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Lectures: Tu Th 11:00-12:20pm Mayer Hall 5623

Lecture notes and supplementary materials available online at:  
[https://courses.physics.ucsd.edu/2018/Winter/physics116\\_216/index.html](https://courses.physics.ucsd.edu/2018/Winter/physics116_216/index.html)

#### Recommended Texts:

- Landau LD, Lifshitz EM. 1987. *Fluid Mechanics* (2<sup>nd</sup> Ed.), Volume 6 of *Course of Theoretical Physics*. Pergamon Press (now an imprint of Elsevier).
- Acheson DJ. 1990. *Elementary Fluid Dynamics*. Clarendon Press; Oxford University Press.
- Lighthill MJ. 1986. *An Informal Introduction to Theoretical Fluid Mechanics*. Clarendon Press.

Grade: The final grade will be based on a combination of problem sets, participation and an oral final exam. Oral final exam will be scheduled during Finals Week.

**Course Topics**

- 1) Overview, Equations, Ideal Fluids
  - Overview of fluid phenomena
  - Euler equations, potential flow
  - Induced mass, quasi-momentum
- 2) Vorticity and Viscous Flow
  - Kelvin's Theorem, vorticity induction, vortex dynamics
  - Viscous flow: constitutive relation, Stokesian dynamics and drag, clamshell theorem
- 3) Instabilities
  - Interfacial: Kelvin–Helmholtz, Rayleigh–Taylor
  - Convection, including rotation and Taylor–Proudman Theorem
- 4) Boundary Layers and Wakes
  - Laminar wake
  - Blasius boundary layer
  - Basics of drag and lift
- 5) Turbulence I: K41 and Beyond
  - Basic ideas, K41, 4/5 Law
  - Richardson phenomenology, anomalous exponents
- 6) Turbulence II: Macroscopics
  - Pipe flow turbulence, Prandtl's law of the wall
  - Turbulent wakes
  - Closure theories of eddy viscosity
- 7) Module 1: Atmospheric Fluids and Turbulence
- 8) Module 2: TBA
- 9) Module 3: TBA
- 10) Module 4: TBA