

Course Outline

1. COURSE INFORMATION

Session Offered	Summer 2017	
Course Name	Mechanics of Fluids	
Course Code	ENG TECH 4TF3E	
Date(s) and Time(s) of lectures	Thursday 18:30 – 21:20, ETB/235	
Program Name	Civil Engineering Infrastructure Technology, Energy Engineering Technologies, Manufacturing Engineering Technology	
Calendar Description	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.	
Instructor(s)	Kostas Apostolou	E-Mail: apostol@mcmaster.ca Office Hours & Location: ETB/207

2. COURSE SPECIFICS

Course Description	Fluid characteristics; fluid statics: pressure variation, forces on plane and curved surfaces, buoyancy, rigid-body motion, applications; Bernoulli's equation and applications; differential analysis: one-dimensional continuity equation and conservation of momentum; viscous flow in pipes: head losses and calculations; dimensional analysis and similitude; turbomachinery: pump performance curves.		
Instruction Type	Code	Type	Hours per term
	C	Classroom instruction	36
	L	Laboratory, workshop or fieldwork	3
	T	Tutorial	
	DE	Distance education	
	Total Hours		39
Resources	ISBN	Textbook Title & Edition	Author & Publisher
	9781118116135	Fundamentals of Fluid Mechanics, 7 th edition	Munson, Rothmayer, Okiishi and Huebsch by John Wiley and Sons
	Other Supplies	Source	
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		
Course Specific Policies	<ul style="list-style-type: none"> • All problem solutions during 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 have their weight shifted to the final exam. 		
Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program.		

	<p>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.</p> <p>Where group work is indicated in the course outline, such collaborative work is mandatory.</p> <p>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.</p> <p>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.</p> <p>Instructor has the right to submit work to software to identify plagiarism.</p>	
3. SUB TOPIC(S)		
Week 1	<u>Introduction - fluid characteristics</u> <ul style="list-style-type: none"> Density, viscosity, surface tension <u>Fluid Statics</u> <ul style="list-style-type: none"> Pressure variation in a stationary fluid, manometry 	Ch. 1 Sec. 2.1-2.7
Week 2	<u>Fluid Statics</u> <ul style="list-style-type: none"> Hydrostatic forces on plane surfaces 	Sec. 2.8
Week 3	<u>Fluid Statics</u> <ul style="list-style-type: none"> Hydrostatic forces on curved surfaces 	Sec. 2.10
Week 4	<u>Fluid Statics</u> <ul style="list-style-type: none"> Buoyancy Lab 1	Sec. 2.11
Week 5	Test 1: Fluid Statics	
Week 6	<u>Fluid Dynamics</u> <ul style="list-style-type: none"> Energy conservation along and across streamlines Mass conservation in pipe flow Bernoulli equation and applications Lab 1 Report Due	Ch. 3
Week 7	<u>Viscous Flow in Pipes</u> Head loss calculations: major losses, minor losses	Ch. 8
Week 8	<u>Viscous Flow in Pipes</u> <ul style="list-style-type: none"> Pump head Pump Curves Lab 2	Ch. 8 Sec. 12.4
Week 9	<u>Control Volume Analysis</u> <ul style="list-style-type: none"> Continuity equation Linear Momentum Balance Lab 2 Report Due	Ch. 5
Week 10	<u>Control Volume Analysis</u> <ul style="list-style-type: none"> Linear momentum balance – Applications 	Ch. 5
Week 11	Test 2: Bernoulli’s Equation, Viscous Flow in Pipes, Continuity, Linear Momentum	
Week 12	<u>Dimensional Analysis</u> <ul style="list-style-type: none"> Buckingham Π theorem Similitude 	Ch 7
Week 13	<u>Turbomachinery</u>	Ch. 12
Week 14 (August 3)	Final Exam: Cumulative	

Classes end: Friday, August 4th, 2017
 Final examination period: Saturday, July 29th to Friday, August 4th, 2017 (in-class)
 All examinations MUST be written during the scheduled examination period.

List of experiments

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

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*	Weight
Mid-term tests (Feb 2 nd and March 23 rd)	40%
On-line quizzes	7%
Labs	8%
Final examination (tests cumulative knowledge)	45%
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.

http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

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 an on-line self-reporting tool for **Undergraduate Students** to report absences for:

- 1) Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:
 - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period that is specified in the MSAF) regarding the nature of the accommodation. All work due in that time period however can be covered by one MSAF.
 - MSAF cannot be used to meet religious obligation or celebration of an important religious holiday, for that has already been completed or attempted or to apply for relief for any final examination or its equivalent.
- 2) For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has not been used previously in that term:
 - Students must visit their Associate Dean's Office (Faculty Office) and provide supporting documentation.

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

<http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf>

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://studentconduct.mcmaster.ca/student_code_of_conduct.html