



# CENTRAL PIEDMONT COMMUNITY COLLEGE

## **Course Syllabus** **AUT 116-05** **Engine Repair**

### **Syllabus Contents:**

#### **Course Description**

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### **Time Requirements:**

**8 Week Session**

**4 Class Hours/Week**

**6 Lab Hours/Week**

**3 Semester Hours Credit**

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**Office hours: By appointment**

## AUT 116-05 ENGINE REPAIR

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**Prerequisites:** None

**Course Description:**

This course covers the theory, construction, inspection, diagnosis, and repair of internal combustion engines and related systems. Topics include fundamental operating principles of engines and diagnosis, inspection, adjustment, and repair of automotive engines using appropriate service information. Upon completion, students should be able to perform basic diagnosis/repair of automotive engines using appropriate tools, equipment, procedures, and service information.

**Core Competency Category:**

Critical Thinking

**Key Indicator:** *(Please choose one of more key indicators that will focus your efforts on the core competency initiative).*

**Applies Knowledge In Practical Ways**

*Briefly describe the instructional methodology or activity designed to teach or incorporate the Core Competency:*

**Students are required to Disassemble, Inspect, Measure, and Reassemble an engine in our engine lab using the most up to date service information. These tasks help the student understand” How an engine operates” thereby enhancing their critical thinking skills when diagnosing and repairing engine related concerns.**

*Briefly describe the primary methods of assessment and how they specifically measure and give feedback regarding students’ attainment of the core competency. Attach any rubrics, tests, evaluation instruments, questions, etc.*

**Students must complete a worksheet detailing the condition and measured tolerances of key engine components. Students will reassemble the engine using the correct procedures and manufacturers torque specs.**

**Upon completion the engine MUST start and run with acceptable oil pressure and no abnormal engine noises.**

**AUT 116-05  
ENGINE REPAIR  
COURSE OBJECTIVES**

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**I. ENGINE REPAIR**

**A. General Engine Diagnosis; Removal and Reinstallation (R & R)**

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 concern; determine necessary action. P-1
3. Research applicable vehicle and service information, such as internal engine 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-1
6. Diagnose engine noises and vibrations; determine necessary action. P-2
7. Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action. P-2
8. Perform engine vacuum tests; determine necessary action. P-1
9. Perform cylinder power balance tests; determine necessary action. P-1
10. Perform cylinder cranking compression tests; determine necessary action. P-1
11. Perform cylinder leakage tests; determine necessary action. P-1
12. Remove and reinstall engine in a front-wheel or rear wheel drive vehicle (OBDII or newer); reconnect all attaching components and restore the vehicle to running condition. P-2
13. Install engine covers using gaskets, seals and sealers as required. P-1

**B. Cylinder Head and Valve Train Diagnosis and Repair**

Visually inspect cylinder head(s) for cracks; check gasket surface areas for warpage and leakage; check passage condition. P-2

Remove and reinstall cylinder heads and gaskets; tighten according to manufacturer's specifications and procedures. P-1

3. Inspect valve springs for squareness and free height comparison; determine necessary action. P-3
4. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks, and valve grooves; determine necessary action. P-2
5. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action. P-3
6. Inspect valves and valve seats; determine necessary action. P-3
7. Check valve face-to-seat contact and valve seat concentricity (runout); determine necessary action. P-3
8. Check valve spring assembled height and valve stem height; determine necessary action. P-3

9. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action. P-2
10. Inspect hydraulic or mechanical lifters; determine necessary action. P-2
11. Adjust valves (mechanical or hydraulic lifters). P-1
12. Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); determine necessary action. P-2
13. Inspect and replace timing belts (chains), overhead cam drive sprockets, and tensioners; check belt/chain tension; adjust as necessary. P-1
14. Inspect camshaft for runout, journal wear and lobe wear. P-2
15. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action. P-3
16. Establish camshaft(s) timing and cam sensor indexing according to manufacturer's specifications and procedures. P-1

### **C. Engine Block Assembly Diagnosis and Repair**

1. Disassemble engine block; clean and prepare components for inspection and reassembly. P-2
2. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action. P-2
3. Perform common fastener and thread repair to include, remove broken bolt, restore internal and external threads, and repair internal threads with thread insert. P-2
4. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action. P-2
5. Deglaze and clean cylinder walls. P-2
6. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action. P-3
7. Inspect crankshaft for end play, straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure journal wear; check crankshaft sensor reluctor ring (where applicable); determine necessary action. P-2
8. Inspect main and connecting rod bearings for damage and wear; determine necessary action. P-2
9. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action. P-3
10. Inspect and measure pistons; determine necessary action. P-2
11. Remove and replace piston pin. P-3
12. Inspect, measure, and install piston rings. P-2
13. Inspect auxiliary (balance, intermediate, idler, counterbalance or silencer) shaft(s); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time. P-2
14. Inspect or replace crankshaft vibration damper (harmonic balancer). P-3

15. Assemble engine block assembly. P-1

**D. Lubrication and Cooling Systems Diagnosis and Repair**

1. Perform oil pressure tests; determine necessary action. P-1
2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action. P-2
3. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action. P-1
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1
5. Inspect and replace engine cooling and heater system hoses. P-1
6. Inspect, test, and replace thermostat and gasket. P-1
7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required. P-1
8. Inspect, test, remove, and replace water pump. P-1
9. Remove and replace radiator. P-2
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams. P-1
11. Inspect auxiliary oil coolers; determine necessary action. P-3
12. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2
13. Perform oil and filter change. P-1

**WEEKLY OUTLINE**  
**AUT 116-01**  
**ENGINE REPAIR**  
**General Curriculum**

**Required Text:** *Automotive Engines:*

**By:** James D. Halderman / Prentice Hall 6th Ed., Copy 2009

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**WEEK 1**

Orientation

Read Text: Chapter 1&2

Service Information, Tools, and Safety

Environmental and Hazardous Materials

Engine Disassembly, Cleaning, And Crack Detection

Read Text Chapter 21

**Quiz: Chapters 1&2**

**WEEK 2**

Measuring Systems and Tools

Read Text: Chapter 7

Engine Fundamentals

Read Text: Chapters 10, and 12

Gasoline & Diesel

**Quiz: Measuring Systems and Tools**

**WEEK 3**

Crankshafts and Bearings

Read Text: Chapter 27&28

Engine Balance and Balance Shafts

Pistons, Rings, and Connecting Rods

Read Text: Chapter 25

**Quiz: Crankshafts and Bearings Engine Fundamentals**

## **WEEK 4**

Gaskets and Sealing  
Fel-Pro Sealing series.

Lubrication System Operation  
Read Text Chapter 14  
Diagnosis Overview

**Quiz: Pistons, Rings and Connecting Rods**

## **WEEK 5**

Cooling System Operation  
Read Text Chapter 13  
Diagnosis Overview

Engine Blocks and Service  
Read Text Chapter 26  
Camshafts and Valve Trains  
Read Text Chapter 24

**Quiz: Lubrication System**

## **WEEK 6**

Cylinder Head and Valve Guide Service  
Read Text Chapter 22  
Valve and Seat Service  
Read Text Chapter 23

**Quiz: Cooling System**

## **WEEK 7**

Engine Condition Diagnosis  
Read Text Chapter 20

**Quiz: Cylinder Head and Valves**

## **WEEK 8**

Lab Cleanup





# 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
<b>The following grades will not be used in computing the grade point average.</b>		
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.**



# CENTRAL PIEDMONT COMMUNITY COLLEGE

## 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.



# CENTRAL PIEDMONT COMMUNITY COLLEGE

## 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.