



El Camino College
COURSE OUTLINE OF RECORD – Official

Subject:	ATEC
Course Number:	41
Descriptive Title:	Engine Rebuilding
Division:	Industry and Technology
Department:	Automotive Technology
Course Disciplines:	Automotive Technology
Catalog Description:	This course covers engine construction, operation, diagnosis and proper rebuilding procedures. Laboratory activities emphasize the proper use of tools and equipment utilized in the field of engine diagnosis and rebuilding. Also covered are machining processes such as drilling and tapping, milling, surfacing, boring and honing, pin fitting, press work, resurfacing, reaming, knurling, repairing of damaged threads, measuring, grinding valves and valve seats and crack detection methods and repairing.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Automotive Technology 1 or equivalent
Enrollment Limitation:	
Hours Lecture (per week):	5
Hours Laboratory (per week):	10
Outside Study Hours:	10
Total Hours:	270
Course Units:	8
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to July 1992
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	

Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	<p>SLO #1 Safety Exam</p> <p>Given an in class exam, based on readings, classroom discussions and demonstrations, the student will be able to work in the Automotive Shop safely and pass the Automotive Safety Exam with 100% accuracy.</p> <p>SLO #2 Cylinder Head Recondition</p> <p>The student will recondition an automotive cylinder head using manufacturer procedures and specifications, then complete a lab sheet.</p> <p>SLO #3 Engine Inspection and Test</p> <p>The student will disassemble, inspect, measure and evaluate the parts of an automotive engine, then reassemble and test the engine using manufacturer procedures and specifications.</p>
Course Objectives:	<ol style="list-style-type: none"> 1. Score 100% accuracy on a safety test. 2. Select and use the proper tools and equipment safely and efficiently. 3. Evaluate, diagnose, and if necessary, remove an engine from a vehicle, disassemble the engine and clean components of the engine. 4. Measure, inspect and evaluate all engine components with precision instruments based upon automotive industry's standards and manufacturer's specifications. 5. Recondition the cylinder block, connecting rods, the cylinder head/heads, valves and crankshaft as required based upon automotive industry standards. 6. Assemble an engine based upon automotive industry standards and automotive manufacturer's specifications. 7. Install and adjust an engine to manufacturers specifications based upon automotive industry standards.
Major Topics	<p>I. OVERVIEW OF ENGINE REBUILDING AND SAFETY (5 hours, lecture)</p> <ol style="list-style-type: none"> A. Safety information and test B. Engine construction and design C. Materials and manufacturing processes D. Four stroke cycle, camshaft and crankshaft timing and valve types E. Piston and crankshaft assembly <p>II. OVERVIEW OF ENGINE REBUILDING AND SAFETY (10 hours, lab)</p> <ol style="list-style-type: none"> A. Safety information and test B. Engine construction and design C. Materials and manufacturing processes D. Four stroke cycle, camshaft and crankshaft timing and valve

- types
- E. Piston and crankshaft assembly

III. ENGINE REMOVAL (10 hours, lecture)

- A. Need for diagrams, notes and recording engine component pictures
- B. Need for organization and procedures
- C. Safety precautions
- D. Draining fluids, disconnecting electrical components and tagging wires and hoses

IV. ENGINE REMOVAL (20 hours, lab)

- A. Need for diagrams, notes and recording of engine component pictures
- B. Need for organization and procedures
 - 1. Bag and tag procedure
- C. Safety precautions
- D. Draining fluids, disconnecting electrical components and tagging wires and hoses

V. CLEANING PROCESSES (5 hours, lecture)

- A. Steam cleaning, hot tank solutions, jet washer and cleaning oven
- B. Hand scraping, abrasive blasting, draw filing, wire wheel, cold spray, vapor degreaser and ultrasonics

VI. CLEANING PROCESSES (10 hours, lab)

- A. Steam cleaning, hot tank solutions, jet washer and cleaning oven
- B. Hand scraping, abrasive blasting, draw filing, wire wheel, cold spray, vapor degreaser and ultrasonics

VII. ENGINE DISASSEMBLING (10 hours, lecture)

- A. Identifying signs of wear and leakage
- B. Sequence of organized disassembling
- C. Ridge removal, removing harmonic balancer
- D. Marking bearing caps, piston removal
- E. Pressing piston pins
- F. Crankshaft storage
- G. Cylinder head disassembly procedures
- H. Camshaft bearing, soft core and oil gallery plug removal

