ENGG*2230 Fluid Mechanics

Fall 2018
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - September 05, 2018

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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-Requisite(s): ENGG*1210, MATH*1210

1.2 Timetable

Lectures:

Tuesday	8:30AM – 9:50AM	MACN 113
Thursday	8:30AM – 9:50AM	MACN 113

Seminars/Tutorials:

Tuesday	#1	2:30PM – 4:20PM	THRN 1002
Monday	#2	2:30PM – 4:20PM	THRN 1002
Friday	#3	2:30PM – 4:20PM	THRN 1002

Laboratory:

Tuesday	#1	2:30PM – 4:20PM	THRN 1125
Monday	#2	2:30PM – 4:20PM	THRN 1125
Friday	#3	2:30PM – 4:20PM	THRN 1125

1.3 Final Exam

Tuesday, December 11, 2018, 19:00 - 21:00, room TBA

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2 Instructional Support

2.1 Instructor(s)

Bill Van Heyst
Email: bvanheys@uoguelph.ca
Telephone: +1-519-824-4120 x53665
Office: THRN 1333
Office Hours: TBA on CourseLink or by appointment

2.2 Instructional Support Team

Lab Technician: Ryan Smith
Email: rsmith17@uoguelph.ca
Telephone: +1-519-824-4120 x53278
Office: THRN 1114

2.3 Teaching Assistant(s)

Teaching Assistant: Scott Gardner
Email: sgardner@uoguelph.ca

Teaching Assistant: Samantha Mehltretter
Email: mehltres@uoguelph.ca

Teaching Assistant: Amir Nazem
Email: anazem@uoguelph.ca
(0.5 GTA allocation)

Teaching Assistant: Carlos Pena
Email: cpena@uoguelph.ca

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3 Learning Resources

3.1 Required Resource(s)

Fluid Mechanics (Textbook)
F.M. White , 8th Edition McGraw-Hill, 2015

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.

3.2 Recommended Resource(s)

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

3.3 Additional Resource(s)

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. You are responsible for reviewing this and having an electronic or hard copy with you during your laboratory sessions. You must read the laboratory manual to prepare for each experiment prior to your scheduled laboratory.

Problem Sets (Other)

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

Tutorials - Cooperative Learning Exercises (Other)

There will be 5 tutorials in which cooperative learning exercises will take place. During these tutorials, you will work in groups to solve problems on the white boards in the tutorial room. Peer and self evaluations on your problem analysis skills as well as instructor and GTA evaluations on the solution process will be used to determine an individual grade for the cooperative learning exercise. Your best **4 out of 5** grades will be considered for your final grade assessment.

Miscellaneous Information (Other)

Other information related to Fluid Mechanics is also posted on CourseLink.

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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, sizing, or flow rates in internal and open flow systems.
4. Estimate lift and drag forces on submerged bodies.
5. Model fluid engineering problems, with stated assumptions, and solve them systematically with clearly communicated solutions complete with correct accuracy, precision, significant digits, and dimensional homogeneity.
6. Use appropriate apparatus, sensors and instruments to collect data and analyze fluid flow by conducting laboratory experiments.
7. Write clear, concise and professional laboratory reports for the biweekly fluid mechanics.
8. Demonstrate effective skills in teamwork during group activities (seminars and biweekly laboratories) and respectful interactions with peers, lab technicians, graduate teaching assistants, and instructor during lectures, seminars and laboratories.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome Set Name	Course Learning Outcome
1	Knowledge Base	1, 2, 3, 4
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 3, 4
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 3, 4
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3, 4
2	Problem Analysis	2, 3, 4, 5
2.2	Identify, organize and justify appropriate information, including assumptions	2, 3, 4, 5
2.3	Construct a conceptual framework and select an appropriate solution approach	2, 3, 4, 5
2.4	Execute an engineering solution	2, 3, 4, 5
2.5	Critique and appraise solution approach and results	2, 3, 4, 5
3	Investigation	6
3.3	Analyze and interpret experimental data	6
3.4	Assess validity of conclusions within limitations of data and methodologies	6
5	Use of Engineering Tools	6
5.2	Demonstrate proficiency in the application of selected engineering tools	6

#	Outcome Set Name	Course Learning Outcome
5.3	Recognize limitations of selected engineering tools	6
6	Individual & Teamwork	8
6.2	Understand all members' roles and responsibilities within a team	8
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	8
6.4	Apply strategies to mitigate and/or resolve conflicts	8
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	8
7	Communication Skills	7
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	7
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	7
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	7
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	7
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	7
8	Professionalism	8
8.3	Demonstrate professional behaviour	8

5 Teaching and Learning Activities

Students are responsible for all information presented in the class, 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.

