

## Course Outline

### 1. COURSE INFORMATION

<b>Session Offered</b>	Winter 2022	
<b>Course Name</b>	Hydraulic Engineering	
<b>Course Code</b>	CIVTECH4MH3	
<b>Date(s) and Time(s) of lectures</b>	Thursday 18:30 – 21:30, Online Via Microsoft Teams/Zoom and/or ABB 166	
<b>Program Name</b>	Civil Engineering Infrastructure Technology	
<b>Calendar Description</b>	Dimensional analysis and hydraulic models.; Application of continuity, momentum and energy principles; Steady, closed conduit flow in single pipes and pipe networks; Steady, open-channel flow under uniform and gradually varied conditions, control sections, hydraulic jumps, and energy dissipaters; Hydraulic transients; surges and water hammer in closed conduits, surface waves in open channels; Concepts and principles of turbo machinery, especially centrifugal pumps; similarity relations and cavitation; operation of pump-and-pipe systems; Introductory concepts of hydraulic structures, including environmental aspects of hydraulic works and water quality management.	
<b>Instructor(s)</b>	Dr. Mohamed Mostafa, P.Eng., CEng MIEI., CPEng MIEAust., IntPE (Canada), M.ASCE	E-Mail: mostam4@mcmaster.ca Office Hours & Location: N/A

### 2. COURSE SPECIFICS

<b>Course Description</b>	Fluid Flow Fundamentals: Continuity, Energy, and Momentum; Viscous Effects on Flow: Laminar vs turbulent flow in closed conduits, Various friction loss relationships; Flow in Pipe systems: Single pipes, Pipe networks, surges and water hammer; Pumps: Pump characteristic curves, Net positive suction head, Pumps in series and parallel; Municipal Water Demand: Water demand variation, Population projection; Distribution Systems: Intake structures, Storage; Open Channel Flow: Specific energy, Gradually varied flow analysis, Rapidly varied flow, hydraulic jumps, design considerations; Hydraulic Structures: concept and design; Water Quality and Standards: Ontario Drinking Water Quality Standards.		
<b>Instruction Type</b>	<b>Code</b>	<b>Type</b>	<b>Hours per term</b>
	C	Classroom instruction	39
	L	Laboratory, workshop or fieldwork	---
	T	Tutorial	---
	DE	Distance education	---
	<b>Total Hours</b>		39
<b>Resources</b>	<b>ISBN</b>	<b>Textbook Title &amp; Edition</b>	<b>Author &amp; Publisher</b>
	ISBN: 0-13-283321-2	Water-Resources Engineering, 3 <sup>rd</sup> Edition, 2013	David A. Chin; Pearson
	<b>Other Supplies</b>	<b>Source</b>	
	Various textbooks from different other publishers such as:	- Mays, L.W., "Water Resources Engineering", 2 <sup>nd</sup> edition, Wiley, 2011	

	<p>McGraw Hill Ryerson Ltd., John Wiley &amp; Sons Inc., Prentice Hall Inc., and Heastad Methods</p>	<ul style="list-style-type: none"> <li>- Boyle, W.P., "Applied Fluid Mechanics", McGraw-Hill Ryerson Ltd., 1986.</li> <li>- Roberson, J.A., J.J. Cassidy, and M.H. Chaudhry, "Hydraulic Engineering", Second Edition, John Wiley &amp; Sons Inc., 1998</li> <li>- Houghtalen, R.J., A.O. Akan, and N.H.C. Hwang, "Fundamentals of Hydraulic Engineering Systems", Fifth Edition, Pearson, 2017.</li> <li>- John, J.E.A. and W.L. Haberman, "Introduction to Fluid Mechanics", Third Edition, Prentice Hall Inc., 1988.</li> <li>- McGhee, T.J., "Water Supply and Sewerage", Sixth Edition, McGraw-Hill Inc., 1991.</li> <li>- Peavy, H.S., D.R. Rowe and G. Tchobanoglous, "Environmental Engineering", McGraw-Hill Inc., 1985.</li> <li>- Walskim, T. M., T. E. Barnard, S. R. Durrans and M. E. Meadows, "Computer Applications in Hydraulic Engineering", Heastad Methods, 2000.</li> <li>Mays, L.W., "Water Resources Handbook", McGraw-Hill Inc., 1996.</li> </ul>
<b>Prerequisite(s)</b>	ENGTECH4TF3E and registration in Civil Engineering Infrastructure Technology	
<b>Corequisite(s)</b>	N/A	
<b>Antirequisite(s)</b>	N/A	
<b>Course Specific Policies</b>	<ul style="list-style-type: none"> <li>- The assigned assignments to be completed individually and not to be solved in groups.</li> <li>- Submitted academic work must be in PDF format except if completed in spreadsheet or word processing software. Photos (e.g. jpeg, png, tiff, etc.) of handwritten solutions WILL NOT be accepted.</li> <li>- Late academic work will not be accepted and will receive a grade of zero. Accommodation to missed academic work will only be given with proper McMaster Student Absence Form (MSAF) and documentations (e.g. note from a physician) submitted to your Faculty/Program office. It will be the general policy that the lowest mark you obtained for the other assignments will be assigned to your missed assignment.</li> <li>- All work must be shown, and any assumptions must be verified from a reputable reference to get full credit.</li> <li>- Both of Mid-Term and final exams are closed book.</li> <li>- Absence from Mid-Term exam without a submitted McMaster Student Absence Form (MSAF) will result to a grade of zero in the Mid-Term. Missed Mid-Term exam with a submitted MSAF will have their weight shifted to the final exam at the discretion of the course instructor.</li> <li>- Students are NOT authorized to record lectures using video, audio, or image recording devices without documented approval from the course instructor.</li> <li>- Email communications to the instructor MUST be sent from your McMaster University Account (not through Avenue, work, or personal email providers). Emails should be written in a professional manner, spell checked, and proof read prior to sending them.</li> </ul>	

