

# Raritan Valley Community College

## Course Outline

### AUTC 201 – Engine Systems & Emissions Control I

#### I. Basic Course Information

- A. Course Number and Title: AUTC 201 – Engine Systems & Emission Control I
- B. New or Modified Course: Modified
- C. Date of Proposal: Spring 2020
- D. Effective Term: Fall 2020
- E. Sponsoring Departments: *Science and Engineering Department*
- F. Semester Credit Hours: 3
- G. Weekly Contact Hours: 5      Lecture: 2  
   Laboratory: 3  
   Out of class student work per week: 5.5
- H. Co-requisite: A grade of C or better in AUTC 101 – Automotive Introduction, Fundamentals, and Safety
- I. Laboratory Fees: Yes
- J. Name and Telephone Number or Email Address of Department Chair and Divisional Dean at time of approval:  
*Department Chair: Marianne Baricevic, [Marianne.baricevic@raritanval.edu](mailto:Marianne.baricevic@raritanval.edu)*  
*Divisional Dean: Sarah Imbriglio, [sarah.imbriglio@raritanval.edu](mailto:sarah.imbriglio@raritanval.edu)*

#### II. Catalog Description

Co-requisite: A grade of C or better in AUTC 101 – Automotive Introduction, Fundamentals, and Safety. This course will include a study of various automotive engine systems with respect to theory and operation of the internal combustible engine, the OTTO cycle, lubricating system, and coolant system. Training is provided in diagnosing, repairing, and theory of the following subsystems: cylinder block, cylinder heads, and intake and exhaust systems with emphasis on emission control systems.

In the lab, students will learn a hands-on strategy to perform basic maintenance of engines and learn how to use a variety of hand tools and precision measurement tools. Students will be required to wear clothing appropriate for auto shop safety at all classes. Safety glasses will also be required at all classes.

### **III. Statement of Course Need**

- A. Automotive technicians are vital to our mobile and transport-dependent community. Understanding the structure and function of engine, fuel, and emissions systems in automobiles and their maintenance are integral elements for the education of well-trained technicians in the field. Efficiency, performance and compliance with EPA regulations (State and Federal) are mandatory in this field as well as customer satisfaction. This course is intended to enhance the student's knowledge beyond understanding.
- B. Lab assignments for the course will introduce basic maintenance and repair of engine systems, while maintaining instruction that reinforces the safety practices in a demonstrative environment.
- C. Course transferability: The course transfers as one of the core fundamental courses for the Automotive Technology major and includes a laboratory component; for New Jersey schools go to the NJ Transfer website, [www.njtransfer.org](http://www.njtransfer.org). For all other colleges and universities, go to their individual websites.

### **IV. Place of Course in College Curriculum**

- A. Free Elective
- B. This course meets the program requirement for the Automotive Technology Certificate and the Associate of Applied Science in Automotive Technology.
- C. Course transferability; for New Jersey schools go to the NJ Transfer website, [www.njtransfer.org](http://www.njtransfer.org). For all other colleges and universities go to their individual sites.

### **V. Outline of Course Content**

- A. Introduction to Engine Systems
  - i. Engine Construction
  - ii. Engine Classification
- B. Principles of Combustion
- C. Chemistry of Combustion
- D. Engine gaskets and Leak Diagnosis
- E. Engine Maintenance
- F. Intake and Exhaust Systems
- G. Basic Cooling System

- H. Basic Fuel Injection Systems
- I. Ignition Systems
- J. Basic Computer Controls
- K. Engine Construction
- L. Total Review of Combined Components
- M. Operational Cycles
  - i. Four- stroke cycle
  - ii. Two-stroke cycle
- N. Lubrication Systems
- O. Engine Disassembly
- P. Cleaning Engine Parts
- Q. Vibration damper

## **VI. General Educational and Course Learning Outcomes**

### **A. General Educational Learning Outcomes**

At the completion of the course, students will be able to:

1. Identify techniques to troubleshoot, repair, maintain, and solve problems with automotive engine systems (GE NJ 4)
2. Apply quantitative reasoning to problems with the maintenance of automotive engine systems (GE NJ 2)
3. Discuss issues involving automotive engine systems (GE NJ 1)

### **B. Course Learning Outcomes**

At the completion of the course, students will be able to:

1. Analyze the structure and function of engines used in automobiles.
2. Compare and contrast the various engine component systems relating to OHV and pushrod engine layout.
3. Inspect, test, and replace engine components according to manufacturer's specifications.
4. Examine internal combustion components and identify appropriate tools and measuring instruments used during diagnosis and repair.
5. Perform lab experiments and tasks to competent skill level as listed on the NATEF curriculum standards.

