ME 611 Dynamics of Incompressible Fluids

Instructor: Dr. P. Singh
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Prerequisite: undergraduate fluid mechanics.

Text Books:
Incompressible Flow (1996)
Ronald L. Panton, John Wiley & Sons
ISBN**:** 0471593583

Fluid Mechanics (1995)
L.D. Landau, E.M. Lifschitz, E.M. Lifshitz, J.B. Sykes, W.H. Reid
Butterworth-Heinemann
ISBN**:** 0750627670

Catalog Course Description:
An introduction to the hydrodynamics of ideal fluids; two-dimensional potential flow and stream functions; conformal mapping; and differential equations of viscous flow. Boundary layer theory and dimensional analysis are introduced.

References:
1. An Introduction to Fluid dynamics (1976)
G.K Batchelor, Cambridge University Press

2. Hydrodynamics, 6^{th} ed. (1945)
H. Lamb, Dover

3. Fluid Mechanics (1959)
L.D. Landau and E.M. Lifshitz, Oxford: Pergamon Press

4. Theoretical Hydrodynamics (1960)
L.M. Milne-Thomson, Macmillan

5. Vector, Tensor and basic equation of fluid mechanics (1962)
R. Aris, Dover

Grading: Homework (about 10) 35%
Midterm 30%
Final 35%

Course Outline (ME 611)

1. Introduction
1.1 Review of vector and tensor analysis
1.2 Integral theorems

2. Basic Laws
2.1 Stress, deformation
2.2 Control volume approach
2.3 Conservation of mass
2.4 Conservation of momentum
2.5 Conservation of energy
2.6 Navier-Stokes equations
2.7 Dimensional Analysis

3. Incompressible viscous flows
2.1 Pressure driven flows
2.2 Couette Flow
2.3 Exact Solutions

4. Inviscid Flows
4.1 Streamfunction and velocity potential
4.2 Potential flows
4.3 Source and sink flows
4.4 Vortex and doublet flows

5. Advanced Topics: I will cover 1-2 advanced topics from this list after discussing your research interests
5.1 Stability
5.2 Numerical methods
5.3 Stokes flow past a sphere and a bubble
5.4 Thin films
5.5 Bubbles

The NJIT Honor Code and Professional Conduct will be strictly enforced.

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