ME3O04
Fluid Mechanics

Undergraduate Studies
Fall 2025/26
Course Outline

CALENDAR/COURSE DESCRIPTION

This course is an introduction to the subject of fluid mechanics. It includes the following topics: Fluid properties and statics, conservation laws, applications of the continuity, momentum and energy equations, dimensional analysis and similarity, boundary layer flow, internal and external flows. While covering the basics and fundamentals of fluid mechanics, the emphasis in this course will be on using those basic principles to analyze various engineering systems.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Both MATH 2Z03 and 2ZZ3 and registration in any Mechanical Engineering program.

Antirequisite(s): CIVENG 2O04, CHEMENG 2O04, and ENGPHYS 3O04.

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. M. Hamed
Office: JHE 203
Email: hamedm@mcmaster.ca

Tel: 905-525-9140 Ext. 26113

Office Hours:

by appointment, upon request via email

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Name	Mahmoud Baioumi	Vincent Wey	Abdelfattah Teamah	Mohab Mefreh	Mingxuan Zhu	Kalu Orji
Email	baioumim@mcmaster.ca	weyt@mcmaster.ca	teamaa1@mcmaster.ca	mefrehm@mcmaster.ca	Zhum92@mcmaster.ca	orjik@mcmaster.ca
Office Hour	Wednesdays 4:30-5:30 PM	Thursdays 4:30-5:30 PM	Mondays 4:30-5:30 PM	Tuesdays 4:30-5:30 PM	Fridays 4:30-5:30 PM	TBA
Location	JHE-215 or Online via Teams	JHE-106B or Online via Teams	JHE-215 or Online via Teams	JHE-215 or Online via Teams	Online via Teams	TBA
Tutorial Section	T01	T01	T02	T02	Quizzes T01	Quizzes T02

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

All course material, marks and announcements will be posted on Avenue to Learn. Lectures and Tutorials will not be recorded. Class attendance is very important.

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

1. Understand and use force analysis in static and moving fluids to analyze fluid flow systems.
2. Understands and knows how to apply the various methods of analysis in fluid mechanics (the Reynolds Transport Equation -Control Volume Analysis and differential approach) to solve real-life fluid flow problems.
3. Select and use flow visualization tools (e.g., Timelines, Streamlines, Pathlines, and Streaklines) to analyze and understand the main features of a certain fluid flow.
4. Comprehends the concepts of boundary layer, displacement thickness, and flow separation and be able to use these concepts to simplify the analysis of real flows.
5. Understand the concept of similarity and dimensional analysis and be able to use it to develop and carry out model-prototype analysis.
6. Estimate friction loss in fluid flow networks.

MATERIALS AND FEES

Required Texts:

"Introduction to Fluid Mechanics", by R. W. Fox, A. T. McDonalds, and J. W. Mitchell, 9th edition (2015) or the 10th edition (2020), John Wiley.

- The textbook will be used to assign problems.
- The textbook supplements lectures and class discussions. However, it is not a substitute for lectures and tutorials.

Calculator: Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:

Several illustrative fluid mechanics videos will be used during lectures.

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 3 classroom-based lectures per week
- 1 classroom-based tutorial per week
- 2 closed-book, in-class, term tests
- 6 closed-book, bi-weekly quizzes
- A closed-book, in-class, final exam. The final exam covers all course material.
- The two term tests and the final exam will include questions on theory and concepts covered during class discussions and tutorials.

The course elements (lectures and tutorials) **will not be offered online, whether live or recorded**. All lectures and tutorials are offered in class (i.e., in-person format). Printouts of lecture notes will be posted on Avenue to Learn. Lectures and Tutorials will not be recorded. Class attendance is very important.

Tutorials:

1. In-class tutorials will start the week of September 8th.
2. A set of Additional Problems, like the assigned problems, will be posted on Avenue to Learn.
3. The TAs will solve these "Additional Problems" during the tutorials.
4. The TAs will also address any unclear concepts and/or help students to solve the assigned problems.

COURSE SCHEDULE

Date/Week	Topic	Readings
Sept 1	Introduction	Chapter 1
Sept 8	Introduction - Continued and Fundamental Concepts	Chapters 1 & 2
Sept 15	Fundamental Concepts - Continued	Chapter 2
Sept 22	Fluid Statics	Chapter 3
Sept 29	Fluid Statics – Continued & Basic Equations in Integral Form	Chapters 3 & 4
Oct 6	Basic Equations in Integral Form & Basic Equations in Integral Form.	Chapters 4 & 5
Oct 13	Reading Week	Covered Chapters
Oct 20	Basic Equations in Integral Form	Chapter 5
Oct 27	Basic Equations in Integral Form & Incompressible Inviscid Flow	Chapters 5 & 6
Nov 3	Incompressible Inviscid Flow & Dimensional Analysis and Similitude	Chapters 6 & 7
Nov 10	Dimensional Analysis and Similitude & Internal Incompressible Viscous Flows	Chapters 7 & 8
Nov 17	Internal Incompressible Viscous Flows	Chapter 8
Nov 24	External Incompressible Viscous Flow	Chapter 9
Dec 1	External Incompressible Viscous Flow	Chapter 9

ASSESSMENT

Component	Due Date	Weight
Quizzes	Bi-weekly	18%
Assignments	Weekly	0%
Term Test 1	Thursday Oct 2nd at 7:30-9:00 PM	16%
Term Test 2	Thursday Nov 6th at 7:30-9:00 PM	16%
Final Exam	TBA	50%
Total		100%

Quizzes:

1. To encourage students to attend tutorials and to study regularly, quizzes will be administered roughly every two weeks.
2. Quizzes will be provided in-class during the tutorials

3. Quizzes will cover conceptual and/or calculation problems like the assigned and the additional problems.
4. Quizzes timetable and clear guidelines regarding the quizzes are provided below.

