

## **MIE1201F – ADVANCED FLUID MECHANICS (Winter 2021)**

**DESCRIPTION:** This fundamental course develops the conservation laws governing the motion of a continuum and applies the results to the case of Newtonian fluids, which leads to the Navier-Stokes equations. From these general equations, some theorems are derived from specific circumstances such as incompressible fluids or inviscid fluids. Basic solutions to, and properties of, the governing equations are explored for the case of viscous, but incompressible, fluids. Topics included involve exact solutions, low-Reynolds-number flows, laminar boundary layers, flow kinematics, and 2D potential flows.

**PREREQUISITES:** Any introductory fluid mechanics course, differential and integral calculus, vector calculus, and previous exposure to partial differential equations.

**INSTRUCTION:**

Instructor: Edmond Young  
Email: [eyoung@mie.utoronto.ca](mailto:eyoung@mie.utoronto.ca)  
Office Hours: By appointment and via Zoom

**TEXT:** *Fundamental Mechanics of Fluids*, 4<sup>rd</sup> ed., I.G. Currie, CRC Press (2012).

Available online at VitalSource, link below:

<https://www.vitalsource.com/en-ca/products/fundamental-mechanics-of-fluids-i-g-currie-v9781466517325?term=9781466517325>

**ONLINE:** Please check Quercus for MIE1201 news and updates. Homework assignments, handouts, and other course content will be posted at the beginning of each week. Due dates will be stated on the assignments.

**LECTURES:** Wednesdays 9:10 am to 12 pm, **on BB Collaborate**, with breaks and interactive breakout sessions. Go online each Wednesday at 9 am to Quercus - > BB Collaborate to access the online classroom.

**GRADING:**

Homework Assignments (5)	40%
Midterm	10%
Project	50%

**MIDTERM:** Wednesday, February 24, during the online lecture (75 min)

**DROP/ADD DEADLINES:**

Add course deadline: Monday, January 18, 2021

Drop course deadline: Monday, March 1, 2021 (without academic penalty)

Course add/drop form is available at:

<https://www.sgs.utoronto.ca/academic-progress/student-forms-letters/>

Other Important Sessional Dates, for School of Graduate Studies:

<https://sgs.calendar.utoronto.ca/sessional-dates>

## TOPICS (BY WEEK)

Week	Date (2021)	Topic	Currie Textbook Sections
1	Jan 13	<i>Course Introduction:</i> Expectations, Prerequisites, and Q&A	(See excerpts from other references)
2	Jan 20	<i>Chapter 1:</i> Governing Equations and Basic Conservation Laws	1.1 to 1.9
3	Jan 27	<i>Chapter 1, continued:</i> Newton's Law of Viscosity, Boundary Conditions and Other Considerations	1.10 to 1.16 (plus additional notes)
4	Feb 3	<i>Chapter 7:</i> Introduction to Viscous Flows	7.1 to 7.3, 7.9
5	Feb 10	<i>Chapters 2 and 3:</i> Flow Kinematics and Special Forms of Governing Equations	All Chapter 2 and 3 (omit 3.3)
6	Feb 17	Reading Week: No live session; study for midterm	
7	Feb 24	<i>Chapter 4:</i> *Midterm live on BB Collaborate*	-
8	Mar 3	<i>Chapter 4:</i> 2D Potential Flows	4.1 – 4.5
9	Mar 10	<i>Chapter 7:</i> More on Viscous Flows	7.4 to 7.7
10	Mar 17	<i>Chapter 9:</i> Boundary Layers	9.1 to 9.4
11	Mar 24	<i>Chapter 9:</i> Boundary Layers	9.5 to 9.12 (omit 9.7 and 9.10)
12	Mar 31	Emerging Topics and Applications in Fluid Mechanics	-
13	Apr 7	Project Presentations and Wrap-Up	-