

Incompressible Fluid Mechanics, MECH3315, Fall, 2016

Instructor: Dr. William Anderson

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Course description: In this course we will study the behavior of fluids at an introductory level. We will begin the course by familiarizing ourselves with the core concepts of fluid mechanics, including the concept of continuum, velocity field and strain rate, viscosity and so forth. We will also briefly review the mathematical skills necessary for this course before we dive into real problems in fluid mechanics. We will study how application of Newton's law, $\mathbf{F} = m\mathbf{a}$, to solve problems in fluid mechanics. At first we will cover simple cases such as fluid statics or the motion of an inviscid flow. We will then consider dynamics of fluids with constant viscosity, also known as Newtonian Fluids. We will solve internal flows (e.g., pipe flows), external flows (drag and lift on a bluff body and streamlined bodies), and flows with free surfaces (the flow of a river) in differential and integral form. Following this, we will study dimensional analysis, which helps define the hierarchical importance of different factors that may influence a flow.

Class time, location: 04:00 pm - 05:15 pm: Monday, Wednesday, GR 3.420

Teaching Assistant: Chao Wang (crj150230@utdallas.edu)

Office hours, location: Thursday, 4:30 pm - 5:30 pm, Location "TBD"

Textbook # 1: Munson et al.: Fundamentals of Fluid Mech., *J. Wiley & Sons*, 7th Ed.

Class website: eLearning

Prerequisites: ENGR 3300

Corequisites: ENGR 2300, MECH 3310

Homework: Homework sets will be due one week after assignment, unless otherwise specified. Homework assignments will be posted to **eLearning**. Homework will be graded for neatness. You must clearly identify what is given in the problem, what you are required to find, and show your units clearly through the entire problem. Work that is not legible or does not include units will not receive credit. Homework will be requested at the beginning of class, and late submissions will be penalized with a 10% grade reduction for each day late.

Grading Policy: Performance will be measured using homework sets, mid-term test, and a comprehensive final exam. The weight of each task is listed below. You are expected to attend all tests and quizzes; make-up tests and quizzes will not be offered without justification (i.e., scheduling conflict with another UT Dallas academic commitment). Grade disputes are welcome but must be submitted via email within one week after the assessment item has been returned. Grade redistribution (i.e. the bell curve) will not be used to determine final grades. Laptops, digital books, and smart phones not allowed on tests or final exams (laptops not allowed in class). Visual recording not permitted in class.

Quizzes: 20%*

Homework: 20%

Group Project: 20%

Midterm: 20%*

Final: 20%* (Date: TBA)

*A non-programmable calculator is the only electronic device allowed during assessment.

Grading scale A+: 97-100; A: 93-97; A-: 90-93
 B+: 87-90 ; B: 83-87; B-: 80-83
 C+: 77-80 ; C: 73-77; C-: 70-73
 D+: 67-70 ; D: 63-67; D-: 60-63
 F: Below 60

Academic Integrity and Honor Code

"UT Dallas students, staff, and faculty shall act in academic matters with the utmost honesty and integrity."

Cheating is wrong. Cheating suppresses scholarly pursuits, creates mistrust, and hinders intellectual growth. Students in this class are required to conduct themselves in accordance with the Rules and Regulations of the Regents of the University of Texas System.

For a full list of university policies, please visit:

1. <http://go.utdallas.edu/syllabus-policies>
2. <http://www.utdallas.edu/BusinessAffairs/TravelRiskActivities.htm>
3. <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html>
4. <http://www.utsystem.edu/ogc/intellectualproperty/copypol2.htm>
5. <http://www.utdallas.edu/disability/documentation/index.html>

INFORMATION IN THIS DOCUMENT IS SUBJECT TO CHANGE AT THE DISCRETION OF THE INSTRUCTOR.

Additional Course Considerations: You are expected to attend each class, and you should be prepared with the necessary materials (textbook, printouts from website, calculator, pencil, and paper). You are expected to check your utdallas.edu e-mail address daily. Electronic notices may be used to disseminate information for all members of the class. Throughout the semester, the instructor may have intermittent, unavoidable professional travel commitments. On these days, the instructor will provide advance notice and class will be administered by a TA.

Email communication: Format your emails professionally before sending: (i) address the recipient appropriately (e.g., “Prof. Anderson”, “Dr. Anderson”, or “Dear Dr. Anderson”), (ii) use correct grammar, capitalization, and sentence structure, and (iii) add sufficient closing (e.g., “Best regards”, or “Best wishes”).

Course Learning Outcomes: The official course-learning outcomes for this course are:

1. Derive the governing equations of fluid mechanics, and use the equations to reason about fluid flows.
2. Explain the concept of control volume and apply it to solve fluid mechanics problems in inertial frames.
3. Identify the key non-dimensional parameters for given systems and use such numbers to characterize the systems.
4. Explain the role of fluids in real life situations.

Outline (subject to change):

Week	Dates	Description	Book Sections
1	8-22, 8-24	Introduction, properties and attributes of fluids	1.1-1.9
2	8-29, 8-31	Hydrostatics, Buoyancy	2.1-2.11
3	9-5, 9-7	Vector calculus, Newton’s second law	3.1-3.4
4	9-12, 9-14	Bernoulli equation	3.5-3.7
5	9-19, 9-21	Reynolds transport theorem, Integral transport analysis	4.3, 4.4, 5.1
6	9-26, 9-28	Integral transport analysis	5.2
7	10-3, 10-5	Differential transport analysis	6.1-6.4
8	10-10, 10-12	Viscous flows	6.8-6.10
9	10-17, 10-19	Dimensional analysis	7.1-7.7
10	10-24, 10-26	Pipe flows	N/A
11	10-31, 11-2	Immersed bodies: boundary layers	8.1-8.6
12	11-7, 11-9	Drag, lift	9.1, 9.2
13	11-14, 11-16	Open-Channel flows	9.3, 9.4
14	11-21, 11-23	“Fall Break”, No classes	10.1-10.6
15	11-28, 11-30	Open-Channel flows	10.1-10.6
16	12-5, 12-7	Review	N/A
		Final Exam	