

**STATE UNIVERSITY OF NEW YORK  
COLLEGE OF TECHNOLOGY  
CANTON, NEW YORK**



**MASTER SYLLABUS**

**COURSE NUMBER – COURSE NAME  
AUTO 220 – INTERNAL COMBUSTION ENGINES**

**Created by: Brandon Baldwin**

**Updated by: Brandon Baldwin**

**Canino School of Engineering Technology**

**Department: AUTOMOTIVE TECHNOLOGY**

**Semester/Year: FALL 2018**

A. **TITLE:** Internal Combustion Engines

B. **COURSE NUMBER:** AUTO 220

C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)

# Credit Hours: 4

# Lecture Hours: 2 per week

# Lab Hours: 4 per week

Other: per week

Course Length: 15 Weeks

D. **WRITING INTENSIVE COURSE:** Yes  No

E. **GER CATEGORY:** None:  Yes: GER !  
*If course satisfies more than one: GER !*

F. **SEMESTER(S) OFFERED:** Fall  Spring  Fall & Spring

G. **COURSE DESCRIPTION:**

This course concerns the principles of operation of the gasoline internal combustion engine. Each student participates in an actual engine overhaul including measuring to factory specification and machining operations with the latest tools and equipment. Designed for Automotive majors principally, applicants from other curricula will be interviewed by department personnel. Tool kit required. This course is the writing intensive course for the Automotive Program.

H. **PRE-REQUISITES:** None  Yes  If yes, list below:

AUTO 113, AUTO 114, ENGL 101 or ENGL 102, MATH 101 or higher

**CO-REQUISITES:** None  Yes  If yes, list below:

**I. STUDENT LEARNING OUTCOMES: (see key below)**

By the end of this course, the student will be able to:

<u>Course Student Learning Outcome</u> <u>[SLO]</u>	<u>Program Student Learning Outcome</u> <u>[PSLO]</u>	<u>GER</u> <i>[If Applicable]</i>	<u>ISLO &amp; SUBSETS</u>	
Demonstrate an understanding of the construction and maintenance on an automotive engine.	ALO1, ALO2		2-Crit Think 5-Ind, Prof, Disc, Know Skills 1-Comm Skills	CA IA PS W
Demonstrate an understanding of the operation of two stroke cycle and four stroke cycle engines.	ALO1, ALO2		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA IA PS Subsets
Hypothesize how variables in compression, ignition, and fuel systems affect the operation of an engine.	ALO1, ALO2		2-Crit Think 5-Ind, Prof, Disc, Know Skills 1-Comm Skills	CA IA PS W
Apply knowledge to completely disassemble and overhaul a "live" automotive engine.	ALO1, ALO2, ALO3		2-Crit Think 5-Ind, Prof, Disc, Know Skills 1-Comm Skills	CA IA PS W
Apply the use of all the factory special tools necessary in reconditioning an automotive engine.	ALO1, ALO2, ALO3		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	CA IA PS Subsets
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<b>KEY</b>	<b><u>Institutional Student Learning Outcomes [ISLO 1 – 5]</u></b>
<b>ISLO #</b>	<b>ISLO &amp; Subsets</b>
<b>1</b>	<b>Communication Skills</b> Oral [O], Written [W]
<b>2</b>	<b>Critical Thinking</b> <i>Critical Analysis [CA] , Inquiry &amp; Analysis [IA] , Problem Solving [PS]</i>
<b>3</b>	<b>Foundational Skills</b> <i>Information Management [IM], Quantitative Lit./Reasoning [QTR]</i>
<b>4</b>	<b>Social Responsibility</b> <i>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</i>
<b>5</b>	<b>Industry, Professional, Discipline Specific Knowledge and Skills</b>

\*Include program objectives if applicable. Please consult with Program Coordinator !

J. **APPLIED LEARNING COMPONENT:** Yes  No

If YES, select one or more of the following categories:

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Classroom/Lab | <input type="checkbox"/> Civic Engagement              |
| <input type="checkbox"/> Internship               | <input type="checkbox"/> Creative Works/Senior Project |
| <input type="checkbox"/> Clinical Placement       | <input type="checkbox"/> Research                      |
| <input type="checkbox"/> Practicum                | <input checked="" type="checkbox"/> Entrepreneurship   |
| <input type="checkbox"/> Service Learning         | (program, class, project)                              |
| <input type="checkbox"/> Community Service        |  |

K. **TEXTS:**

Automotive Engines: Theory and Servicing 7th edition by James Halderman, & NATEF Standards job sheets, Erjavec

