



ENGG*2230 Fluid Mechanics

01, 02

Winter 2021

Section(s): C01, C02

School of Engineering

Credit Weight: 0.50

Version 1.00 - January 11, 2021

1 Course Details

1.1 Calendar Description

Analysis of steady ideal and viscous fluid flow systems using the Continuity, Bernoulli and Momentum equations. Boundary layer theory is treated in terms of viscous and pressure drag, lift and its importance in heat and mass transfer. Dimensional analysis and dynamic similitude are studied to provide an understanding of flow systems analysis and modeling. Introduction to pipe flow and open channel flow.

Pre-Requisites: ENGG*1210, MATH*1210

1.2 Timetable

Lectures:

Tues./Thurs. 1:00-2:20pm

Online Zoom Meetings

Labs/Tutorials:

Section 1. (Wed. 1:30pm-3:20pm)

Online: Zoom

Section 2. (Tues. 3:30pm-5:20pm)

Online: Zoom

Section 3. (Fri. 12:30pm-2:20pm)

Online: Zoom

Section 4. (Thur. 3:30pm-5:20pm)

Online: Zoom

1.3 Final Exam

Wed., April 21, 2:30am to 4:30pm, Room: Online

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Wael Ahmed
Email:	ahmedw@uoguelph.ca
Telephone:	+1-519-824-4120 Ext 53674
Office:	THRN 2507
Office Hours:	Tues. and Thur. 2:30pm-3:30pm (Online)
Lab Technician:	Ryan Smith
Email:	rsmith17@uoguelph.ca
Telephone:	+1-519-824-4120 x53278
Office:	THRN 1114

2.2 Teaching Assistants

Teaching Assistant:	Mohammad Khodabakhshisoureshjani
Email:	mkhodaba@uoguelph.ca
Office Hours:	TBA on CourseLink
Teaching Assistant:	Scott Gardner
Email:	sgardner@uoguelph.ca
Office Hours:	TBA on CourseLink
Teaching Assistant:	Arash Yoosefdoost
Email:	arashyd@uoguelph.ca
Office Hours:	TBA on CourseLink
Teaching Assistant:	Andrew Newton
Email:	anewto03@uoguelph.ca
Office Hours:	TBA on CourseLink

3 Learning Resources

3.1 Required Resources

Fluid Mechanics (Textbook)

"Fluid Mechanics", by Frank M. White , 8th Edition, McGraw-Hill, 2016, ISBN 978-0-07-339827-3.

Available from the publisher as Hardcopy and as eBook:

<https://www.mheducation.com/highered/product/fluid-mechanics-%20white/M9780073398273.html>

Please note that hardcopies of the textbook have been placed on reserve at the McLaughlin Library.

Course Website (Website)

<https://courselink.uoguelph.ca/>

Course material, news, announcements, and grades will be regularly posted to the ENGG*2230 CourseLink site. You are responsible for checking the site regularly. **As per University regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly;** e-mail is the official route of communication between the University and students.

3.2 Additional Resources

Lecture Information (Notes)

Lectures will be presented through a combination of PowerPoint slides and Document Camera notes. The slides for the lectures will be posted on the course website (CourseLink). These slides are augmented with in-class notes and detailed example solutions. You are thus expected to **take notes** during class, which includes theory, the example solutions, and supplementary information the professor provides while lecturing.

Lab Manual (Lab Manual)

The lab manual is available on CourseLink. The lab during this semester will be virtual and the lab videos will be posted on the course link. The main objective of this exercise is to get the students to write a report on the lab work. **You are responsible for reviewing the lab materials prior to preparing your lab reports.** The lab manual also contains instructions and questions to be addressed in the lab reports in order to be completed. The labs will be explained in the videos and the TA will be available during the office hours and tutorials session to answer any questions. For your convenience, you will be allowed to view the lab videos anytime during the assigned week and prepare a group report that will be submitted electronically in the assigned dropbox.

Problem Sets (Other)

There will be **weekly** problem sets assignment on CourseLink during the term. You are expected to complete each problem set on a timely basis. This set will be discussed during the tutorials sessions. Most students find that practice problems are the best way to stay engaged in the course. The solutions will be posted on CourseLink approximately one week after the problem set is posted.

