

ATL 110 Course Outline as of Fall 2024**CATALOG INFORMATION**

Dept and Nbr: ATL 110 Title: IC ENGINE
 Full Title: Internal Combustion Engine Theory and Repair
 Last Reviewed: 1/22/2024

Units	Course Hours per Week		Nbr of Weeks		Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.50	17.5	Lecture Scheduled	43.75
Minimum	3.00	Lab Scheduled	1.50	6	Lab Scheduled	26.25
		Contact DHR	0		Contact DHR	0
		Contact Total	4.00		Contact Total	70.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 87.50

Total Student Learning Hours: 157.50

Title 5 Category: AA Degree Applicable

Grading: Grade or P/NP

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

Catalog Description:

Students will learn internal combustion, fuel-agnostic engine fundamentals including configurations and designs, operation, diagnostic tests, disassembly, inspection, assembly, timing chains and belts, valve adjustments, cooling systems, introduction to engine machining, proper use of shop related tools and equipment, and safety practices. Fuel-agnostic refers specifically to low-carbon and zero-carbon fuels: hydrogen, natural gas, propane, clean diesel, etc. Lecture, demonstration, and practical lab experience also emphasize proper and safe use of tools and equipment. Prepare students to take the Automotive Service Excellence (ASE) A1 Engine Repair, T1 Gasoline Engines or D2 Diesel Engines certification tests (Mechanical portions).

Prerequisites/Corequisites:

Course Completion of ATL 101 and ATL 161

Recommended Preparation:

Eligibility for ENGL 1A or equivalent and MATH 25 or equivalent

Limits on Enrollment:**Schedule of Classes Information:**

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Prerequisites/Corequisites: Course Completion of ATL 101 and ATL 161

Recommended: Eligibility for ENGL 1A or equivalent and MATH 25 or equivalent

Limits on Enrollment:

Transfer Credit:

Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	Area	Effective:	Inactive:
CSU GE:	Transfer Area	Effective:	Inactive:
IGETC:	Transfer Area	Effective:	Inactive:
CSU Transfer:		Effective:	Inactive:
UC Transfer:		Effective:	Inactive:

CID:

Certificate/Major Applicable:

Both Certificate and Major Applicable

COURSE CONTENT

Student Learning Outcomes:

At the conclusion of this course, the student should be able to:

1. Demonstrate proper use of measuring tools on an engine block and components
2. Identify engine block assembly components and configurations
3. Demonstrate the proper steps to remove a cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure
4. Demonstrate the proper steps for performing a timing belt replacement and setting the timing belt, crankshaft, and camshafts in proper positions

Objectives:

At the conclusion of this course, the student should be able to:

1. Verify and interpret engine concerns, and determine necessary action
2. Inspect an engine assembly for fuel, oil, coolant, and other leaks, and determine necessary action
3. Perform cooling system, cap, recovery system tests (pressure, combustion leakage, and temperature), and determine necessary action
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys
5. Test coolant; drain and recover coolant; flush and refill cooling system with recommended

coolant; bleed air as required

6. Inspect, test, remove, and replace engine cooling and heater system hoses, radiator, thermostat and housing, and water pump
7. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams
8. Inspect, test, and replace oil temperature and pressure switches and sensors
9. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action
10. Diagnose engine noises and vibrations, and the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action
11. Visually inspect cylinder head(s) for cracks, check gasket surface areas for warpage and leakage
12. Install cylinder heads and gaskets, and tighten according to manufacturer's specifications and procedures
13. Inspect and test valve springs for squareness, pressure, free-height comparison, valve spring retainers, locks, and valve grooves and replace as needed
14. Inspect valve guides for wear, check valve guide height, and stem to guide clearance, recondition or replace as needed
15. Check valve spring assembled height and valve stem height; service valve and spring assemblies as needed
16. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices), and perform necessary action
17. Adjust valves (mechanical and hydraulic lifters)
18. Inspect and replace timing belt(s), overhead cam drive sprockets, and tensioners, check belt tension, and adjust as necessary
19. Verify camshaft(s) timing according to manufacturer's specifications and procedures
20. Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); replace as necessary
21. Inspect camshaft for runout, journal wear and lobe wear
22. Establish camshaft(s) timing and cam sensor indexing according to manufacturer's specifications and procedures
23. Disassemble engine block; clean and prepare components for inspection and reassembly
24. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, surface warpage, and determine necessary action
25. Inspect and measure cylinder walls for damage/wear, deglaze, and determine necessary action
26. 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
27. Inspect and measure main and connecting rod bearings for damage, clearance, and end play; determine necessary action
28. Replace camshaft, main and connecting rod bearings using manufacturer's recommended procedures
29. Inspect, measure, service pistons and pins, and install piston rings
30. Assemble the engine using gaskets, seals, and formed-in-place (tube-applied) sealants, thread sealers, etc., according to manufacturer's specifications
31. Prime engine lubrication system
32. Confirm engine operation

