ME 303-Fluid Mechanics

Fall 2009

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Course web resources

This course makes heavy use of the Blackboard online learning environment. All course materials, announcements and course information are distributed via Blackboard.

Prerequisite

ME 301 Engineering Mechanics.

Course schedule

A1 (Dr Barba) Monday & Wednesday, 10am–12pm in PHO-203
B1 (Dr Porter) Tuesday & Thursday, 12–2pm in GCB-204

Discussion session:
A2 – Mon 2:00–3:00 pm in CAS 229
A3 – Tue 9:00–10:00 am in PHO 201
A4 – Tue 4:00–5:00 pm in GCB 208

Textbook

"Fundamentals of Fluid Mechanics" by Munson, Young, Okiishi, Huebsch (Wiley)

Course aims

This course will give students a sense of the *importance* of fluid mechanics in the engineering world, and will emphasize their *intuition* and *understanding* of physical principles.

Learning objectives

i. Develop the ability to model and analyze one and two dimensional (static and dynamic) fluid mechanical systems using applicable natural laws including those for ideal gases, and conservation of mass, momentum and energy, utilizing the control volume approach.

ii. Gain increased understanding of the experimental physical and intuitive aspects of fluid mechanics, and the ability to judge when experiments, rather than (or in conjunction with) mathematical analysis are most likely to produce the desired solutions through methods such as dimensional analysis.

iii. Gain experience in performing fluids laboratory experiments as part of a team and interpreting results.

iv. Gain experience in writing individual technical reports on laboratory projects.

v. Gain experience in generating simple computer solutions to fluid mechanics problems.

vi. Gain insight into the application of fluid mechanics to practical problems in a variety of disciplines emphasizing aerospace and mechanical engineering, but also including bio- and civil engineering.

Assessment policies

Midterm exam = 30%
Final exam = 40%
Homework = 15%
Labs = 15%

Exam schedule

Exam schedule will be announced in Blackboard in due course.

Homework policy

There will be 10 homework sets in the course. The final homework grade will be obtained by averaging the *best* 8 out of 10 homework grades. In other words, students have two "get out of homework free" (GOOHF) cards ... but extensions on homework deadlines will never, ever be granted.

Discussion of homework with classmates is allowed and encouraged. However, students must prepare their own homework paper to be graded. Copying homework problems is a violation of the Student Code of Conduct. Using solutions for homework problems from other years or from any published solution manual is also a violation.

Schedule of lab sessions

Dates for lab sessions will be announced in Blackboard.

Lecture by lecture topics

This plan is subject to changes, but approximately, we will cover the following subjects by lecture:

1. Fundamental definitions
2. Compressibility of fluids
3. Fluid statics
4. Fluid statics (cont.)
5. Bernoulli equation
6. Bernoulli equation (cont.), Fluid kinematics
7. Fluid kinematics
8. Conservation of mass
9. Conservation of momentum
10. Fluids and thermodynamics
11. Differential analysis of fluids
12. Navier-Stokes equations
13. Navier-Stokes equations (cont.), viscous flow
14. Viscous flow
15. Dimensional analysis
16. Buckingham Pi therem
17. Dimensionless groups
18. Experiments and modeling
19. Similitude
20. Laminar pipe flow
21. Turbulent pipe flow
22. Pipe systems
23. Flow over bodies
24. Boundary layers
25. Drag and lift