data relating to the fuel system.
- F. Lab: Test and Inspect Fuel injection System and components
 - Reading Assignment: Chapter 14

WEEK 13

QUIZ: Types of Fuel Injection, components and operation

- A. Discuss Emission control systems
- B. Evaporative Emission Controls
- C. PCV Systems
- D. Spark Control Systems
- E. Lab: identify and test Emission Control devices.
 - Reading Assignment: Chapter 11

WEEK 14

- A. Emission control systems (cont)
- B. EGR Systems
- C. Intake Heat Control
- D. Catalytic Converters
- E. Lab: Identify and test Emission Control devices
 - Reading Assignment: Chapter 8 Pages 220- 240

WEEK 15

QUIZ: Emission control systems

- A. Discuss OBD II.

WEEK 16

- B. Settle Lab Projects, Final Grades
- C. **Lab: Clean Shop, All Must Participate**



CENTRAL PIEDMONT COMMUNITY COLLEGE

STUDENT GRADE POINT AVERAGE

Students will be graded according to the following grade point system.

Grade	Point Value	Description
A	4	Excellent
B	3	Very Good
C	2	Satisfactory
D	1	Poor
F	0	Failing
The following grades will not be used in computing the grade point average.		
I = Incomplete		W = Withdrawal
S = Satisfactory		U = Unsatisfactory
AUD = Audit		N = Never Attended
X = Credit by Examination		

- **Since this course is preparatory to entering the automotive service industry, job attitude, neatness, promptness and care of equipment will be considered part of the final grade. The final grade on these items will be determined by the instructor and based upon accepted industry standards.**

GRADING

1. FOR A GRADE OF "A":

- Complete all written tests with an average of 93% to 100%.
- Attend 90% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined EXCELLENT in an actual shop.

2. FOR A GRADE OF "B":

- Complete all written test with an average of 85% to 92%.
- Attend 85% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined VERY GOOD in an actual shop.

3. FOR A GRADE OF "C":

- Complete all written tests with an average of 77% to 84%.
- Attend 80% of scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined SATISFACTORY in an actual repair shop.

4. FOR A GRADE OF "D":

- Complete all written tests with an average of 70% to 76%.
- Attend 80% of all scheduled class/lab hours.
- Complete all lab/shop work in a manner as would be determined POOR in an actual repair shop.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Department Student Dress Code Effective August 2005

All automotive students will have and wear safety glasses at all times in shop or lab areas. Failure to adhere to safety glasses rules may result in disciplinary action.

1. All students are required to wear their dealer sponsored uniform to school each day. If a student has not been sponsored by a dealer, the student may purchase approved CPCC shirts from the school store. All shirts must be clean and tucked in. Rips and tears must be mended in a timely manner.
2. Dark colored work-style pants are recommended or Proper fitting jeans that meet the following requirements (length above the shoes, jeans above the hip with belt). No oversized jeans will be permitted. **Shorts are not allowed.** Rips and tears must be mended in a timely manner.
3. Facial jewelry of any type is **NOT** permitted. This includes ear, nose, lip, eyebrow, and cheek rings and/or studs. We also suggest that you refrain from wearing necklaces, rings, or bracelets of any kind as these items may pose a safety hazard.
4. All belts will be of the type that does not have an exposed buckle. No keys, chains or wallets hanging out of pockets.
5. Hats are permitted in the shop area only! If a hat has a brim, it must be worn with it facing forward.
6. Students must wear leather work boots or shoes with steel toes. We highly recommend oil resistant soles. No sneakers, tennis shoes, open toed shoes, or dress shoes are permitted.
7. Other appearance issues not directly covered by these rules will be considered on a case-by-case basis. CPCC staff will decide what is professional in appearance and what is not.

Any Student Not Following These Guidelines Will Be Dismissed From Class And Attendance Credit For That Day Will Not Be Given. No Excuses Will Be Considered.