Quizzes Instructions, Guidelines and Timetable

1. Each quiz will be administered at the beginning of the scheduled tutorial, according to the timetable provided below.
2. Each student should bring couple of blank papers with him/her to write the quiz on.
3. Student must write his/her name, student number, quiz number and date and tutorial section number on the quiz answer sheet(s) that he/she intends to submit.
4. Each quiz will cover conceptual and calculation problems, like the assigned and the additional problems.
5. Any quiz written with the wrong tutorial section will not be marked and a zero mark will be given.
6. A student who has a legitimate reason to write one of her/his quizzes with the other tutorial section must request permission to do so via email to Dr. Hamed at hamedm@mcmaster.ca.
7. The permission request email must be received, at least, two days before the date of the quiz, not after that date.
8. The date, time and material covered in each quiz are indicated in the table below.
9. Any quiz submitted by a student who chose not to follow these instructions will be not be marked and a zero mark will be given.

Quiz number	Week of	Covering Chapter(s)	Covering Assignment(s)	Quiz Date and Time	
				T01	T02
1	15-Sep	1	1	Wednesday Sept 17th at **2:35 PM**	Tuesday Sept 16th at **2:35 PM**
2	22-Sep	2	2a	Wednesday Sept 24th at **2:35 PM**	Tuesday Sept 23th at **2:35 PM**
3	06-Oct	2 and 3	2b and 3	Wednesday Oct 8th at **2:35 PM**	Tuesday Oct 7th at **2:35 PM**
4	27-Oct	4 and 5	4 and 5	Wednesday Oct 29th at **2:35 PM**	Tuesday Oct 28th at **2:35 PM**
5	10-Nov	6 and 7	6 and 7	Wednesday Nov 12th at **2:35 PM**	Tuesday Nov 11th at **2:35 PM**
6	24-Nov	8	8	Wednesday Nov 26th at **2:35 PM**	Tuesday Nov 25th at **2:35 PM**

Assignments:

- Roughly, every week, textbook problems and conceptual questions based on class discussions will be assigned and posted on AVENUE TO LEARN.
- Students are strongly encouraged to attempt solving these assignments to prepare for the term tests and the final examination.
- Students' assignment solutions ***will not be*** collected or marked.

- Solutions of the Assigned and the Additional Problems will be posted on AVENUE TO LEARN before each term test and before the final exam.

Formulas Needed for Term Tests and Final Exam:

- A "Formulas Sheet" is posted on AVENUE TO LEARN.
- Only formulas provided on the posted sheet will be provided in the two term test papers and the final examination paper.
- All other formulas that have been covered in class and/or included in the course material; however not included within the posted "Formulas Sheet", will not be included in the term tests paper or the final exam paper. Students are expected to study and memorize these other formulas.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
Competence in Mathematics	1.1
Competence in Engineering fundamentals	1.3
Identifies and states reasonable assumptions and suitable engineering fundamentals, before proposing a solution path to a problem.	2.1
Proposes problem solutions supported by substantiated reasoning, recognizing the limitations of the solutions.	2.2

For more information on Accreditation, please visit: https://www.engineerscanada.ca

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the Student Wellness Centre.
Talkspot is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

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:
1. plagiarism, e.g. the submission of work that is not one's 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.

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. AVENUE TO LEARN, 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.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (AVENUE TO LEARN), 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.

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 to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage on Avenue to Learn for updates and announcements.
2. Any legitimate conflicts with the two term tests scheduled on Oct 2nd and Nov 6th (at 7:30-9:00 PM EST) must be communicated by email to Dr. Hamed at the start of the term. The deadline to do so is Friday Sept 12th. No accommodations will be provided for conflicts reported after this deadline. Sometimes it is not possible to avoid conflicts with scheduled night classes. Students should notify the other instructor of the scheduled term test.
3. The weight of any missed work that has been properly reported and approved using MSAF will be automatically added to the weight of the final examination. No other accommodation will be provided for missed work.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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".

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:

   - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
   - Students may submit requests for relief using the MSAF once per term.
   - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
   - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
   - The MSAF cannot be used for academic work that has already been completed attempted.
   - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
   - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

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 been used previously in that term:

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate supporting documentation.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

In ME3O04, the weight of any missed work that has been properly reported and approved using MSAF will be automatically added to the weight of the final examination. No other accommodation will be provided for missed 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.

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, AVENUE TO LEARN and/or McMaster email.