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- E. Pressing piston pins
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**IX. PRECISION MEASURING DEVICES AND PROPER USE
(5 hours, lecture)**

- A. Use of ruler
- B. Outside and inside micrometers
- C. Dial indicators
- D. V-blocks
- E. Feeler gauges
- F. Dividers
- G. Telescopic and hole gauges
- H. Spring testers
- I. Bore gauges
- J. Alignment fixtures
- K. Go, no-go gauges

**X. PRECISION MEASURING DEVICES AND PROPER USE
(10 hours, lab)**

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- H. Spring testers
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- J. Alignment fixtures
- K. Go, no-go gauges

XI. MEASUREMENT AND INSPECTION (10 hours, lecture)

- A. Terms
 1. Taper
 2. Out of round
 3. Straightness
 4. Valve stem height
 5. Installed spring height and clearance
 6. Measuring cylinder walls
 7. Crankshaft
 8. Camshaft
 9. Valve and guides
 10. Pistons
 11. Saddle bores
 12. Push rod concentricity
 13. Valve margin
 14. Connecting rod length
 15. Piston compression height

- B. Indicators of cracks, porosity, scuffing, galling, chipping, pitting and overheating
- C. Crack detectors - magnaflux, zyglo, x-ray and dye penetrants

XII. MEASUREMENT AND INSPECTION (20 hours, lab)

- A. Terms
 - 1. Taper
 - 2. Out of round
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 - 4. Valve stem height
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- C. Crack detectors - magnaflux, zyglo, x-ray and dye penetrants

XIII. MACHINING PROCESSES (15 hours, lecture)

- A. Cylinder boring demonstration
- B. Cylinder honing demonstration - manual and power
- C. Crankshaft grinding practices
- D. Connecting rod resizing demonstration
- E. Align boring and honing practices
- F. Cylinder block and head milling demonstration
- G. Valve guide knurling and replacement
- H. Valve seat replacement
- I. Piston pin removal and installation procedures
- J. Valve tipping, chamfering and facing procedures
- K. Machining for positive guide seals
- L. Valve spring installed height restoration
- M. Leak testing valve and seats
- N. Crack repair

XIV. CYLINDER BLOCK MACHINING (15 hours, lab)

- A. Cylinder boring demonstration
- B. Cylinder honing demonstration - manual and power
- C. Crankshaft grinding practices
- D. Connecting rod resizing demonstration
- E. Align boring and honing practices
- F. Cylinder block demonstration

XV. CYLINDER HEAD MACHINING (15 hours, lab)

- A. Cylinder head milling demonstration
- B. Valve guide knurling and replacement
- C. Valve seat replacement
- D. Piston pin removal and installation procedures
- E. Valve tipping, chamfering and facing procedures
- F. Machining for positive guide seals
- G. Valve spring installed height restoration
- H. Leak testing valve and seats
- I. Crack repair

XVI. ENGINE ASSEMBLING (15 hours, lecture)

- A. Block and crank preparation - cleanliness
- B. Torqueing procedures
- C. Crankshaft installation - checking for bind and clearances
- D. Camshaft bearing installation procedures
- E. Piston rings ring-end gaps and end and staggering gaps
- F. Piston assembly installation
- G. Degreeing cam and crankshaft
- H. Cylinder head and valve train installation
- I. Oil pump and drive installation
- J. Manifolds, oil pan and timing chain cover installation
- K. Ignition and timing procedures
- L. Transmission and clutch installation

XVII. ENGINE ASSEMBLING (30 hours, lab)

- A. Block and crank preparation - cleanliness
- B. Torqueing procedures
- C. Crankshaft installation - checking for bind and clearances
- D. Camshaft bearing installation procedures
- E. Piston ring end and staggering gaps
- F. Piston assembly installation
- G. Degreeing cam and crankshaft
- H. Cylinder head and valve train installation
- I. Oil pump and drive installation
- J. Manifolds, oil pan and timing chain cover installation
- K. Ignition and timing procedures
- L. Transmission and clutch installation

