CHE 211: Fluid Mechanics – COURSE INFORMATION (Fall 2022)

Instructor: Prof. M. Ioannidis, PhD, PEng, FEC
E-mail: mioannid@uwaterloo.ca

Teaching Assistant: Meghana Chepuru
E-mail: mchepuru@uwaterloo.ca

Required Textbook: "Fundamentals of Momentum, Heat and Mass Transfer", Welty et al. (7^{th} edition; earlier editions will also do), Wiley.

Multimedia: "Multimedia Fluid Mechanics Online", Homsy et al., Cambridge University Press [online]
https://lib.uwaterloo.ca/web/research-databases/id/1596

Data Resource: Engineering ToolBox, (2001). [online]
Available at: https://www.engineeringtoolbox.com

Course Description: Fundamentals of fluid flow. Conservation laws for mass, momentum and mechanical energy. Flow of fluids in conduits. Flow past immersed bodies. Flow through beds of solids, fluidization. Transportation and metering of fluids. Dimensional analysis.

Grading:

Home Assignments (best 5 out of 6)	25%
Team Project	25%
Final Exam	40%
Quizzes (2)	10%
Discussions	5%

Course Plan

	Learning Module	Home Assignments	Assessments
Week 1	Module 1: Basic Concepts		
Week 2	Module 2: Understanding Static Fluids	**HA#1**	
Week 3	Module 3: Conservation Principles Revisited	**HA#2**	
Week 4	**Project Checkpoint**		
Week 5	Module 4: Dimensional Analysis	**HA #3**	
Week 6	Module 5: Poiseuille and Couette Flows		**Quiz 1**
Week 7	Module 6: Turbulent Flow in Pipes	**HA #4**	
Week 8	Module 7: Pipe Flow Analysis & Design		
Week 9	Module 8: Flow in Porous Media	**HA #5**	
Week 10	Module 9: External Flows		**Quiz 2**
Week 11	Module 10: Pumps & Flow Metering Devices	**HA#6**	
Week 12	**Project Wrap-Up**		

Learning Modules: Each module is a curated collection of annotated readings, narrated presentations, solved practice problems, Excel worksheets, movies, animations, etc. Each module comes with a single-page "roadmap" articulating the module's key learning objectives and the actions you have to take in order to achieve them.

Assignments: Assignments are of equal value (5% of the final course grade each). Each assignment consists of a solution to a set of problems (this is Part I of the assignment and is worth 50% of the assignment's grade if it is submitted on time and 0% otherwise) and a reflection on the problems and their solution (this is Part II of the assignment and is worth 50% of the assignment's grade if Part I is submitted on time and 30% otherwise). This scheme allows you to earn points for problems that you were not able or did not have time to do at all, but you have to try Part I and submit your best work on time. When grading Part I, emphasis will be placed on how you approach the solution. Specifically, the TA will look for:

- Statement of rationale (why is what you're doing the right thing to do?)
- Symbol definition and unit consistency
- Clear exposition of intermediate steps in calculations and derivations
- Clear statement and justification of any assumptions made to obtain a solution (what you are assuming, why you need to assume it, and why is it OK to assume it)

Of course, obtaining the correct answer is highly desirable, but will not be the only criterion for grading assignments. The TA will grade each question in Part I using the 1-2-3 grading scheme:

- The solution strategy is correct and is implemented correctly or with minor errors (3/3)
- The solution strategy which is implemented is partly correct, or a correct strategy is implemented with significant errors (2/3)
- Effort has been made to solve the problem, but a solution strategy is either absent or seriously flawed (1/3)

The solutions to Part I will be available immediately after Part I is due, and Part II will be due exactly one week later.

Reflection is the conscious examination of past experiences, thoughts and ways of doing things. Its goal is to surface learning about oneself and the situation, and to bring meaning to it in order to inform the present and the future. It allows us to increase/improve our performance and skills, it increases our awareness of our abilities and our evidence of these, helps us evaluate the quality and success of our action plans, and expands our understanding of the content. When grading Part II, we will be expecting you to reflect on your solution approach after having seen the solution provided by the instructor. What was right and what wrong in your solution and why? How serious was the error? Did you have a misunderstanding that is now cleared up? Is the misunderstanding still there? For problems that you were not able (or didn't have time) to solve, can you articulate in your own words the strategy that the posted

solution followed? Does it make sense to you? Your reflection (Part II) must not be more than two (2) pages long and must contain specific references to your solution (Part I) and/or the posted solution.

Quizzes: The quizzes are intended to test your evolving understanding of fundamental concepts and are not calculation heavy. Quiz 1 will test Modules 1 to 3 and Quiz 2 will test Modules 1 to 7.

Team Project: Your task is to design and simulate the pipe network in a two-story house. The house has water outlets in 2 bathrooms (one on each level), laundry room, kitchen and garage. This is an open-ended problem. Students are responsible for specifying design criteria and constraints. To be carried out in groups of 2 or 3 students. Details about project requirements and assessment are available on Learn.

Discussions: Discussions take place on the Learn discussion forum on topics based on content items (curated and organized thematically on Learn) that you read, view etc. I will frame and manage the discussions, providing discussion prompts. For each Module, there will be a few discussion prompts: a question that you are to answer, a statement you are asked to comment on, an activity you are to engage in. You may also use the discussion forum to ask questions about that Module's content and discuss the materials with others in the course. By participating and contributing in these discussions you'll be engaging in and facilitating your own learning. Aim to make a post to every discussion in every module (but don't fret if other commitments make this occasionally impossible). Sometimes it will be appropriate to add just a sentence or two to the discussion, whereas at other times a paragraph or two will be needed. While you will want to strive for accuracy in your posts, participation in the discussions and a willingness to work with others to understand the material are the more important goals. Your grade for this activity will be based on all your contributions to the discussion forum.

Class Meetings: There will be two 2-hour meetings each week (Tuesday 1:30 pm EDT and Thursday 1:30 pm EDT. During the meetings I will present and discuss key concepts, as well as illustrate solution approaches to assignment problems, practice questions, and the project. For efficiency in answering your questions (and since neither you nor I can anticipate each one of them during the meeting), I kindly ask you to **submit questions 24 hrs in advance of each meeting by email to the course TA** (use "*My Question for the Tutorial*" in the email title so she can identify them easily). The TA will collect these questions in an email to me the day before each meeting.

Office Hours: There will be one office hour each Friday at 2:00 pm in E6-3036.

Academic integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check https://uwaterloo.ca/academic-integrity/ for more information.]

Grievance: A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for their actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to Policy 72, Student Appeals.

Note for students with disabilities: AccessAbility Services, located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.