L. **REFERENCES:**

ShopKeyPro, AllData, Subaru STIS

M. **EQUIPMENT:** None  Needed: student tool list, engine rebuilding tools

N. **GRADING METHOD:** A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

Exams, quizzes, homework, lab performance

P. **DETAILED COURSE OUTLINE:**

1. **Lab and Lecture Organization**
  - A. **2 per week**
  - B. **Projects – 1 engine per team of 2 students**
    - Disassembly
    - Measuring/Machining
    - Assembly
  - C. **Grading**
    - Project completion
    - Participation
2. **Engine Disassembly**
  - A. **Drain all fluids from engine assembly**
    1. **Drain coolant**
    2. **Drain oil**
  - B. **Accessory, intake and cylinder head removal**
    1. **Removal of all external accessories**
    2. **Removal of intake manifold**
    3. **Removal of cylinder head(s)**

- a. Remove head bolts
- b. Remove head(s) from engine block
4. Removal of head gasket(s)
5. Clean and check for cracks
6. Recondition heads and valves
- C. Cylinder block disassembly
  1. Ream cylinder ridge (if necessary)
  2. Remove oil pan
    - a. Inspect oil residue in pan for debris
  3. Removal of pistons and connecting rods
    - a. Mark connecting rods
    - b. Remove connecting rods and pistons from cylinder block
    - c. Inspect connecting rod bearings
    - d. Clean piston and rod assembly
    - e. Recondition connecting rod
    - f. Replace pistons (if necessary)
  4. Removal of crankshaft
    - a. Remove main bearing caps
    - b. Inspect main bearings
    - c. Remove crankshaft
    - d. Clean and measure crankshaft
    - e. Recondition crankshaft (if necessary)
5. Cylinder block
  - a. Inspection
  - b. Cleaning
  - c. Measure cylinders
  - d. Cylinder reconditioning
    1. Ball honing
    2. Boring and honing
    3. Sleaving
  6. Gaskets and seals
3. Engine Lubrication Systems
  - A. Types and designs of lubrication systems
  - B. Cleaning oil pumps and systems
  - C. Inspection and repair
  - D. Engine oils
    1. Break-in
    2. Normal operation
    3. Winter operation
4. Engine Assembly
  - A. Cylinder block assembly
    1. Install core and oil galley plugs
    2. Install camshaft bearings
    3. Install flat tappets (mushroom style)
    4. Install camshaft, retainer and rear core plug
    5. Check piston ring end gap
    6. Install lower rear main seal half (2 pc. Seals only)
    7. Install main bearings and check clearance
    8. Install crankshaft and main caps
    9. Install rod bearings and check clearance
  10. Install timing gears and chain or sprockets for proper valve timing

11. **Install timing cover with seal**
12. **Install pistons on rods**
13. **Install rings on pistons**
14. **Install piston and rod assembly**
15. **Install oil pump and driver rod**
16. **Install oil pan**
- B. **Cylinder head assembly**
  1. **Assemble valves, seals, springs, retainers and locks in head**
  2. **Install head gaskets**
  3. **Install head on block**
  4. **Install head bolts and torque in sequence**
  5. **Install valve lifters (if applicable)**
  6. **Install push rods (if applicable)**
  7. **Install valve actuation system; adjust to specifications**
- C. **Installation of Intake Manifold and Accessories**
  1. **Install intake manifold**
  2. **Install valve cover(s)**
  3. **Install exhaust manifold**
  4. **Install fuel pump**
  5. **Install oil pressure sending unit**
  6. **Install any applicable sensors**
  7. **Install flywheel**
  8. **Install vibration damper**

Q. **LABORATORY OUTLINE:** None  Yes

1. **Safety**
2. **Organization**
3. **Removing engine from vehicle**
4. **Clean outside of engine**
5. **Using chain falls mount engine to rebuild stand**
6. **Draining all fluids from engine to be rebuilt**
7. **Using factory procedures to disassemble an engine**
8. **Use valve grinder to recondition valves**
9. **Recondition valve guides**
10. **Using valve seat grinder and/or cutter to recondition valve seats**
11. **Using valve spring tester to qualify used valve springs**
12. **Qualifying lifters**
13. **Removing vibration damper**
14. **Camshaft removal**
15. **Measurement of cam bearings and journals**
16. **Measurement of cam lobe lift and straightness**
17. **Ridge reaming**
18. **Removing piston and connecting rod assembly from block**
19. **Removing piston from connecting rod**
20. **Cleaning pistons**
21. **Checking connecting rod straightness**
22. **Taking measurements for pistons and connecting rods**
23. **Disassemble, clean and measure oil pump**
24. **Measuring crankshaft journals (rods and mains)**
25. **Cylinder block cleaning**



- 26. Measuring cylinder bore for taper and out-of-round**
- 27. Restoring cross hatch in cylinder**
- 28. Installation cam bearings**
- 29. Checking main bearing clearance**
- 30. Installation rear main seal (types: rope, rubber, 1 and 2 pc.)**
- 31. Setting camshaft timing**
- 32. Checking rod bearing oil clearance**
- 33. Installation piston rings**
- 34. Installation piston and connecting rod assemblies**
- 35. Installation of cylinder head assemblies**
- 36. Engine start-up and break-in**