This is an introductory course that provides students with theory, knowledge and skills necessary to perform minor and major service on automotive gasoline powered engines. Instruction is given and lab experience provided in engine diagnosis, removal, disassembly, analysis and inspection, precision measurements, re-assembly and installation. Information presented is based on the Automotive Service Excellence (ASE) A-1 Engine Repair Tasks and Standards intended to prepare students for the ASE Certification Examination. Lecture and Lab.

CATALOG DESCRIPTION:

PREREQUISITES:

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:

Automotive technology

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00

CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]

GRADING POLICY: Pass/No Pass [X] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]

TRANSFER STATUS: CSU Transferable[X] UC/CSU Transferable[ ] Not Transferable[ ]

BASIC SKILLS STATUS: Yes [ ] No [X]

LEVELS BELOW TRANSFER: Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable

NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course

OCCUPATIONAL (SAM) CODE: C

REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:

REQUIRED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]

Associate of Arts: Liberal Arts: Emphasis in Business and Technology(Associate in Arts)
Engine Performance and Emission Specialist(Associate in Arts)
Engine Performance and Emission Specialist(Certificate of Achievement)

GE AND TRANSFER REQUIREMENTS MET:

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:
1. Demonstrate mastery of diagnostic tools and equipment used for automotive repair.

2. Evaluate engine components based on precision measurements compared to factory specifications.

3. Demonstrate an ability to self-assess progress and development in a specific area and to further design and pursue a course of action based on the self-assessment.

4. Analyze and diagnose automotive engines and related components for correct system operation.

**COURSE OBJECTIVES:**

1. Pass the SP-2 Mechanical Safety and Mechanical Pollution Prevention Test.
2. Analyze automotive engine systems using industry-accepted testing procedures.
3. Retrieve and interpret service and repair information.
4. Analyze and diagnose engine overall mechanical condition.
5. Perform precision measurements and compare against factory specifications.
6. Evaluate and diagnose cylinder head assembly and valve train component condition.
7. Diagnose engine block assembly for condition.
8. Identify component failures using analytical skills, processes, and industry-accepted procedures.
9. Apply industry-accepted processes and principles for repairs and engine re-assembly.

**COURSE CONTENT:**

**LECTURE CONTENT:**

A. Safety
   1. Basic auto technology shop safety instruction and demonstrations.
   2. SP-2 Mechanical Safety and Mechanical Pollution Prevention tests.

B. General Engine Diagnosis; Removal and reinstallation (R & R)
   1. Vehicle and related service and repair information and data.
   2. Vehicle repair orders.
   3. Engine noises and vibrations.
   4. Oil consumption.
   5. Engine vacuum tests.
   6. Cylinder power balance tests.
   7. Cylinder compression tests.
   8. Cylinder leakage tests.

C. Cylinder Head and Valve Train Diagnosis and repair: Inspection, analysis of precision measurements, wear patterns.

   1. Cylinder head and related parts.
      a. Valve springs.
      b. Valve stem seals.
      c. Valve guides.
      d. Valve and valve seats.
         - Valve to face-to-seat contact and valve seat concentricity.
      e. Valve spring assembled height and valve stem height.
      f. Pushrods, rocker arms, rocker arm pivots and shafts.
   2. Camshaft and related parts.
      a. Hydraulic and mechanical lifters.
      b. Camshaft drives.
         1. Timing belt.
         2. Timing chain.
         3. Timing gears.
c. Camshaft bearing surface.

D. Engine Block Assembly Diagnosis and Repair: Inspection, analysis of precision measurements, wear patterns.
   1. Visible cracks, passage, core and gallery plugs.
   2. Internal and external threads.
   3. Cylinder walls.
   5. Crankshaft.
   6. Main and connecting rod bearings.
   7. Pistons, piston rings, piston pins.
   8. Auxiliary support bearings.
   9. Crankshaft vibration damper (harmonic balancer).

E. Lubrication System: Inspection, testing, analysis
   1. Lubrication system pressure testing.
   2. Pump housing, pump drive, gears or rotors, and pressure relief devices.
   3. Auxiliary oil coolers.
   4. Oil temperature and pressure switches and sensors.

F. Cooling system: Inspection, testing, analysis.
   1. Radiator, radiator pressure cap.
   2. Coolant, coolant recovery system.
   3. Thermostat and housing.
   4. Water pump.
   5. Hoses and related piping.
   6. Drive belts, tensioners, and pulleys.
   7. Cooling fans.
      a. Electric fans and related circuitry.
      b. Mechanical fans and related components including fan clutch and fan shroud.
      c. Outside air dams.