Tutorials - Problem Analysis Exercises (Other)

During the tutorials sessions, you will work with the TA to solve some of the assigned problems set in groups. This will help you to learn more about problems analysis and understand how to approach fluid mechanics problems. This activities aims at engaging the students in the learning process.

Engineering Peer Helpers (Voluntary) (Other)

The peer helper program, staffed by upper year engineering students, offers regular workshops aimed at developing problem solving skills and new learning tools specific to core engineering courses such as Fluid Mechanics. For more information on the Peer Helper program, visit:

<https://www.uoguelph.ca/engineering/content/current/peer-helper>

Miscellaneous Information (Other)

Supporting information will also be occasionally posted on the CourseLink site.

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Describe the physical and flow properties of fluids, and their impact on engineered systems and structures.
2. Characterize and analyze fluid mechanics problems through the use of the appropriate tools, including conservation of mass, conservation of momentum, and the conservation of energy, and using the appropriate approaches, including integral (control volume), differential, or dimensional approaches.
3. Estimate head loss, required power, conduit sizing, and flow rates in internal and open flow systems. Also determine the lift and drag forces on submerged bodies.
4. Model fluid engineering systems, with stated assumptions, systematically solved and clearly communicated, including the use of correct accuracy, precision, significant digits, and dimensional homogeneity.
5. Use appropriate apparatus, sensors and instruments to analyze fluid flow, test fluid flow hypotheses, and collect data, by conducting laboratory experiments.
6. Write clear, concise and professional laboratory reports for the biweekly fluid mechanics laboratories.
7. Demonstrate effective skills in teamwork during group activities (cooperative exercises and biweekly laboratories), and respectful interactions with peers, lab technicians, graduate teaching assistants, and instructor during lectures, tutorials and laboratories.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 3
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 3
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 3
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3
2	Problem Analysis	2, 3, 4
2.2	Identify, organize and justify appropriate information, including assumptions	2, 3, 4
2.3	Construct a conceptual framework and select an appropriate solution approach	2, 3, 4
2.4	Execute an engineering solution	2
2.5	Critique and appraise solution approach and results	2, 3, 4
3	Investigation	5
3.3	Analyze and interpret experimental data	5
3.4	Assess validity of conclusions within limitations of data and methodologies	5
5	Use of Engineering Tools	5
5.2	Demonstrate proficiency in the application of selected engineering tools	5
5.3	Recognize limitations of selected engineering tools	5
6	Individual & Teamwork	7
6.2	Understand all members' roles and responsibilities within a team	7
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	7
6.4	Apply strategies to mitigate and/or resolve conflicts	7
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	7
7	Communication Skills	6
7.1	Identify key message(s) and intended audience in verbal or written	6

#	Outcome	Learning Outcome
	communication as both sender and receiver	
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	6
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	6
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	6
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	6
8	Professionalism	7
8.3	Demonstrate professional behaviour	7

5 Teaching and Learning Activities

Students are responsible for all information presented in the lectures, tutorials, and labs, and student participation is encouraged. The dynamics of each learning activity should be based on professionalism and mutual respect. Cell phones are to be turned off during the class, ear buds are to be put away, and the use of laptops and tablets in class is restricted to taking class notes. Everyone in the classroom has the right to participate and contribute.

Note that the lecture topics listed below are the plan at the time of course outline writing, but may be subject to change during the semester.

