ME 3340 A Fluid Mechanics

Instructor: Archana Sridhar

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Course description

This is the introductory course to fluid mechanics for students of mechanical engineering. Students will learn the basic principles and simplifying assumptions of fluid mechanics, how fluid mechanics problems are mathematically modeled and solved, and common fluid-flow phenomena found in mechanical engineering systems.

Topics covered

1. Introduction: basic definitions of fluid mechanics, fluid characteristics, viscosity, compressibility.
2. Fluid statics: pressure distribution in a fluid, manometry, force on planar and curved surfaces, buoyancy, rigid body motion.
3. Fluid kinematics: fluid velocity and acceleration fields, Eulerian and Lagrangian descriptions, velocity field, streamlines, pathlines, streaklines, acceleration in a fluid.
4. Control volume analysis: Reynolds transport theorem, conservation of mass, momentum balance, angular momentum balance, conservation of energy, moving control volume, accelerating control volume, Bernoulli's equation.
5. Differential analysis: exact solutions of the Navier-Stokes equations, stream function.
6. Similitude: dimensional analysis, Buckingham PI theorem (dimensionless groups), modeling.
7. Pipe flow: laminar and turbulent flow (including transition), fully developed flow, losses, Moody diagrams, flow meters.

Required Course materials

Fundamentals of Fluid Mechanics, 9th Edition by B. R. Munson, D. F. Young & T. H. Okiishi

Participation

ME 3340 A will be taught in person. You are expected to attend and participate in the lectures.

Grading

- Quizzes (1.5 hours): 25%, 25%, 25%
- Homework: 15%
- Final Presentation: 10%
- Extra Credit : Participation in the CIOS survey.

Homeworks

Homework problems and their solutions will be posted on Canvas weekly. You are strongly encouraged to work out the assigned problems on your own and consult the solutions to check your work or for guidance on how to proceed with the solution of a specific problem after making a reasonable effort on your own. You are allowed to work in groups on homework assignments, but you must turn in work individually, and any collaboration must be declared. Late submissions will not be permitted except in an emergency with proper documentation. Use of Generative AI is discouraged because out-of-class work is guided through the solutions.

Quizzes

There will be three quizzes during the course, and will contribute towards 75% of your grade. Each quiz will be given 90 minutes during class time. The quizzes will be closed book and closed notes, but you will be allowed to use one standard index card (3 x 5 in.) for any handwritten information you deem useful. Make-up quizzes will not be permitted, except when warranted by circumstances (please see GT policy concerning absences for medical reasons http://www.catalog.gatech.edu/rules/4/), and should be scheduled at least two weeks before the quiz date.

Final Presentation

For the last 10% of the grade, the students will be divided into teams of four and will be required to give a 5-minute presentation per team on their topic of interest in fluid mechanics. The presentations will be held in the last week of classes (time permitting) or recordings will be expected to be posted online. Further details will given in the first week of classes.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct. Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.