# Course Outline

## 1. COURSE INFORMATION

<table>
<thead>
<tr>
<th>Session Offered</th>
<th>Summer 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Name</td>
<td>Mechanics of Fluids</td>
</tr>
<tr>
<td>Course Code</td>
<td>ENG TECH 4TF3E</td>
</tr>
<tr>
<td>Date(s) and Time(s) of lectures</td>
<td>Thursday 18:30 – 21:20</td>
</tr>
<tr>
<td>Program Name</td>
<td>Civil Engineering Infrastructure Technology, Energy Engineering Technologies, Manufacturing Engineering Technology</td>
</tr>
<tr>
<td>Calendar Description</td>
<td>Fluid statics, flow in closed conduits, dimensional analysis and similarity, energy and Bernoulli’s equation, flow kinematics, hydraulic cross-sections, energy loss in piping system, fluid Machinery.</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Kostas Apostolou E-Mail: <a href="mailto:apostol@mcmaster.ca">apostol@mcmaster.ca</a> Office Hours &amp; Location: ETB/207</td>
</tr>
</tbody>
</table>

## 2. COURSE SPECIFICS

<table>
<thead>
<tr>
<th>Instruction Type</th>
<th>Code</th>
<th>Type</th>
<th>Hours per term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom instruction</td>
<td>C</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Laboratory, workshop or fieldwork</td>
<td>L</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Tutorial</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance education</td>
<td>DE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td></td>
<td>36</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th>ISBN</th>
<th>Textbook Title &amp; Edition</th>
<th>Author &amp; Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9781118116135</td>
<td>Fundamentals of Fluid Mechanics, 7th edition</td>
<td>Munson, Rothmayer, Okiishi and Huebsch by John Wiley and Sons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Supplies</th>
<th>Source</th>
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</thead>
</table>

| Prerequisite(s) | ENG TECH 3MA3 and registration in Civil Engineering Infrastructure Technology, Energy Engineering Technologies or Manufacturing Engineering Technology. |
| Corequisite(s)  | N/A    |
| Antirequisite(s) | CIV TECH 3FM3, ENR TECH 3FM3, 3MF3, MAN TECH 4TF3 |

### Course Specific Policies
- All problem solutions, whether assignments or tests, should include a brief description of each major step taken. Incomprehensible solutions will not receive partial credit.
- All work must be shown to get full credit.
- Absence from exams or quizzes without a submitted MSAF will result to a grade of zero. Missed exams and tests with submitted MSAF will be either deferred or have their weight shifted to the final exam, at the discretion of
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)**

| Week 1 | Introduction - fluid characteristics  
|        | - Density, viscosity, surface tension  
|        | Fluid Statics  
|        | - Pressure variation in a stationary fluid, manometry  
|        | Ch. 1  
|        | Sec. 2.1-2.7  
| Week 2 | Fluid Statics  
|        | - Hydrostatic forces on plane surfaces  
|        | Ch. 2  
| Week 3 | Fluid Statics  
|        | - Hydrostatic forces on curved surfaces  
|        | Ch. 2  
| Week 4 | Fluid Statics  
|        | - Buoyancy  
|        | Fluid Dynamics  
|        | - Energy conservation along and across streamlines  
|        | - Bernoulli equation and applications  
|        | Ch. 2  
|        | Ch. 3  
| Week 5 | **Test 1: Fluid Statics**  
| Week 6 | Fluid Dynamics  
|        | 1. Bernoulli equation and applications  
|        | Ch. 3  
| Week 7 | Viscous Flow in Pipes  
|        | - Head loss calculations: major losses, minor losses  
|        | Ch. 8  
| Week 8 | **Lab 1**  
|        | Viscous Flow in Pipes  
|        | - Pump head, flow networks  
|        | Ch. 8  
| Week 9 | **Lab 1 Due**  
|        | Control Volume Analysis  
|        | - Continuity equation – Linear Momentum Balance  
|        | Ch. 5  
| Week 10 | Control Volume Analysis  
|        | - Linear momentum balance – Applications  
|        | Ch. 5  
| Week 11 | **Test 2: Bernoulli’s Equation, Viscous Flow in Pipes, Continuity, Linear Momentum**  
| Week 12 | **Lab 2**  
|        | Dimensional Analysis  
|        | 1. Buckingham π theorem  
|        | 2. Similitude  
|        | Ch. 7  
<p>|</p>
<table>
<thead>
<tr>
<th>Week 13</th>
<th>Lab 2 Due</th>
<th>Turbomachinery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Pump curves</td>
<td>Ch. 12</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Week 14</th>
<th>Final Exam – August 4, 2016</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Classes end – Friday, August 5, 2016</td>
</tr>
<tr>
<td></td>
<td>Final examination period: As arranged by instructor in class time.</td>
</tr>
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</table>

**List of experiments**

<table>
<thead>
<tr>
<th>Exp 1</th>
<th>Impact of a jet: Calculation of water jet impact force on several targets and comparison to theoretical predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp 2</td>
<td>Pelton turbine: Generation of turbine performance curves and identification of optimal operating conditions</td>
</tr>
<tr>
<td>Exp 3</td>
<td>Francis turbine: Generation of turbine performance curves and identification of optimal operating conditions</td>
</tr>
<tr>
<td>Exp 4</td>
<td>Osbourne – Reynolds apparatus: Observation of transition from laminar to turbulent flow and experimentation on the flow characteristics that lead to each type of flow</td>
</tr>
<tr>
<td>Exp 5</td>
<td>Hydrostatic pressure – tilting jar quadrant: Calculation of force on plane submerged surface and comparison to theoretical predictions</td>
</tr>
<tr>
<td>Exp 6</td>
<td>Pumps in series and parallel: Generation of pump performance curves and comparison for a single pump, and two identical pumps in series or in parallel.</td>
</tr>
<tr>
<td>Exp 7</td>
<td>Venturi Tube Application of Bernoulli’s law in a Venturi tube. Static, dynamic and stagnation pressure.</td>
</tr>
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</table>

Note that this structure represents a plan and is subject to adjustment term by term.

The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. **ASSESSMENT OF LEARNING *including dates***

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term tests (June 2nd and July 14th)</td>
<td>40%</td>
</tr>
<tr>
<td>On-line quizzes</td>
<td>7%</td>
</tr>
<tr>
<td>Labs</td>
<td>8%</td>
</tr>
<tr>
<td>Final examination (tests cumulative knowledge)</td>
<td>45%</td>
</tr>
</tbody>
</table>

**TOTAL** 100%

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

5. **LEARNING OUTCOMES**

1. Apply the principles of fluid statics for several calculations, including forces on submerged surfaces, torques on gates, and pressure measurement with manometers.
2. Identify conditions under which Bernoulli’s equation applies and implement it.
3. Calculate pressure drops and pump requirements for flow through closed conduits.
4. Apply the one-dimensional continuity and linear momentum equations to viscous incompressible flow setting.
5. Execute dimensional analysis and use the result in transferring experimental data on model structures into predictions for prototypes.
6. Compare different pumps and select the optimal one for given flow requirement(s).
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](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 DUE TO MINOR MEDICAL SITUATIONS that last up to 3 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 (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation.

If you are absent for reasons other than medical reasons, for more than 3 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/](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](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.