5.1 Lecture

Weeks 1-2

Topics: Fluids and fluid properties
References: Chapter 1
Learning Outcome: 1, 4

Weeks 3-4

Topics: Fluid statics and pressure distribution
References: Chapter 2
Learning Outcome: 1, 4

Weeks 4-5

Topics:	Fluid flow concepts: control volumes
References:	Chapter 3
Learning Outcome:	1, 2
Weeks 6-7	
Topics:	Fluid flow concepts: differential analysis
References:	Chapter 4
Learning Outcome:	1, 2
Weeks 7-8	
Topics:	Dimensional analysis
References:	Chapter 5
Learning Outcome:	1, 2
Weeks 8-9	
Topics:	Internal viscous flow (pipe flow)
References:	Chapter 6
Learning Outcome:	1, 2, 3, 4
Weeks 9-10	
Topics:	External flow and boundary layer theory
References:	Chapter 7
Learning Outcome:	1, 2, 3, 4, 4
Week 11	
Topics:	Pumps and turbomachinery
References:	Chapter 11
Learning Outcome:	1, 3
Week 12	
Topics:	Open channel flow
References:	Chapter 10
Learning Outcome:	1, 2, 3

5.2 Labs

The laboratory is an important part of the course in order for students to visualize and understand some fluid mechanics concepts. Due to COVID-19 restriction, all labs are recorded and data was collected by the TAs. In order to make the best out of this important activities, the main objective of the online lab is to get students familiar with how to report and present lab findings. Labs reports will be done in groups of up to three (5) students during the assigned weeks. You will write your lab reports using data that is assigned to your groups. Although lab reports will be written remotely, it is expected that each group member equally contribute to each lab report, and approve the lab report before submission.

Before preparing your lab report, **each person must have read and understood the corresponding information in the lab manual** (available on CourseLink) and **must have**

watched the corresponding video (also available on CourseLink). You are expected to show sample calculations on your report. **Students who need more explanation on how the lab experiments were done and how to complete their lab report needs to contact the TA during the tutorials/lab help sessions and office hours.**

5.3 Lab Activities

Lab Activity	Topic
0	Intro to the fluids lab and lab safety
#1	Flow measurement
#2	Impact of a jet
#3	Pipe friction
#4	Minor losses
#5	Discharge over weirs

5.4 Due Dates

The lab reports are to be submitted electronically in dropboxes in CourseLink that will be created based on your lab teams. Due dates for each lab group will be posted on Courselink.

Each lab report is to include the data assigned to your group.

Each team must submit a single electronic report for each experiment. The report is to be no longer than 10 pages, which includes the title page, page includes the assigned data, and up to 8 pages for the rest of the work. Additional report information is in the laboratory manual.

For your convenience, and because of the online delivery mode of the lab materials, you will be able to view the lab video anytime during the assigned week. You can connect with the TA during the office hours to ask any questions on the lab material and then, you can submit the lab report electronically in the assigned dropbox any time during the week before the due date for each lab. If you miss a laboratory **due to grounds for granting academic consideration or religious accommodation**, arrangements must be made with the teaching assistant to complete the lab during open days (last week of classes).

5.5 Tutorials-PROBLEM ANALYSIS EXERCISES

The tutorials will be conducted online via zoom every week. 5 of these session will be running problem analysis exercises as per the schedule listed in this outlines. During the two-hour time blocks (assigned for each section), the TA will divide the section into random group rooms and assigned a problem for each group. The group will work on solving the problem together and with some discussion with the TA. The instructor will be joining the activities and encourage the discussion and explain how problem analysis is performed. Students can choose to present their answers to the rest of the section if larger discussion is needed.

Students must attend their scheduled Tutorial sessions in order to keep the record for the participants.

5.6 Lab and Tutorial Schedule

Lab	Submission due date (All sections)
Lab #1 (Impact of a jet)	January 29th 2021
Lab #2 (Flow measurement)	February 12th 2021
Lab #3 (Pipe friction)	March 5th 2021
Lab #4 (Minor losses)	March 19th 2021
Lab #5 (Discharge over weirs)	April 1st 2021

Tutorial Sessions Activities

Week	Section (1) Wed.	Section (2) Tues.	Section (3) Fri.	Section (4) Thur.
Jan. 11-15	Tutorials Trails	Tutorials Trails	Tutorials Trails	Tutorials Trails
Jan. 18-	Problem Analysis 1	Problem Analysis 1	Problem Analysis 1	Problem Analysis 1

