Fall 2019

ME 611-101: Dynamics of Incompressible Fluids

P. Singh

ME 611 (FALL 2019)
Dynamics of Incompressible Fluids

Instructor: Dr. P. Singh
Office Hours: F 4-5 pm, or by appointment
Office: 316MEC
Phone: 973-596-3326
Email: singhp@njit.edu

Prerequisite: undergraduate fluid mechanics.

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.

Text Books:
Incompressible Flow, fourth edition
Ronald L. Panton, John Wiley & Sons
ISBN**:** 978-1-118-01343-4

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

2. Hydrodynamics, 6th Edn. (1945)
H. Lamb, Dover

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

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

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

Grading: Homework (about 10) 30%
Two Midterms (20+20) 40%
Final 30%

- There will be **no** makeups for missed midterm exams. Unexcused exams will earn 0 points. The grade for an excused midterm exam will be based on the final exam grade.

Homework problems will be assigned every week. These are intended to help broaden and solidify your understanding of the subject matter, and to give you practice in putting your understanding of the material into words. From each set of homework problems collected, one problem will be chosen at random and graded.

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Course Outline

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 finding out more about your research interests

5.1 Floating particles
5.2 Numerical methods
5.3 Stokes flow past a sphere and a bubble
5.4 Thin films and Bubbles

Statement on academic integrity:

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"