5.1 Lecture

Week 1
Topic(s): Fluids and fluid properties
Reference(s): Chapter 1

Weeks 2-4
Topic(s): Fluid statics and pressure distribution
Reference(s): Chapter 2

Weeks 4-5
Topic(s): Fluid flow concepts: control volumes
Reference(s): Chapter 3

Week 6
Topic(s): Midterm Exam
Reference(s): Chapter 1-3

Weeks 6-7
Topic(s): Fluid flow concepts: differential analysis
Reference(s): Chapter 4

Weeks 7-8
Topic(s): Dimensional analysis
Reference(s): Chapter 5

Weeks 8-9

Topic(s): Internal viscous flow (pipe flow)

Reference(s): Chapter 6

Week 10
Topic(s): External flow and boundary layer theory
Reference(s): Chapter 7

Week 11
Topic(s): Pumps and turbomachinery
Reference(s): Chapter 11

Week 12
Topic(s): Open channel flow
Reference(s): Chapter 10

5.2 Labs

The laboratory is a vital part of the course – material introduced in the lab may be a part of either exam. Labs will be done in groups of 3 students during your scheduled lab time.

You must attend your scheduled lab during the week of September 10 to 14, 2018. At that time you will be introduced to the lab, including lab safety, and you will sign up for your lab groups. There will be sign-up sheets available in the Fluids Lab (THRN 1125) and posted on the wall outside of the Fluids Lab once completed.

Before arriving to the laboratory to perform an experiment, **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 do the intermediate calculations and, in some cases, all of the calculations before

leaving the lab.

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 drop boxes in CourseLink that will be created based on your lab teams. The due date will be one week after the two week block used to conduct each lab topic at 11:59 pm. Due dates will be posted on Courselink.

Each lab report is to include a scanned version of the raw data sheet used to record the data while doing the experiment. This sheet is to be signed and dated by either the lab technician or the GTA before you leave the lab.

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

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 a makeup lab during open lab days.

5.5 Seminar/Tutorials

The labs and tutorials will be conducted in alternating weeks during the same two-hour time blocks (Labs in THRN 1125 and tutorials in THRN 1002). **Everyone must attend your scheduled lab during the week of September 10– 14, 2018 (THRN 1125).** During this lab time, students will be familiarized with the Fluids Lab and the required safety procedures. In addition, the sections will be divided into two groups of students of approximately equal size (designated as “A” and “B” groups). This A and B group designation will indicate which weeks you have a lab and which weeks you have a tutorial as per the schedule included in the course

outline.

5.6 Lab and Tutorial Schedule

	Monday	Tuesday	Friday
Sept. 10-14	**Section 02** Groups A&B – THRN 1125: Intro to the Fluids Lab	**Section 01** Groups A&B – THRN 1125: Intro to the Fluids Lab	**Sections 03** Groups A&B – THRN 1125: Intro to the Fluids Lab
Sept. 17-21	**Section 02** Group A – Lab #1 Group B – Tut #1	**Section 01** Group A – Lab #1 Group B – Tut #1	**Sections 03** Group A – Lab #1 Group B – Tut #1
Sept. 24-28	**Section 02** Group A – Tut #1 Group B – Lab #1	**Section 01** Group A – Tut #1 Group B – Lab #1	**Sections 03** Group A – Tut #1 Group B – Lab #1
Oct. 01-05	**Section 02** Group A – Lab #2 Group B – Tut #2	**Section 01** Group A – Lab #2 Group B – Tut #2	**Sections 03** Group A – Lab #2 Group B – Tut #2
Oct. 08-12	**Section 02** Thanksgiving – No	**Section 01** Fall Study Break – No	**Sections 03** Group A – Tut #2