XVIII. ENGINE INSTALLATION (10 hours, lecture)

- A. Safety precautions
- B. Common installation problems
 - 1. Wrong mounts
 - 2. Omission of transmission cooler lines
 - 3. Linkages subject to damage
 - 4. Cross threading tubing fittings
 - 5. Double checking all installation bolts
- C. Hood installation

XIX. ENGINE INSTALLATION (20 hours, lab)

	<p>A. Safety precautions</p> <p>B. Common installation problems</p> <ol style="list-style-type: none"> 1. Wrong mounts 2. Omission of transmission cooler lines 3. Linkages subject to damage 4. Cross threading tubing fittings 5. Double checking all installation bolts <p>C. Hood installation</p> <p>XX. INITIAL START UP AND BREAK-IN PROCEDURES (5 hours, lecture)</p> <p>A. Check all fluid levels - transmission, engine oil, coolant, power steering pump and fuel</p> <p>B. Operation of throttle and transmission shifter</p> <p>C. Block wheels forward and aft</p> <p>D. Prime oil system</p> <p>E. Start and break-in procedures for cam and rings</p> <p>F. Final checks, adjustments, and test oil pressure, timing, carburetor transmission and brakes</p> <p>XXI. INITIAL START UP AND BREAK-IN PROCEDURES (10 hours, lab)</p> <p>A. Check all fluid levels - transmission, engine oil, coolant, power steering pump and fuel</p> <p>B. Operation of throttle and transmission shifter</p> <p>C. Block wheels forward and aft</p> <p>D. Prime oil system</p> <p>E. Start and break-in procedures for cam and rings</p> <p>F. Final checks, adjustments, and test oil pressure, timing, carburetor, transmission and brakes</p>
Total Lecture Hours:	90
Total Laboratory Hours:	180
Total Hours:	270
Primary Method of Evaluation	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Remove valves from a cylinder head. Clean, measure and inspect cylinder heads, valves, valve springs and record data to multiple pages cylinder head lab sheet. Analyze data using manufacturer's specifications to determine the serviceability of valves. Set up valve grinder and install valves into valve grinder and reface valves, set up seat grinding and/or seat reconditioning equipment and recondition valve seats to automotive/truck factory standards and automotive/truck industry standards. Consult the instructor for evaluation.
Critical Thinking Assignment 1:	Perform a compression test on an engine and report data on a one-page compression test lab sheet. Analyze data from compression test using manufacturer's specifications to determine the serviceability and needed repairs. Report needed repairs on a one-page lab report and submit lab sheet and lab report to the instructor.

Critical Thinking Assignment 2:	Perform a valve spring pressure test and record data to a one-page cylinder head lab sheet. Analyze data using manufacturer's specifications to determine the serviceability of valve springs. Report findings on a one-page lab report and submit lab report and lab sheet to the instructor.
Other Evaluation Methods:	Class Performance Completion Homework Problems Laboratory Reports Matching Items Multiple Choice Other Exams Performance Exams Quizzes True/False
Instructional Methods:	Demonstration Discussion Lab Lecture Multimedia presentations
If other:	
Work Outside of Class:	Answer questions Problem solving activity Required reading Study Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Textbooks:	JAMES HALDERMAN, <u>AUTOMOTIVE ENGINES: THEORY AND SERVICING</u> , 10th edition, Pearson Publishing, 2023
Alternative Textbooks:	
Required Supplementary Readings:	Lab sheets Procedure sheets Shop manuals
Other Required Materials:	Three ring binder notebook and paper Pen and pencil Safety glasses Shop safe clothing including boots Calculator (portable type) Digital Volt Ohm Meter (optional) Tools (optional) Tape recorder (optional)
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	

Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite:	
Requisite and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	Automotive Technology 1
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	<p>Ability to complete a safety exam with 100% accuracy.</p> <p>ATEC 1 - Complete a safety test with 100% accuracy.</p> <p>Ability to select and use the proper automotive tools.</p> <p>ATEC 1 - Select and use the proper tools.</p>
Requisite:	or equivalent
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	If a student has taken an equivalent course at another college, the student will be prepared to enroll in this course. If students are able to pass a safety test with the ability to select and use the proper automotive tools, they will be prepared to enroll in this course. It is recommended that students have basic automotive knowledge to enhance their success in this course.
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Hiram T. Hironaka
Date:	10/25/1985
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Harry Stockwell
Date:	04/17/2018
Last Board Approval Date:	12/19/2022