Course Administration

Instructor: Calvin Lui
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Objectives: to develop a solid, physical intuition towards viscous effects on fluid flows

Textbook: "Viscous Flow" by F. M. White, McGraw-Hill (optional)
"Boundary Layer Theory" by H. Schlichting, McGraw-Hill (optional)
"Multi-Media Fluid Mechanics" by G. M. Homsy, *et al.*, Cambridge University Press (optional)

References: "Viscous Flow" by F. S. Sherman, McGraw-Hill
"An Album of Fluid Motion" by M. Van Dyke, Parabolic Press
(All references are kept in the Logan Library reserve under "Lui".)

Grading: The total grade will be based on class participation, homework and an informal conversational exam during the final week.

Grade Distribution:

Class participation	20%
Homework	40%
Mid-term	15%
Final	25%

Class Participation:
Due to the small class size, you are expected to take an active role in the learning process by participating in the interactive class discussion, rather than acting as a passive listener. Questions are ALWAYS respected both inside and outside classroom.

Homework:
Homework will be assigned on a regular basis. It will be collected, graded and returned to students in a timely fashion (within one day). Binary grading will be adopted, *i.e.* full credit for complete work and zero credit for incomplete or incorrect work. You have the right to re-submit any graded homework within two weeks of receiving the assignment until you get it correct. The only goal of homework is to enhance your learning of the course materials.

Mid-term and Final:
Every student is required to schedule an informal conversational mid-term and final, between 30 and 45 minutes, with the instructor during the fifth week and the final week, respectively. They are meant to be conducted in a non-intimidating environment. Due to the nature of the course materials, a conventional "pencil and paper" exam may not be the best way to assess a student's learning. If there is any concern regarding this issue, please feel free to contact the instructor.

Tentative topics (as of 9/2/2004)

- Review on ES 202 topics:
  - concept of boundary layer
  - physics of drag
  - finite control volume analysis
  - dimensional analysis
  - empirical drag calculation
- Concept of field variable
- Eulerian and Lagrangian description of fluid motion
- Kinematics of fluid motion
- Vorticity dynamics
- Differential control volume analysis (mass, momentum, energy equations, constitutive relations)
  - Navier-Stokes equation
  - Euler's equation
  - Bernoulli's equation
- Reynolds Transport Theorem
- Classical solution of Navier-Stokes equation
  - exact versus approximate (integral) solutions
  - internal versus external flows
  - effects of pressure gradients
  - blowing versus suction
  - boundary motion
- Order of magnitude analysis
- Low Reynolds number flows
- Boundary layer theory
  - scaling argument
  - boundary layer equation
  - Blasius solution
  - matching between viscous boundary layer and inviscid, potential flow
- Laminar-turbulent transition
  - fundamental difference between laminar and turbulent flows
- Receptivity, flow instability, bypass transition
- Turbulence (macroscopic characteristics of turbulence)
- Control of turbulence
- Turbulence prediction
  - CFD
  - turbulence modeling: the closure problem