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Jan. 25-29	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help
Feb. 1-5	Problem Analysis 2	Problem Analysis 2	Problem Analysis 2	Problem Analysis 2
Feb. 8-12	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help
Feb. 22-26	Problem Analysis 3	Problem Analysis 3	Problem Analysis 3	Problem Analysis 3
Mar. 1-5	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help
Mar. 8-12	Problem Analysis 4	Problem Analysis 4	Problem Analysis 4	Problem Analysis 4
Mar. 15-19	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help	Tutorials/Lab help
Mar. 22-26	Problem Analysis 5	Problem Analysis 5	Problem Analysis 5	Problem Analysis 5
Mar. 29-Apr. 2	Tutorials/Lab help	Tutorials/Lab help	Holiday/No tutorials	Tutorials/Lab help
Apr. 5-9	Tutorials/Review	Tutorials/Review	Tutorials/Review	Tutorials/Review
Apr. 12	April 2nd missing section		Tutorials/Lab help	

***It is critical that you sign up in a slot during your scheduled lab time.**

Pick your lab group wisely as you will work with the same lab group during the entire semester. If you sign up for "Group A" you will always conduct your lab during the first week the experiment is offered, and if you sign up for "Group B" you will always do it during the second week it is offered.

5.7 Other Important Dates

Monday, January 11, 2021: First day of class

Week of February 15-22, 2021: Winter break - no lectures, labs or tutorials

Friday, April 2, 2021: NO CLASSES SCHEDULED – classes rescheduled to Monday, April 12

Friday, April 12, 2021: Last day to withdraw from course

Friday, April 12, 2021: Last day of class

6 Assessments

6.1 Marking Schemes & Distributions

6.2 Assessment Details

Unmarked Problem Sets (0%)

Date: Mon, Jan 11 - Mon, Apr 12, 12 problem sets posted weekly on Courselink

Learning Outcome: 1, 2, 3, 4, 4

Labs (20%)

Date: Mon, Jan 11 - Thu, Apr 1

Learning Outcome: 5, 6, 7

Due dates is listed in the course outlines. A grade of zero will be issued to any team member who did not included in the lab reports as per the assigned groups.

As there are no in-person labs, there will not be any missed labs. If you are unable to contribute to writing a lab report due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab report at the end of the semester (last week of classes).

Tutorial Problem Analysis Exercises (15%)

Date: Mon, Jan 11 - Mon, Apr 12

Learning Outcome: 1, 2, 3, 4, 4, 7

5 problem analysis exercises during the tutorials sessions will be considered the final grade assessment for this component. Grades will be given for participating in these activities.

Mockup test (0%)**Date:** Mon, Feb 1, 12:00 AM - Fri, Feb 19, 11:55 PM, Online

In preparation for the midterm exam, This test is a trail test to get you familiar with the online tools used in the exam.

Midterm Exam (20%)**Date:** Tue, Mar 2, 1:00 PM - 2:15 PM, Online**Learning Outcome:** 1, 2, 4

Open book; covers material up to last lecture prior to exam.

Missed Midterm Exam: If you miss the midterm due to grounds for granting academic consideration or religious accommodation, the weight of the missed assessment will be added to the final exam. There will be no makeup midterm exam.

Final Exam (45%)**Date:** Wed, Apr 21, 2:30 PM - 4:30 PM, Online**Learning Outcome:** 1, 2, 3, 4, 4

Open book; covers entire course.

6.3 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Passing grade: Passing grade of the course is 50%

6.4 Assessment Note on Exams

The examinations will be delivered/completed remotely/online. As such, students are expected to behave ethically, which includes completing examinations individually and according to examination conditions set out. Students must agree to the ethical guidelines stated on the cover page of the examinations, at the time of writing the examinations. The students who violate these ethical guidelines will be subject to academic misconduct investigation.

7 Course Statements

7.1 Remote/Online Teaching

The course is entirely delivered online/remotely this semester. As such, there is no expectation for students to be on campus during scheduled activities. Also, all interactions with course Instructors and Teaching Assistants, including office hours will be done remotely, by email or video conferencing (Zoom or WebEx).

7.2 COVID Pandemic

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information>) and circulated by email.

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on CourseLink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared

responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
