AUTO G110: ENGINE REPAIR

Item	Value
Curriculum Committee Approval Date	10/05/2021
Top Code	094800 - Automotive Technology
Units	5 Total Units
Hours	126 Total Hours (Lecture Hours 72; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

This course provides students with theory, knowledge, and skills necessary to perform minor and major service on automotive gasoline powered engines, using lecture and lab. Instruction is given and lab experience provided in engine diagnosis, removal, disassembly, analysis and inspection, precision measurements, reassembly, 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. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Analyze automotive engines and related components for correct system operation.
3. Use diagnostic tools and equipment used for automotive repair.
4. Use precision measurement tools to solve mechanical concern with automotive engine components through systematic analysis.

Course Objectives

- 1. Demonstrate shop safety regarding working procedures, hazardous materials and waste handling
- 2. Analyze automotive engine systems using industry-accepted testing procedures.
- 3. Interpret service and repair information for automotive engine repair.
- 4. Diagnose engine overall mechanical condition.
- 5. Use precision measurements and compare against factory specifications.
- 6. Apply industry-accepted processes and principles for repairs and engine re-assembly.

Lecture Content

Safety Basic auto technology shop safety instruction and demonstrations Pass instructor provided safety test(s) General Engine Diagnosis; Removal and Reinstallation (RR) Vehicle and related service and repair information and data Vehicle repair orders Engine noises and vibrations Oil consumption Engine Vacuum tests Cylinder power balbance tests Cylinder compression tests Cylinder leakage tests Engine and Related Components: RR Processes and Techniques Cylinder Head and Valve Train Diagnosis and Repair: Inspection, Analysis of Precision Measurements, Wear Patterns. Valve springs Valve stem seals Valve guides Valve and valve seats Valve face-to-seat contact and valve seat concentricity Valve spring assembled height and valve stem height Pushrods, rocker arms, rocker arm pivots and shafts Camshaft and Related Parts Hydraulic and mechanical lifters Camshaft drives Timing belt Timing chain Timing gears Camshaft bearing surface Engine Block Assembly Diagnosis and Repair: Inspection, Analysis of Precision Measurements, Wear Patterns Visible cracks, passage,core, and gallery plugs Internal and external threads Cylinder walls Camshaft bearings Crankshaft Main and connecting rod bearings Pistons, piston rings, piston pins Auxiliary support bearings Crankshaft vibration damper (harmonic balancer) Balance shaft Lubrication System: Inspection, Testing, Analysis Lubrication system pressure testing Pump housing, pump drive, gears or rotors, and pressure r elief devices Auxiliary oil coolers Oil temperature and pressure switches and sensors Cooling System: Inspection, Testing, Analysis Radiator, radiator pressure cap Coolant, coolant recovery system Thermostat and housing Water pump Hoses and related piping Drive belts, tensioners, and pulleys Cooling fans Electric fans and related circuitry Mechanical fans and related components including fan clutch and fan shroud Outside air dams

Lab Content

General Engine Diagnosis; Removal and Reinstallation (RR) Complete work order to include customer information, vehicle identifying information, customer concern,related service history, cause, and correction Identify and interpret engine concern; determine necessary action Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins Locate and interpret vehicle and major component identification numbers Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action Diagnose engine noises and vibrations; determine necessary action Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action Perform cylinder cranking and running compression tests; determine necessary action Perform cylinder leakage test; determine necessary action Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition Install engine covers using gaskets, seals and sealers as required Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert Inspect, remove, and replace engine mounts Cylinder Head and Valve Train Diagnosis and Repair Remove cylinder head; inspect gasket conditon; install cylinder head and gasket; tighten according to manufacturers specifications and procedures Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition Inspect valve springs for squareness and free height comparison; determine necessary action Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action Inspect valves and valve seats; determine necessary action Check valve spring assembled height and valve stem height; determine necessary action Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action Inspect valve lifters; determine necessary action Adjust valves (mechanical or hydraulic lifters) Inspect and replace camshaft and drive belt/chain (inculdes checking drive gear wear and backlash, endplay, 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) Inspect and/or measure camshaft for runout, journal wear and lobe wear Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action Establish camshaft postion sensor indexing Engine Block Assembly Diagnosis and Repair Disassemble engine block; clean and prepare componets for inspection and reassembly Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action Deglaze and clean cylinder walls Inspect and mearure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; che ck oil passage condition; measure enplay and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action Inspect main and connecting rod bearings for damage and wear; determine necessary action Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action Inspect and measure piston skirts and ring lands; determine necessary action Remove and replace piston pin Determine piston-to-bore clearance Inspect, measure, and install piston rings Inspect auxiliary shaft(s) (balance, intermediate, idler, counter balance or silencer); inspect shaft(s) and support bearing for damage and wear; determine necessary action; reinstall and time Remove, inspect or replace crankshaft vibration damer (harmonic balancer) Assemble engine block Lubrication and Cooling Systems Diagnosis and Repair Perform oil pressure test; determine necessary action Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank and hoses; determine necessary action Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment Inspect and replace engine cooling and heater system hoses Inspect, test, and replace thermostat and gasket/seal Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required Inspect, remove, and replace water pump Remove and replace radiator Inspect and test fan(s) (electrical or mecchanical), fan clutch, fan shroud, and air dams Inspect auxiliary coolers; determine necessary a ction Inspect, test, and replace oil temperature and pressure switches and sensors Perform oil and filter change Identify causes of engine overheating Practice sample ASE (A1) Engine Repair certification test

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

Instructional Techniques

Lecture Presentation Discussion Guided Practice Physical Demonstration

Reading Assignments

Textbook Reading Assignments

Writing Assignments

Create vehicle repair orders which include industry accepted documenation of repairs (Complaint, Cause, and Correction). Repair orders should also include mathematical computation of part costs and labor totals.

Out-of-class Assignments

Interactive Web-based training modules

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, 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.

Eligible Disciplines

Automotive technology: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Halderman, James D.. Automotive Engines, Theory and Servicing, 9th ed. New Jersey: Pearson Education, 2020

Other Resources

1. GWC automotive work uniform and safety glasses