LABORATORY CONTENT:

After acquiring the appropriate lecture information, the successful student will demonstrate skill accomplishment by completing worksheet-driven NATEF-approved tasks. NATEF (National Automotive Technicians Education Foundation) is a non-profit agency that evaluates technician training programs against standards developed by the automotive industry. All of the current NATEF approved tasks for this class are listed below, and are also contained in a separate document that is handed out on the first day of class.

ENGINE REPAIR

For every task in Engine Repair, 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; Removal and Reinstallation (R & R)
   1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
   2. Identify and interpret engine concern; determine necessary action.
   3. Research applicable vehicle and service information, such as internal engine operation,
vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
6. Diagnose engine noises and vibrations; determine necessary action.
7. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action.
8. Perform engine vacuum tests; determine necessary action.
9. Perform cylinder power balance tests; determine necessary action.
10. Perform cylinder cranking and running compression tests; determine necessary action.
11. Perform cylinder leakage tests; determine necessary action.
12. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.
13. Install engine covers using gaskets, seals and sealers as required.
14. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
15. Inspect, remove and replace engine mounts.

B. Cylinder Head and Valve Train Diagnosis and Repair
1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer’s specifications and procedures.
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.
3. Inspect valve springs for squareness and free height comparison; determine necessary action.
4. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.
5. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.
6. Inspect valves and valve seats; determine necessary action.
7. Check valve spring assembled height and valve stem height; determine necessary action.
8. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.
9. Inspect valve lifters; determine necessary action.
10. Adjust valves (mechanical or hydraulic lifters).
11. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components).
12. Inspect and/or measure camshaft for runout, journal wear and lobe wear.
13. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

C. Engine Block Assembly Diagnosis and Repair
1. Disassemble engine block; clean and prepare components for inspection and reassembly.
2. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.
3. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.
4. Deglaze and clean cylinder walls.
5. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.

6. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action.

7. Inspect main and connecting rod bearings for damage and wear; determine necessary action.

8. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.

9. Inspect and measure piston skirts and ring lands; determine necessary action.

10. Remove and replace piston pin.

11. Determine piston-to-bore clearance.

12. Inspect, measure, and install piston rings.

13. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.

14. Remove, inspect or replace crankshaft vibration damper (harmonic balancer).

15. Assemble engine block.

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Perform oil pressure tests; determine necessary action.

2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

3. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action.

4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.

5. Inspect and replace engine cooling and heater system hoses.

6. Inspect, test, and replace thermostat and gasket/seal.

7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

8. Inspect, remove and replace water pump.

9. Remove and replace radiator.

10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.

11. Inspect auxiliary coolers; determine necessary action.

12. Inspect, test, and replace oil temperature and pressure switches and sensors.

13. Perform oil and filter change.


E. Practice sample ASE (A1) Engine Repair certification test.

METHODS OF INSTRUCTION:

A. Lecture:

B. Lab:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:

Reading Assignments

Required Reading:

Websites

Web-based assignments: Autoshop101.com, CTE Online.com, other topic specific websites as needed.
Out-of-class Assignments
1. Visit an automotive machine shop
2. Visit an automotive parts house
3. Visit an automotive dealership

Writing Assignments
1. Explain and demonstrate knowledge of four stroke cycle theory.
2. Demonstrate an understanding of engine math principles by solving related mathematical problems.
3. Use information and concepts learned in class to successfully pass a practicum exam or written test or assignment.
4. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during diagnostic and analysis activities.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Essay Examinations
Objective Examinations
Report
Projects (ind/group)
Problem Solving Exercises
Oral Presentations
Skills Demonstration

Demonstration of Critical Thinking:
1. Demonstrate the ability to rebuild an engine and restore it to factory-level service.
2. Analyze, diagnose, and confirm engine mechanical and other related issues based on symptoms indicated on repair orders.
3. Analyze results of engine diagnostic tests to determine the mechanical condition of an engine.
4. Relate diagnostic test results directly to engine component failures based on factory readings or measurements

Required Writing, Problem Solving, Skills Demonstration:
1. Explain and demonstrate knowledge of four stroke cycle theory.
2. Demonstrate an understanding of engine math principles by solving related mathematical problems.
3. Use information and concepts learned in class to successfully pass a practicum exam or written test or assignment.
4. Use on-line service and repair information to compare factory specifications with actual readings and measurements acquired during diagnostic and analysis activities.

TEXTS, READINGS, AND RESOURCES:
TextBooks:

Other:
1. GWC Auto Tech work shirt
   Basic hand tool set
LIBRARY:
   Adequate library resources include:
   Comments:

Attachments:
   Attached Files