

Plan

AE 225 – Incompressible Fluid Mechanics

Aniruddha Sinha

Department of Aerospace Engineering
IIT Bombay

Contact

- Email: as@aero.iitb.ac.in
- Office hours: By appointment made by email at least 2 hours prior

Topics

1. Introduction to fluid mechanics
2. Fluid properties and fluid forces
3. Classification of fluid flows
4. Fluid statics
5. Kinematics of fluid flows: Lagrangian & Eulerian descriptions
6. Equation of motion in differential form
7. Streamline, pathline and streakline; dilation strain rate; circulation and vorticity; Bernoulli's equation
8. Examples of conservation of mass, momentum and energy in fixed, deforming and moving control volumes
9. Navier-Stokes equation

Topics (contd.)

10. Similitude, dimensional analysis and modeling; important non-dimensional groups in fluid mechanics
11. Potential flow, Stream function, Velocity potential, Source, Sink, Doublet, Vortex
12. Mean flow equation: Reynolds averaging & Reynolds stresses
13. External flows: boundary layer theory, wake and drag
14. Internal flows: viscous flows with exact solutions, pipe flow
15. Introduction to turbulence

References

- White, F. M., Fluid Mechanics (SI Units), 7th ed., McGraw Hill, 2011
- Panton, R. L., Incompressible Flow, 3rd ed., Wiley India Edition, 2006
- Cengel, Y. A. & Cimbala, J. M., Fluid Mechanics (Fundamentals and Applications), 3rd ed., McGraw Hill, 2014

Evaluation

Test	%
Quiz #1	10
Group homework assignment	5
Mid-semester exam	35
Quiz #2	10
Group programming assignment	5
End-semester exam	35

Attendance policy

Attendance is compulsory. IITB attendance policy for the students will be strictly followed for this class. Students whose attendance is below 80% of the total no. of classes will be given a **DX** letter grade.

Grading policy

Your score will be first normalized with the highest score

Letter grades assigned based on your normalized score per range:

AA: 100 – 90, AB: 90 – 80, BB: 80 – 70, BC: 70 – 60,
CC: 60 – 50, CD: 50 – 40, DD: 40 – 35, FR: Below 35

Note:

- The above system is based on the assumption that the actual score of at least one student is greater than or equal to 85
- If none of the students in the class score marks greater than or equal to 85 then no one will be given an AA grade.
- In such a circumstance, the scores of all the students will be normalized according to the formula: $\text{score} = (\text{your_actual_score}) \times 90/85$.
- Letter grades then will be assigned based on the split given above.

AE 216 – Concurrent course

- 8-credit course
- Also covers topics in compressible fluid mechanics (self-study)
- 4 extra homework assignments for 5 marks each (also covering compressible fluid mechanics)
- Remaining assessment same as for AE 225, but scaled to 80%

Test	%
Quiz #1	8
Homework assignment #1	5
Homework assignment #2	5
Group homework assignment	4
Mid-semester exam	28
Quiz #2	8
Homework assignment #3	5
Homework assignment #4	5
Group programming assignment	4
End-semester exam	28

Attendance policy very much in effect!