

ME 3340R: Fluid Mechanics

Spring 2022 (DRAFT)

Georgia Institute of Technology

Catalog descriptions: The fundamentals of fluid mechanics. Topics include fluid statics, control-volume analysis, the Navier-Stokes equations, similitude, inviscid, viscous, and turbulent flows, pipe flow, boundary layers, and external flows.

Course outcomes: See ABET syllabus online <http://www.me.gatech.edu/files/ug/me3340.pdf>

Prerequisites: ME 2202 Dynamics of Rigid Bodies, MATH 2401 Calculus III (C or better), and MATH 2403 Differential Equations (C or better)

Corequisites: ME 3322 Thermodynamics

Some explanations on the pre-&co-requisites: Math: Multivariable calculus, and ordinary and partial differential equations; Mechanics: Statics (free-body diagrams, forces and movements, equilibrium, stress and strain), dynamics of rigid bodies (center of mass motion, kinematics and kinetics, energy and momentum); Thermodynamics: mass and energy conservation laws for closed and open systems, and the second law of thermodynamics.

Textbook: “*Munson, Young, and Okiishi’s Fundamentals of Fluid Mechanics*,” Eighth Edition (2018), by P. M. Gerhart, A. L. Gerhart, and J. I. Hochstein, Wiley.

Instructor: Dr. Zhuomin Zhang, Professor of Mechanical Engineering
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Office hours: TBD. You are encouraged to email me for any questions.

Website: Handouts, homework, and solutions will be posted on GT Canvas.
This semester we will use GT Canvas and emails; but NOT use Wiley-Plus.

Class Time and Location: TBD.

Attendance is essential for successful performance. Class roll will be called and anyone who misses more than 7 classes will receive a penalty (see below).

Homework: There will be ten (10) homework assignments. Discussions among students are allowed; but you should complete the work independently. You are asked to handwrite or use a computer tool to put down all the steps and derivations clearly. Please scan or take photo of your work and convert to a single pdf file. If you work on a computer, simply convert it to a single pdf file. Upload your solution to Canvas. Solutions will be posted on the web after the due date. Please read the relevant sections of the textbook before each lecture and read the book examples carefully before doing homework. You are supposed to do all assigned problems or will receive a penalty for each unsolved problem. You may drop one homework assignment. If you turn in all 10 assignments, only the highest 9 sets will be counted. Only under special circumstances, late homework will be approved ahead of the due date.

Examination: There will be three (3) in-class quizzes (designed for 60 min each, but will allow 10 min extra time) and a final exam. All quizzes and final exam will be closed book, no computer or cell phones allowed. More details will be given later on the policy of cheat sheets. You will need a calculator for all quizzes and the final exam. All students must take the final exam as scheduled (the exact date will be announced well before the final week).

Attendance: All attendance will be recorded, including online attendance. Unless specially approved, you are allowed to miss four lectures (no reasons needed) and three lectures (with a reasonable excuse). You will loss one point for each additional absence up to five points.

Grading Method and Percentage:

- Homework: 10% (Based on 9 highest scores out of 10 assignments)
- Attendance: 5% (See above, 1 point = 1%)
- Quizzes: 55% (Each quiz will be graded on 100 base)
(0.23*highest + 0.18*middle + 0.14*lowest score; this gives a curve)
- Final exam: 30% (0.30*final score on 100 base)

Note: Final Exam is required for all students.

Letter grade guidelines are given in the following table. The actual scale will be determined after the final exam and may vary slightly according to the class overall performance.

Score Range	90-100	80-89	70-79	60-69	Below 60
Letter Grade	A	B	C	D	F

Academic Honesty: Academic integrity and honesty are essential to achieve high-quality education and to keep the prestige of the institution. We will not tolerate any academic misconduct, such as cheating or other violations of the Georgia Tech Honor Code: <https://osi.gatech.edu/content/honor-code>. Cheating includes but is not limited to copying directly from unauthorized source, such as friends, classmates or a solutions manual; allowing another person to copy your work; signing another person’s name or having another person sign your name on an attendance sheet; taking a test or quiz in someone else’s name, or having someone else take a test or quiz in your name; or asking for regrade of a paper that has been altered from its original form.

Accommodation: Please inform the instructor as soon as possible if any accommodation, delay of due date, and schedule change are needed. The instructor will consider it on a case-by-case basis in accordance with the GT policy.

A list of topics is posted on the next page based on the week # and will be updated with the exact date/day. Some topics may also be modified depending on the recess period.

List of Topics

Week	Day	Topics	Chap	Quiz	Due
1		Introduction, syllabus, fluids and flow	1		
		Properties, quantities & units, dimensions	1		
2		Shear stress, viscosity, surface tension	1		
		Fluid statics, manometry, plane surfaces	2		HW#1
3		Curved surfaces, buoyancy	2		
		Buoyance examples; force calculation	2		HW#2
4		Streamlines, pressures (static, dynamic, stagnation)	3		
		Bernoulli's equation applications	3		HW#3
5		Examples and review	1,2,3		
		Fluid kinematics, introduction	4,5		HW#4
6		<i>60 min Quiz + 10 min grace period</i>		Qz#1	
		Recess, it depends			
7		Conservation equations, mass balance	5		
		Momentum balance and energy balance	5		HW#5
8		Control volume analysis, examples	5		
		More fluid kinetics, differential equations	6		HW#6
9		Examples and review	4,5		
		Inviscid Flow			
10		<i>60 min Quiz + 10 min grace period</i>		Qz#2	
		Stream function, and velocity potential	6		
11		Navier-Stokes equations	6		
		Examples and applications	6		HW#7
12		Pipe flow, laminar and turbulence	6,8		
		Pipe flow and boundary layer	8		HW#8
13		Dimensional analysis & similarity - 1	7		
		Examples and review	6,8		HW#9
14		<i>60 min Quiz + 10 min grace period</i>		Qz#3	
		Dimensional analysis & similarity - 2	7		
15		Boundary layer, drag and lift forces	9		
		Boundary layer, drag and lift forces	9		
		Final review and discussion			HW#10

Final Exam: In accordance with the schedule (to be announced).