Topics and Scope:

Lecture-Related Topics and Scope:

- I. Mobile Equipment Safety and Shop Practice
- II. Proper Care and Manipulation of Basic Hand Tools
- III. Engine Fundamentals, Types, Construction, Operation, and Identification
 - A. Four stroke cycle
 - B. Flathead, overhead valve (OHV), single overhead camshaft (SOHC), dual overhead camshaft (DOHC)
 - C. Valve timing relationship
 - D. Ignition timing
 - E. Cooling system operation
 - F. Lubrication system
 - G. Fuel types for internal combustion
- IV. Engine Condition Diagnosis, Inspection and Repair
- V. Compression Tests
- VI. Cylinder Leakage Tests
- VII. Engine Vacuum Tests
- VIII. Oil Pressure Tests
- IX. Engine Combustion Four-gas Analysis
- X. Engine Components
- XI. Engine Precision Measurement, Proper Care, and Operation of Precision Measurement Tools
- XII. Engine Disassembly, Cleaning Techniques and Procedures, and Assembly
- XIII. Cylinder Head Diagnosis, Disassembly, Testing, and Inspection
- XIV. Valve Guide, Valve and Valve Seat Inspection, and Servicing
- XV. Cylinder Head Reconditioning, Reassembly and Inspection
- XVI. Camshaft, Timing Belts, Timing Chains and Valve Train Service
- XVII. Hazardous Waste Handling
- XVIII. Hybrid, Electric, and Alternative Fuel Safety
- XIX. Hybrid, Electric, and Alternative Fuel Applicable Systems Awareness

Lab-Related Topics and Scope:

- I. Demonstrate Proper Safety Practices Including Hazardous Waste Handling
- II. Demonstrate the Proper Use of Basic Hand Tools
- III. Demonstrate the Use of Basic Shop Tools and Equipment
- IV. Access Vehicle Service Information
- V. Apply the Knowledge of Engine Fundamentals, Types, Construction, Operation and Identification in Servicing and Repair of Mobile Equipment Engines
- VI. Diagnosis of Engine Problems as a Result of Conducting Engine Test
- VII. Compression Tests
- VIII. Cylinder Leakage Tests
- IX. Engine Vacuum Tests
- X. Pressure Test
- XI. Demonstrate Broken Bolt Removal and Thread Repair
- XII. Properly Disassemble Engine for Inspection
- XIII. Measure and Evaluate the Condition of Internal Engine Components
- XIV. Perform Visual Inspections of Engine Components
- XV. Properly Assemble Engine for Operation

Assignment:

Lecture-Related Assignments:

- 1. Weekly reading (20 - 50 pages)
- 2. Notebook: Compile lab notes, class notes, and handouts
- 3. Engine performance and operation exercises using formulas and calculations

4. Test(s) and final exam

Lab-Related Assignments:

1. Lab activities and worksheets: hands-on engine diagnosis, inspection, and rebuilding activities
2. Lab reports: record measurements and calculations for all activities
3. Performance exam(s): demonstrate a running reassembled engine

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments and skill demonstrations are more appropriate for this course.

Writing
0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Engine performance and operation exercises; lab reports

Problem solving
5 - 10%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab activities and worksheets; performance exam

Skill Demonstrations
30 - 50%

Exams: All forms of formal testing, other than skill performance exams.

Test(s) and final exam

Exams
30 - 50%

Other: Includes any assessment tools that do not logically fit into the above categories.

Notebook

Other Category
0 - 10%

Representative Textbooks and Materials:

Automotive Engine Repair: CDX Master Automotive Technician Series. Goodnight, Nicholas and VanGelder, Kirk. Jones and Bartlett Learning. 2017 (classic)

Fundamentals of Medium/Heavy Duty Diesel Engines. 2nd ed. Wright, Gus. Jones & Bartlett Learning. 2023

Instructor prepared materials