- Students will bring tools required for class with them at class time.
 - **No Tools, No Lab Credit.**
- **Remember how you act and present yourself will reflect on the department and presentations to prospective employers.**



Automotive Department Student Guidelines / Expectations

- No tobacco products usage is allowed inside any college building at any time.
- Eating or drinking in classrooms is with permission of instructor only; **there will be no eating or drinking in shop or lab or lab areas.**
- Students are expected to be in class on time and will be held responsible for any information covered by instructor, even if late or absent. Tests and quizzes missed may be made up only with instructor permission.
- Missed or late assignments will affect student's course grade.
- Tardiness is a problem; any student who is over 15 minutes late for a class will be counted as absent. CPCC attendance policy is in the on line student handbook.
- Students are expected to conduct themselves in a mature manner at all times. Students caught cheating, fighting, stealing, spinning tires, vandalizing or purposely damaging a vehicle or equipment will be **EXPELLED** from the automotive program. Care should be shown to college vehicles and property.
- Leaving class or shop/lab early without instructor permission will not be tolerated.
- Students are expected to come prepared for class. This means with paper, textbook, pens, pencils or other required material.
- Cell phones and pagers must be turned off during all class or lab times. Cell phones may only be used outside of the automotive buildings. Cell phones which ring during class will be subject to forfeiture or may result in student loss of privilege.
- The area in front of the main lab is not a parking area for students. The laneway must remain open for emergency vehicles. Vehicles inappropriately parked will be ticketed and towed. No parking means No Parking.
- All students are expected to clean up and put away all tools and equipment used during class or lab before leaving. Housekeeping is very important and will be part of your grade.
- Whenever you are unsure about anything ask your instructor! It is your responsibility to make sure that no physical damage occurs to any vehicle that you are working on or driving. Students are responsible for their actions!
- **Safety glasses** and student tools are mandatory in all shop/lab areas, no exceptions.
- All vehicles brought into the main lab will have a CPCC work order filled out and visible on windshield.



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Automotive Technology, Tool List

Safety Glasses or Goggles Mandatory in Labs

- Toolbox
- Common slotted screwdrivers, 4"x3/16, 6"x1/4, 8"x1/4
- Phillips screwdrivers number 1 and number 2
- Torx bit set T10 to T60
- Standard combination wrench set 5/16 to 1 1/4"
- Metric combination wrench set 6mm to 22mm
- 16 oz ball peen hammer
- 6" needle nose pliers
- Regular slip joint pliers
- 10 or 12" Channel Lock pliers
- 6 or 7" side cutting pliers
- Set of punches and chisels
- Feeler gauge set
- 3/8" drive socket set, including ratchet, extensions, standard and metric sockets,
 - 3/8 to 7/8 and 8mm to 17mm
- 3/8" to 1/2" socket adapter, 1/2" to 3/8" socket adapter
- 1/2" drive socket set with extensions and ratchet,
- 1/2" drive flex handle at least 18" long (breaker bar)
- 1/2" drive sockets, 7/16 to 1 1/4 and 10mm to 22mm
- 1/2" inch drive torque wrench
- Spark plug sockets 5/8" and 13/16" 3/8" drive
- Gasket scraper
- Set of Allen wrenches
- 12-volt test light
- 1/4" drive socket set, standard and metric sockets, including ratchet
- Non-sparking drift punch, brass or aluminum
- Digital Volt, Ohm and Ammeter DVOM, with Leads Example Fluke model 83

You may wish to purchase additional tools for the specific program you are enrolled in such as ASEP, BMW, T-TEN, CAP. Check with your instructor for a list.



CENTRAL PIEDMONT COMMUNITY COLLEGE

Automotive Technology Safety Regulations

- An Instructor must be present any time a class or session is working in the lab

Use of safety glasses is required/mandatory in lab areas.

- Any safety hazard will be reported to the instructor immediately. Floor will be kept clear of all liquids and tripping hazards.
- No equipment will be operated by students until they have received instruction on proper and safe operation of same equipment.
- Vehicle lifts must be secured with mechanical locks prior to working under vehicle
- Jack stands will be used when jacking up a vehicle for service.
- Brake asbestos "dust" will be controlled any time work is done which could lead to asbestos exposure.
- Floor exhaust system will be used anytime an engine is running in the lab.
- Use of tobacco is not permitted in any lab or classroom.
- Use of audio equipment is not permitted during class/lab hours.
- Students and faculty must follow OSHA rules concerning exposure to blood borne diseases.
- Proper disposal of automotive waste products, including hazardous wastes, is required.

-