### **NATEF Standards: AI Engine Repair**

- a. General: Engine Diagnosis; Removal and Reinstallation (R & R)
  - i. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
  - ii. Research vehicle service information including fluid type, internal engine operation, vehicle service history, service precautions, and technical service bulletins. P-1
  - iii. Verify operation of the instrument panel engine warning indicators. P-1

- iv. Inspect engine assembly for fuel, oil, coolant, & other leaks; determine needed action P-1
- v. Install engine covers using gaskets, seals, and sealers as required. P-1
- b. Cylinder Head and Valve Train Diagnosis and Repair
  - i. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition. P-1
  - ii. Adjust valves (mechanical or hydraulic lifters). P-1
- c. Engine Block Assembly Diagnosis and Repair
  - i. Remove, inspect, &/or replace crankshaft vibration damper (harmonic balancer). P-1
- d. Lubrication and Cooling Systems Diagnosis and Repair
  - i. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine needed action. P-1
  - ii. Identify causes of engine overheating. P-1
  - iii. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1
  - iv. Inspect and/or test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. P-1
  - v. Inspect, remove, and replace water pump. P-2
  - vi. Remove and replace radiator. P-2
  - vii. Remove, inspect, and replace thermostat and gasket/seal. P-1
  - viii. Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action. P-1
  - ix. Perform oil pressure tests; determine needed action. P-1
  - x. Perform engine oil and filter change; use proper fluid type per manufacturer specification. P-1
  - xi. Inspect auxiliary coolers; determine needed action. P-3
  - xii. Inspect, test, and replace oil temperature and pressure switches and sensors. P-2
  - xiii. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform needed action. P-2

### **NATEF Standards: AVIII Engine Performance**

- a. General: Engine Diagnosis
  - i. Identify and interpret engine performance concerns; determine needed action. P-1
  - ii. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. P-1
  - iii. Perform cylinder power balance test; determine needed action. P-2
  - iv. Perform cylinder cranking and running compression tests; determine needed action. P-1
  - v. Perform cylinder leakage test; determine needed action. P-1
  - vi. Verify engine operating temperature; determine needed action. P-1
- b. Computerized Controls Diagnosis and Repair
  - i. Access & use service info to perform step-by-step (troubleshooting) diagnosis. P-1
  - ii. Perform active tests of actuators using a scan tool; determine needed action. P-1
- c. Ignition System Diagnosis and Repair
  - i. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action. P-2

- ii. Remove and replace spark plugs; inspect secondary ignition components for wear and damage. P-1
- d. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
  - i. Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; perform needed action. P-1
  - ii. Replace fuel filter(s) where applicable. P-2
  - iii. Inspect, service, or replace air filters, filter housings, and intake duct work. P-1
  - iv. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2
  - v. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform needed action. P-1
  - vi. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action. P-1
- e. Systems Diagnosis and Repair
  - i. Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform needed action. P-2

### **C. Assessment Instruments**

1. lectures
2. demonstrations
3. laboratory work
4. instructional videos/DVDs
5. laboratory performance
6. examinations
7. NATEF task list
8. Online modules
9. Manufacturer programs

## **VII. Grade Determinants**

- A. Lab performance
- B. Examinations
- C. Class participation
- D. Technical writing
- E. Interactive simulations
- F. Module completion
- G. Homework assignments

Primary formats, modes, and methods for teaching and learning that may be used in the course:

- A. Lecture/discussion
- B. Small-group work
- C. Group discussion
- D. Computer-assisted instruction

- E. Laboratory
- F. Simulation/role playing
- G. Demonstration
- H. Student collaboration
- I. Individual assignments
- J. Electude
- K. Manufacturer training

### **VIII. Text and Materials**

- A. Suggested Text: Automotive Technology: Principles, Diagnosis, and Service Plus MyAutomotiveLab with Pearson eText -- Access Card Package / Edition 5 by James D. Halderman (Author), Prentice Hall Publishing ISBN-10: 0134009088 / ISBN-13: 9780134009087
- B. Students will be required to wear clothing appropriate for auto shop safety at all classes. Student are required to wear a standard industry uniform. Safety glasses will also be required at all classes.
- C. The Automotive Program utilizes online curriculum and online industry service and repair information from the following sources:
  - I. AllData
  - II. Snap On Industries
  - III. Shop Key Pro.
  - IV. Electude
  - V. Manufacturer Training
- D. Various Automotive Magazines
- E. Students are provided the use of RVCC technology during the course

Please note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

### **IX. Resources**

- A. Reference books
- B. AllData
- C. Shop Key Pro
- D. Snap On Industries
- E. NAPA Pro-Link
- F. Published Automotive Magazines

- G. Lab/Shop Tools and Equipment
- H. CDX Interactive Courseware
- I. Safety equipment
- J. Lubricants and various automotive fluids
- K. Sample automotive system components
- L. Instructional videos/DVDs
- M. Auto mechanics shop facility at RVCC workforce building
- N. Electude
- O. Manufacturer Training