<b>Departmental Policies</b>	<p>Students must maintain a GPA of 3.5/12 to continue in the program.</p> <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>
<b>3. SUB TOPIC(S)</b>	
Week 1: Jan. 13	<p><u>Introduction:</u>                  Overview of fluid flow properties and terms</p> <p><u>Fluid Flow Fundamentals:</u>                  Continuity, Energy, Momentum.</p>
Week 2: Jan. 20	<p><u>Viscous Effects on Flow:</u>                  Real vs. ideal fluids. Circular and non-circular conduit flow. Laminar and turbulent flow friction losses. Friction loss relationships.</p>
Week 3: Jan. 27	<p><u>Flow in Pipe systems:</u>                  Types of pipe flow problems. Minor losses. Pipe networks Energy and hydraulic grade lines. Siphons. Cavitation. Pressure surge and water hammer. Full and partially full flow in pipes</p>
Week 4: Feb. 3	<p><u>Pumps:</u>                  Types of pumps. NPSH. System curves. Pump characteristic curves. Single pumps. Pumps in series. Pumps in parallel.</p>
Week 5: Feb. 10	<p><u>Municipal Water Demand:</u>                  Water demand. Population projections.</p> <p><u>Distribution Systems:</u>                  Distribution methods. Storage. Pressure and flow requirements. Water distribution system design considerations.</p> <p><u>Water Quality and Standards:</u>                  Physical, Chemical, Microbiological, and Biological Characteristic of Water, Ontario Drinking Water Quality Standards</p>
<b>Week 6: Feb. 17</b>	<b>Mid-Term</b>
Mid-term Recess: Monday, February 21 <sup>st</sup> to Sunday, February 27 <sup>th</sup> , 2022	
Week 8: Mar. 3	<p><u>Open Channel Flow:</u></p>
Week 9: Mar. 10	Principles of open channel flow. Channel cross-sections. Velocity distributions.
Week 10: Mar. 17	Specific energy. Normal and critical depths. Subcritical and supercritical flows.

	Transitions and control sections. Gradually varied flow analysis. Rapidly varied flow analysis. Open channel design considerations.
Week 11: Mar. 24	<u>Hydraulic Structures:</u>
Week 12: Mar. 31	
Week 13: Apr. 7	<u>Revision</u>

Midterm Recess: Monday, February 21 to Sunday, February 27  
 Classes end: Tuesday, April 12  
 Final Examination Period: Thursday, April 14 to Friday, April 29  
 All examinations MUST be written during the scheduled examination period.

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.

<b>4. ASSESSMENT OF LEARNING *including dates*</b>	<b>Weight</b>
6 Assignments (~ Bi-weekly assignments)	20%
Mid-term test (February 17 <sup>th</sup> , 6:30pm – 8:00pm)	35%
Final examination (tests cumulative knowledge)	45%
<b>TOTAL</b>	<b>100%</b>

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

#### **5. LEARNING OUTCOMES**

1. Ability to draw and identify components of Hydraulic Grade Line (H.G.L.) and Energy Grade Line (E.G.L.) in a pipe system
2. Ability to use the Hardy Cross Method to calculate flow in a pipe network system
3. Ability to estimate population growth using forecast estimation models
4. Ability to identify water surface profiles in an open channel based on various obstacles and bed slopes
5. Ability to carry on calculations to identify whether flow conditions in an open channel will result in the generation of a hydraulic jump or not.
6. Ability to identify flow types in a culvert and calculate the hydraulic parameters needed for a hydraulic culvert design.

#### **6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS**

##### **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](http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf)

##### **ACADEMIC INTEGRITY**

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

### **AUTHENTICITY / PLAGIARISM DETECTION**

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **COURSES WITH AN ON-LINE ELEMENT**

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

### **ONLINE PROCTORING**

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

### **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.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar’s Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests. <http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf>

### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.