# Course Outline

## 1. COURSE INFORMATION

<table>
<thead>
<tr>
<th>Session Offered</th>
<th>Winter 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Automotive Engineering Technology III</td>
</tr>
<tr>
<td>Course Code</td>
<td>AUTO TECH 4AE3</td>
</tr>
</tbody>
</table>
| Date(s) and Time(s) of lectures | Monday, 12:30 – 14:20, MARC/266  
Thursday, 12:30 – 13:20, MARC/266 |
| Program Name    | Automotive and Vehicle Technology |
| Calendar Description | Internal combustion engine maps; engine development process; engine configuration and balance; materials, design, manufacturing and assembling main engine components; bearings; lubrication; cooling; gaskets and seals; powertrain design, manufacture and assembly. |
| Instructor(s)   | Dr. D. Centea  
E-Mail: Avenue Mail |
| Office Hours & Location | MARC/272 – by appointment |

## 2. COURSE SPECIFICS

| Course Description | Engine operating characteristics: work, pressure, torque, power, air-fuel ratio, fuel consumption, efficiency, emission. Engine cycles: air standard, Otto, Diesel, Dual, Miller, two-strokes. Stirling and Lenoir. Air fuel induction: volumetric efficiency, valves, injection, supercharging and turbocharging for SI, CI and two-stroke engines. Fluid motion within combustion chamber: turbulence, swirl, squish, tumble, crevice, blowby. Combustion in SI and CI engines and modern fast-burning cycles. Exhaust flow: exhaust stroke, valves, temperature, manifold; EGR, tailpipe and muffler. Heat transfer: energy distribution, engine temperatures, heat transfer in intake system, combustion changers and exhaust system; air cooled engines. Friction and lubrication: Engine friction, forces on piston, engine lubrication system, and lubrication for the two-strokes engine. Labs have been designed with respect to failure analysis, and cause/effect relationship of each area. |

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Code</th>
<th>Type</th>
<th>Hours per term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>Classroom instruction</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>Laboratory, workshop or fieldwork</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>Tutorial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DE</td>
<td>Distance education</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Hours</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th>ISBN</th>
<th>Textbook Title &amp; Edition</th>
<th>Author &amp; Publisher</th>
</tr>
</thead>
</table>
|           | ISBN-10: 0131405705  
Pearson (Prentice Hall) |

<table>
<thead>
<tr>
<th>Other Supplies</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety glasses or goggles and safety shoes</td>
<td></td>
</tr>
</tbody>
</table>

| Prerequisite(s) | AUTOTECH 3AE3, 3AV3 |
| Corequisite(s)  | |
| Antirequisite(s) | |
| Course Specific Policies | The course includes a lecture component and a lab component. The lab component is mandatory. A student who does not attend a lab will not get the |
A minimum of 50% for the lab component and a minimum of 50% for the lecture component are required to pass the course. All material submitted after the deadline will not be marked or reviewed.

### Departmental Policies

Students must maintain a GPA of 3.5/12 to continue in the program.

In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of “out-of-class” work for every scheduled hour in class. “Out-of-class” work includes reading, research, assignments and preparation for tests and examinations.

Where group work is indicated in the course outline, such collaborative work is mandatory.

The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception.

Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class.

Instructor has the right to submit work to software to identify plagiarism.

### 3. SUB TOPIC(S)

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction&lt;br&gt;  - Early history&lt;br&gt;  - Engine classification&lt;br&gt;  - Engine components&lt;br&gt;  - Basic engine cycles</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>2</td>
<td>Engine operating characteristics&lt;br&gt;  - Engine parameters&lt;br&gt;  - Work&lt;br&gt;  - Mean effective pressure&lt;br&gt;  - Torque and power</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>3</td>
<td>Engine operating characteristics&lt;br&gt;  - Dynamometers&lt;br&gt;  - Air-fuel ratio&lt;br&gt;  - Specific fuel consumption&lt;br&gt;  - Efficiencies&lt;br&gt;  - Emissions&lt;br&gt;  - 42-volt electrical systems</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>4</td>
<td>Engine cycles&lt;br&gt;  - Air standard cycles&lt;br&gt;  - Otto cycle&lt;br&gt;  - Real air-fuel engine cycles</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>5</td>
<td>Engine cycles&lt;br&gt;  - Diesel cycle&lt;br&gt;  - Dual cycle&lt;br&gt;  - Comparison of Otto, Diesel and Dual cycles</td>
<td>Chapter 3</td>
</tr>
<tr>
<td>6</td>
<td>Engine cycles&lt;br&gt;  - Miller cycle&lt;br&gt;  - Two-strokes SI and CI cycles&lt;br&gt;  - Stirling cycle and Lenoir cycle</td>
<td>Chapter 3</td>
</tr>
</tbody>
</table>

