ME3O04 - Fluid Mechanics

Fall/Winter 2020/21

Course Outline

Calendar/Course Description

This course is an introduction to the subject of fluid mechanics. It includes the following topics: fundamental concepts, fluid statics, conservation laws, incompressible inviscid flows, dimensional and similarity analysis, internal incompressible viscid flows, introduction to boundary layers, and lift and drag. 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.

Course Topics

1. Introduction and Fundamental Concepts.
2. Fluid Statics.
3. Integral Analysis.
4. Differential Analysis.
5. Incompressible Inviscid Flow.
6. Dimensional Analysis.
7. Internal Incompressible Viscous Flow.
8. External Incompressible Viscous Flow.

Pre-Requisites and Anti-Requisites

Prerequisite(s): Both MATH 2M03 and 2MM3 (or 2M06), or both MATH 2Z03 and 2ZZ3, or both MATH 2PO4 and 2Q04; and registration in any Mechanical Engineering program.

Instructor Office Hours and Contact Information

Dr. Mohamed Hamed
JHE 203
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ext. 26113

Office Hours:
Online, by appointment

Teaching Assistant Office Hours and Contact Information

Name	**Ahmed Teamah**	**Panashe Muzidi**	**Massoud Ebrahimi**	**Saksham Gupta**	**Nikhil Guduri**
Email	teamaha@mcmaster.ca	mudzip@mcmaster.ca	ebrahm8@mcmaster.ca	guptas70@mcmaster.ca	gudurin@mcmaster.ca;
Office Hour	Wednesdays 4:00-5:00 PM	Fridays 4:00-5:00 PM	Thursdays 4:00-5:00 PM	Mondays 4:00-5:00 PM	Tuesdays 4:00-5:00 PM
Tutorial Section	T01	T01	T02	T02	

Course Website/Alternate Methods of Communication

http://avenue.mcmaster.ca/

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., Streamline, 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

Required Textbook:
"Introduction to Fluid Mechanics", by R. W. Fox, A. T. McDonalds, and J. W. Mitchell, 10th edition, John Wiley, 2020.

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

Calculator: Only a Casio FX-991 MS or MS+ calculator is allowed.
Other Materials: A number of illustrative videos will be made available on A2L.

Course Format and Expectations

- The course is organized as follows:
  - 3 online-based lectures per week
  - 1 online-based tutorial per week
  - 2 closed-book term tests
  - A closed-book final exam. The final exam covers all course material.
  - All exams (i.e., term tests and final) will include questions on theory and concepts covered in lectures and class discussions.

Assessment

Component	Date/Time	Weight
Term test 1	Wed. October 7 at 7:30 PM	25%
Term test 2	Wed. November 11 at 7:30 PM	25%
Final Exam	TBA	50%
Total		100%

LECTURES

- Lecture notes will be posted on the A2L course page. All posted material is copyright protected and should not be shared with and/or distributed to others.
- Synchronous online lectures will be delivered on Tuesdays, Thursdays, and Fridays at 11:30 AM-12:20 PM using Microsoft Teams (Teams).
- Lectures will be recorded. Videos will be posted on Teams.
- Class discussions might include points that are not necessarily included in the textbook.
- Attending lectures is very important and highly recommended.

TUTORIALS

1. Synchronous online tutorials will start the week of September 14th.
2. T01 tutorials are scheduled on Mondays at 8:30-10:20 AM (Virtual Classroom).
3. T02 tutorials are scheduled on Fridays at 9:30-11:20 AM (Virtual Classroom).
4. Online tutorials will be provided using Microsoft Teams.
5. Tutorials will be recorded. Videos will be posted on Teams.
6. A set of additional problems, similar to the assigned ones, will be posted on A2L. TAs will solve these additional problems during tutorials.
7. TAs will also address any unclear concepts and help students solve assigned problems.

INSTRUCTIONS ON ATTENDING TEAMS VIRTUAL LECTURES AND TUTORIALS

1. Mute your microphone and keep your video turned off when joining.
2. Select the Join button to join the meeting.
3. To open the chat side panel, click the Chat icon.
4. To raise your hand during a lesson, click the Hand Up icon.
5. When the instructor is ready to hear your question, he/she will turn on your microphone so you can ask your question or contribute to the conversation.
6. Remember: Please respect other students' rights to learn without interruptions. All university and classroom rules apply online as well as they do at school.

ASSIGNMENTS

- Roughly, every week, textbook problems and questions based on class discussions will be assigned and posted on A2L. Students are strongly encouraged to attempt solving these problems to prepare for the two term tests and final examination. Assignment solutions ***will not be*** collected or marked.
- Assignments might include questions based on lectures and class discussions.

EQUATIONS NEEDED FOR TERM TESTS AND FINAL EXAM

- An “Equations Sheet” will be posted on the course A2L webpage.

- Only formulas provided on the "Equations Sheet" will be included in term tests and final examination papers.
- Other formulas that have been covered in class and in course material and not included within the "Equations Sheet" **will not be** included in exam papers. Students must memorize these 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
1-6	Knowledge base for Engineering (Indicator 3)

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 Mechanical Engineering 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.

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

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.

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 (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

Online proctoring software maybe used 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.

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 A2L, 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 A2L for updates and announcements.
2. 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.*

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, A2L and/or McMaster email.