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:

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

*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:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☒ Entrepreneurship
  (program, class, project)

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