	Classes	Classes	Group B – Lab #2
Oct. 15-19	**Section 02** Group A – Tut #2 Group B – Lab #2	**Section 01** Group A – Tut #2 Group B – Lab #2	**Sections 03** Group A – Lab #3 Group B – Tut #3
Oct. 22-26	**Section 02** Group A – Lab #3 Group B – Tut #3	**Section 01** Group A – Lab #3 Group B – Tut #3	**Sections 03** Group A – Tut #3 Group B – Lab #3
Oct. 29 – Nov. 02	**Section 02** Group A – Tut #3 Group B – Lab #3	**Section 01** Group A – Tut #3 Group B – Lab #3	**Sections 03** Group A – Lab #4 Group B – Tut #4
Nov. 05 -09	**Section 02** Group A – Lab #4 Group B – Tut #4	**Section 01** Group A – Lab #4 Group B – Tut #4	**Sections 03** Group A – Tut #4 Group B – Lab #4
Nov. 12 -16	**Section 02** Group A – Tut #4	**Section 01** Group A – Tut #4	**Sections 03** Group A – Lab #5

	Group B – Lab #4	Group B – Lab #4	Group B – Tut #5
Nov. 19-23	**Section 02** Group A – Lab #5 Group B – Tut #5	**Section 01** Group A – Lab #5 Group B – Tut #5	**Sections 03** Group A – Tut #5 Group B – Lab #5
Nov. 26 – 30	**Section 02** Group A – Tut #5 Group B – Lab #5	**Section 01** Group A – Tut #5 Group B – Lab #5	**Open lab day for makeup labs**

***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 “Section A” you will always conduct your lab during the first week the experiment is offered, and if you sign up for “Section B” you will always do it during the second week it is offered.

5.7 Other Important Dates

Thursday, September 6, 2018: First day of class

Monday, October 8, 2018: Thanksgiving holiday – no classes

Tuesday, October 9, 2018: Fall Study Break – no classes

Friday, November 2, 2018: drop date – 40th class

Thursday, November 29, 2018: Tuesday schedule in effect

Friday, November 30, 2018: last day of class (Monday schedule in effect)

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6 Assessments

6.1 Marking Schemes & Distributions

Assessment of your final grade will be evaluated against four different assessment schemes as described in the table below with your **final grade assigned being the maximum calculated by the four schemes**. Schemes B and D allows students who performed poorly on the midterm to diminish the weight of the midterm by putting more weight on the final exam. Schemes C and D allows students not to participate in the Tutorial Cooperative Learning Exercises by assigning more weight to the final exam.

If you fail (< 50%) both the midterm and the final, you will receive a failing grade in the course equal to the highest of your midterm or final assessment.

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

Name	Scheme A (%)	Scheme B (%)	Scheme C (%)	Scheme D (%)
Unmarked Assignments	0	0	0	0
Labs	20	20	20	20
Tutorial Cooperative Learning Exercises	10	10	0	0
Midterm Exam	25	10	25	10
Final Exam	45	60	55	70
Total	100	100	100	100

6.2 Assessment Details

Unmarked Problem Sets (0%)
Date: Mon, Sep 10 - Fri, Nov 30, 10 problem sets posted weekly on Courselink

Labs (20%)
Date: Mon, Sep 10 - Fri, Nov 30
Due dates will be one week after the two week block used to conduct the experiments and will

be posted on CourseLink. A grade of zero will be issued to any group member who is not in attendance when the group completes the lab.

You must attend and complete all laboratories. 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 a makeup lab (i.e. during open lab days).

Tutorial Cooperative Learning Exercises (10%)
Date: Mon, Sep 10 - Fri, Nov 30
4 out of 5 exercises will be considered the final grade assessment for this component.

Midterm Exam (25%)
Date: Tue, Oct 16, 8:30 AM - 9:50 AM, In Class
Closed 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: Tue, Dec 11, 7:00 PM - 9:00 PM, TBA
Closed book; covers entire course

6.3 Midterm and Final Exam: Note

The midterm and final exams will be closed book tests. Necessary equations and information will be provided or announced prior to each exam. Calculators are permitted, but they must be non-communicating devices.

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7 Course Statements

7.1 Fluid Mechanics Lab

You must familiarize yourself with the lab equipment by reading the manual and watching the accompanying video prior to your lab, in addition to attending the safety orientation during the first lab session (week 1). There is to be no food or drinks in the Fluids Lab. Pay especial attention to the labs rules for appropriate attire as **no open toed shoes (e.g. sandals) are allowed**.

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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.

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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 regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

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.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate 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 which apply to undergraduate, graduate and diploma programs.