**Term Test #1**

Mid-term recess (Monday, February 16 to Saturday, February 21)
| Week 7 | Air and fuel induction  
|  | - Intake manifolds  
|  | - Volumetric efficiency of engines  
|  | - Intake valves  
|  | - Fuel injection  
|  | - Supercharging and turbocharging  
|  | - Intake for two-strokes engines  
|  | - Intake for CI engines  
| Chapter 5 |
| Week 8 | Fluid motion within combustion chamber  
|  | - Turbulence  
|  | - Swirl, squish and tumble  
|  | - Divided combustion chambers  
|  | - Crevice and blowby  
| Chapter 6 |
| Week 9 | Exhaust flow  
|  | - Blowdown  
|  | - Exhaust stroke  
|  | - Exhaust valves  
|  | - Exhaust temperature  
|  | - Exhaust manifold  
|  | - Turbochargers  
|  | - Exhaust gas recirculation  
|  | - Tailpipe and muffler  
|  | - Two-stroke cycle engines  
| Chapter 7 |
| Week 10 | Heat transfer in engines  
|  | - Energy distribution  
|  | - Engine temperatures  
|  | - Heat transfer in intake system  
|  | - Heat transfer in combustion chambers  
| Term Test #2 |
| Week 11 | Heat transfer in engines  
|  | - Heat transfer in exhaust system  
|  | - Effect on engine operating variables on heat transfer  
|  | - Air-cooled engines  
| Chapter 10 |
| Week 12 | Friction and lubrication  
|  | - Mechanical friction and lubrication  
|  | - Engine friction  
|  | - Forces on piston  
|  | - Engine lubrication systems  
| Chapter 11 |
| Week 13 | Friction and lubrication  
|  | - Two-stroke cycle engines  
|  | - Lubricating oil  
|  | - Oil filters  
| Chapter 11 |

Classes end – Wednesday, April 8, 2015  
Final examination period: Friday, April 10, 2015 to Thursday, April 30, 2015  
All examinations MUST BE written during the scheduled examination period.

**List of experiments**

| Lab #1 | Cylinder combustion integrity: compression test  
| Lab #2 | Cylinder combustion integrity: cylinder leakage and component failure analysis  
| Lab #3 | Cooling system inspection and testing (coolant PH balance, pressure and strength testing)  

Mid-term recess (Monday, February 16 to Saturday, February 21)
4. ASSESSMENT OF LEARNING *including dates*

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term -term #1</td>
<td>15%</td>
</tr>
<tr>
<td>Term -term #2</td>
<td>15%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Labs</td>
<td>15%</td>
</tr>
<tr>
<td>Final examination (tests cumulative knowledge)</td>
<td>45%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Analyse the operating characteristics of internal combustion engines
2. Compare engine cycles using mathematical models and determine their parameters
3. Describe the processes that take place in the intake system and exhaust system of engines
4. Categorize the complex turbulent fluid motion that take place within the combustion chamber
5. Model the combustion processes that take place in engines
6. Evaluate heat transfer in the intake system, combustion chamber, and exhaust system of engines
7. Explain the effect of friction in combustion engines and describe lubrication

6. POLICIES

Anti-Discrimination

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.


Academic Integrity

You are required to exhibit honestly and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf

The following illustrates only three forms of academic dishonesty:
1. Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations.
Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is a self-reporting tool for Undergraduate Students to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period.

You may submit a maximum of 1 Academic Work Missed requests per term. It is YOUR responsibility to follow up with your Instructor immediately regarding the nature of the accommodation.

If you are absent more than 5 days or exceed 1 request per term you MUST visit your Associate Dean’s Office (Faculty Office). You may be required to provide supporting documentation.

This form should be filled out immediately when you are about to return to class after your absence.

http://www.mcmaster.ca/msaf/

E-Learning Policy

Consistent with the Bachelor of Technology’s policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. Avenue can be accessed via http://avenue.mcmaster.ca.

Communications

It is the student’s responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student’s designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student’s @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

Turnitin (Optional)

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin’s database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student’s work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to http://www.mcmaster.ca/academicintegrity/turnitin/students/

Protection of Privacy Act (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades and all other personal information at all times. For example, the submission and return of assignments and posting of grades must be done in a manner that ensures confidentiality.

http://www.mcmaster.ca/univsec/fippa/fippa.cfm
Academic Accommodation of Students with Disabilities Policy

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information consult McMaster’s policy for Academic Accommodation of Students with Disabilities

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. http://sas.mcmaster.ca

Student Code of Conduct

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.
http://judicialaffairs.mcmaster.ca/pdf/SCC.pdf