

Fluid Mechanics - Course Syllabus

Course Number: ME 200B

Course Title: Fluid Mechanics

Academic Semester:	Spring	Academic Year:	2015/ 2016
Semester Start Date:	Jan 24, 2016	Semester End Date:	May 19, 2016

Class Schedule: Mond/Thursday 2.30/4pm

Classroom Number: R3137

Instructor(s) Name(s): Fabrizio Bisetti
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Office Location: Building 5, Office 4222 (Level 4)

Office Hours:

Teaching Assistant name:
Email:

COURSE DESCRIPTION FROM PROGRAM GUIDE

Fundamentals of fluid mechanics. Microscopic and macroscopic properties of liquids and gases; the continuum hypothesis; review of thermodynamics; general equations of motion; kinematics; stresses; constitutive relations; vorticity, circulation; Bernoulli's equation; potential flow; thin-airfoil theory; surface gravity waves; buoyancy- driven flows; rotating flows; viscous creeping flow; viscous boundary layers; introduction to stability and turbulence; quasi onedimensional compressible flow; shock waves; unsteady compressible flow; acoustics.

COMPREHENSIVE COURSE DESCRIPTION

Prerequisites: Undergraduate fluid mechanics, AMCS 201 and AMCS 202 or equivalent (may be taken concurrently). Fundamentals of fluid mechanics. Microscopic and macroscopic properties of liquids and

gases; the continuum hypothesis; review of thermodynamics; general equations of motion; kinematics; stresses; constitutive relations; vorticity, circulation; Bernoulli's equation; potential flow; thin-airfoil theory; surface gravity waves; buoyancy-driven flows; rotating flows; viscous creeping flow; viscous boundary layers; introduction to stability and turbulence; quasi onedimensional compressible flow; shock waves; unsteady compressible flow; acoustics.

Course outline (tentative)

Week Topic Reading

1 Equations and limit for $Re \rightarrow 0$, slowly-varying channels, lubrication theory,

Notes, B/p216,217,219

2 two-dimensional flow in a corner, flow past a sphere, Oseen's solution.

Notes, B/224,230,241

3 Two-dimensional boundary layer equations, Blasius similarity solution,

Notes, B/p308

4 Displacement & momentum thickness, flow on a wedge, boundary layer separation,

Notes, B/p311,316,320,325

5 Jets, free shear layers and wakes. Notes, B/p343

6 Preliminaries on stability, linear stability example, proof of Poincaré inequality,

Notes

7 Kelvin-Helmholtz, Rayleigh-Taylor, shear flow instabilities, introduction to turbulence, midterm,

Notes, P/XX

8 Statistics & Reynolds stresses, velocity correlations, energy spectra. Notes, P/XX

9 Introduction, equations for steady one-dimensional compressible flow, isentropic flow
OC/XX

10 Stagnation conditions, introduction to shock waves, normal shock waves and Mach number relations, OC/XX

11 Prandtl-Meyer flows, expansion waves, wave reflection, interaction with the boundary layer, OC/XX

12 variable area flow, nozzles, introduction to low density flows. OC/XX

13 Linearized equations, base characteristics, introduction to non-linear acoustics, spherical acoustics.

Notes

GOALS AND OBJECTIVES

TBD

REQUIRED KNOWLEDGE

TBD

REFERENCE TEXTS

G.K. Batchelor. An introduction to fluid dynamics. Cambridge Univ Pr, 2000

P.H. Oosthuizen and W.E. Carscallen. Compressible fluid flow. McGraw-Hill, 1997

S.B. Pope. Turbulent flows. Cambridge Univ Pr, 2000

METHOD OF EVALUATION

Graded content
Pop quizzes : 10% Homeworks (tentatively, one every two weeks): 20% Midterm and final exams: 30% and 40%, respectively <i>Pop quizzes:</i> Those will be administered once in a while at the beginning of the class. Students will have 15 minutes to answer in written form to one or two questions pertaining to the material explained in class during the previous weeks.

COURSE REQUIREMENTS

Assignments

TBD

Course Policies

There is absolutely no tolerance for academic misconduct. All assigned material is to be prepared individually.

Late assignments will not be accepted, unless under exceptional circumstances at the instructor's full discretion.

Additional Information

NOTE

The instructor reserves the right to make changes to this syllabus as necessary.