

**THE UNIVERSITY OF COLORADO BOULDER**

**ASEN 6037 / MCEN 7221: Turbulent Flows / Turbulence  
Spring 2020**

**SYLLABUS**

**Instructor:** Assistant Professor John Evans  
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Office Hours: Monday/Wednesday/Thursday, 12:00 pm – 1:00 pm

**Time:** Monday/Wednesday, 2:30 pm – 3:45 pm

**Location:** AERO 232

**Web Page:** Canvas ([\\_\\_\\_\\_\\_](#))

**Course Objective:**

To establish a fundamental understanding of the mathematics and physics of turbulent flows and to introduce the concepts and analytical tools needed in developing turbulence models and turbulence simulation methods.

**Prerequisites:**

This class requires a graduate course in fluid mechanics such as ASEN 5051 / MCEN 5021. Topics covered should include kinematics of fluid flows, conservation laws, vorticity dynamics, theory and application of irrotational flows, dynamic similarity, viscous flows, and boundary layers. A working knowledge of vector calculus, Cartesian tensors, and Fourier transforms is also required.

**Required Textbook:**

*Turbulent Flows*, Pope, Cambridge University Press, 2000.

**Reference and Supplemental Textbooks:**

*Fluid Mechanics*

*Turbulence: An Introduction for Scientists and Engineers*

*Statistical Theory and Modeling for Turbulent Flows*

*A First Course in Turbulence*

*Turbulence: The Legacy of A.N. Kolmogorov*

**Topics:**

**1. Turbulence Theory**

- a. Statistical Description of Turbulence
- b. Mean Flow Equations
- c. Free Shear Flows
- d. Wall-Bounded Flows
- e. The Scales of Turbulent Motion

**2. Turbulence Modeling and Simulation**

- a. Direct Numerical Simulation (DNS)
- b. Reynolds Averaged Navier-Stokes (RANS) Models
  - i. Turbulent Viscosity Models
  - ii. Reynolds Stress Transport Models
- c. Large Eddy Simulation (LES)

**Class Format:**



under the Students tab on the Disability Services website.

**Classroom Behavior:**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance.

See the [campus policy regarding religious observances](#) for full details.

**Prepared by:** John Evans

**Date:** December 30, 2019