

ME 3340R: Fluid Mechanics

Fall 2021

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
zhuomin.zhang@me.gatech.edu

Office hours: 10:00 am – 12:00 noon Tuesday. In addition, you are encouraged to email me for questions or separate appointment. Tuesday afternoons are good to make appointment.

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

Class Time and Location: 4:30–5:45 pm Monday & Wednesday.

Homework: There will be ten (10) homework assignments. Discussions among students are allowed; but you should complete the work independently. 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. Under special circumstances, late homework may be approved. However, you must submit your request with reasons a couple of days before the due date, or as soon as possible. Upload a single pdf file online via Canvas. Scan or photo copy your solutions and combine them to a single pdf file (in the proper page order). You may use a computer writing tool, and then convert your solutions to a single pdf file.

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 Policy: All attendance will be recorded, including online attendance. Unless specially approved, you are allowed to miss four (4) lectures (no reasons needed) and three (3) lectures (with a reasonable excuse). You will loss one (1) point for each additional absence up to five (5) 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.

Tentative Schedule: A tentative schedule is posted on the next page. Please note key due dates. Any changes of the due dates will be announced in advance.

Tentative Schedule

Date	Day	Topics	Chap	Quiz	Due
8/25	Wed	Introduction, syllabus, fluids and flow	1		
8/27	Fri	Properties, quantities & units, dimensions	1		
8/30	Mon	Shear stress, viscosity, surface tension	1	Tues*	HW#1*
9/1	Wed	Fluid statics, manometry, plane surfaces	2		
9/6	Mon	Curved surfaces, buoyancy	2		HW#2
9/8	Wed	Buoyance examples; force calculation	2		
9/13	Mon	Streamlines, pressures (static, dynamic, stagnation)	3		HW#3
9/15	Wed	Bernoulli's equation applications	3		
9/20	Mon	Fluid kinematics, introduction	4		HW#4
9/22	Wed	Examples and review	1,2,3		
9/27	Mon	<i>60 min Quiz + 10 min grace period</i>		Qz#1	
9/29	Wed	Conservation equations, mass balance	5		
10/4	Mon	Momentum balance and energy balance	5		HW#5
10/6	Wed	Control volume analysis, examples	5		
10/11	Mon	More fluid kinetics, differential equations	6		HW#6
10/13	Wed	Inviscid flow: stream function,	6		
10/18	Mon	Inviscid flow: velocity potential, applications	6		HW#7
10/20	Wed	Examples and review	4,5,6a		
10/25	Mon	<i>60 min Quiz + 10 min grace period</i>		Qz#2	
10/27	Wed	Navier-Stokes equations	6		
		11/1-11/4 Recess			
11/8	Mon	Examples and applications	6		HW#8
11/10	Wed	Pipe flow, laminar and turbulence	6,8		
11/15	Mon	Pipe flow and boundary layer	8		HW#9
11/17	Wed	Examples and review (6,8), Introduction to Ch. 7	6,8,7		
11/22	Mon	<i>60 min Quiz + 10 min grace period</i>		Qz#3	
11/24	Wed	Dimensional analysis & similarity	7		
11/29	Mon	Boundary layer, drag and lift forces	9		
12/1	Wed	Boundary layer, drag and lift forces	9		
12/6	Mon	Final review and discussion			HW#10

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

***All homework assignments are due Tuesday by 5:00 PM Paris time (to be submitted online).**