Syllabus

MAE 5130-001: Advanced Fluid Dynamics

University of Colorado at Colorado Springs
Mechanical and Aerospace Engineering
Spring 2006

Meets: R 7:15-9:50 p.m., UH 133

Instructor: Dr. Jason Roney
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Textbook: White, F.M., Viscous Fluid Flow, 3rd edition, McGraw -Hill, Inc., 2006.

Grading: Homework/Projects*: 30%
Midterm: 30%
Final (Comprehensive): 40%

Important Dates:
Midterm: Tentatively Thursday, March 23rd, 2006 (2 hours)
Final: Thursday, May 11th, 2006 7:15-9:50 p.m.
First Day of Class: Thursday, January 19th, 2006
Last Day of Class: Thursday, May 4th, 2006
No Class: March 30th, 2006

*Homework and Projects will be due at the beginning of class on the due date and must be in the format in the hand-out. Late policy: 50% off, one day late, and will not be accepted 2 days late.

Course Outline:

Advanced Fluid Dynamics

This course will introduce the student to fluid mechanics at a graduate level to develop an understanding necessary to do research in areas of fluid mechanics, to understand current literature on the subject, and to confidently apply the principles in advanced applications such as Computational Fluid Dynamics (CFD). The course will provide an overview of underlying fundamental advanced fluid dynamics principles in viscous flow including turbulence and provide an introduction to compressible flow.

Prerequisites: MAE 3130 Fluid Mechanics.

Outline of Topics:

1. Equations of Viscous Fluid Motion (≈ 2/3 of Class)
    a. Navier-Stokes Equations
    b. Non-Dimensional Numbers
    c. Euler and Bernoulli Equations
    d. Boundary Layer Flows
    e. Stability of Laminar Flows

2. Turbulence (≈ 1/3 of Class)
    a. Physical Description
    b. Reynold's Equations
    c. Turbulent Boundary Layer
    d. Turbulent Diffusion

3. Compressible Flow (If time remaining)
    a. Inviscid Flow Equations
    b. One Dimensional Flow
    c. Oblique Shock and Expansion Waves
    d. Quasi-1D Flow

A solid overview of Chapters 2-6 from F.M. White, 2006 will be covered and compressible flow will be covered with supplemental materials and Chapter 7.