**AE 6080 Dynamics of Turbulence**

**Catalog description:** AE 6080 **-** Dynamics of Turbulence 3-0-3.

Fundamental physics of turbulent flows. Vorticity dynamics, Kolmogorov similarity hypotheses and nonlinear interactions. Mixing and dispersion. Direct and large-eddy simulations, Reynolds stress modeling. Advanced topics.

Prerequisite: AE 6010 (Shear Flows) or equivalent.

**Coordinator:** P. K. Yeung, Professor

**Learning objectives**

* Learn about advanced concepts in the study of turbulence and turbulent mixing
* Learn about different approaches in turbulence simulation and modeling
* Gain exposure to the research literature and advanced topics of current interest.

**Textbook:** Pope 1997, Turbulent Flows.

**Additional References**

* Tennekes& Lumley 1972, McComb 1990.
* Selected research papers from the literature.

**Lecture Topics**

1. Introduction
2. Vorticity transport equation
3. Analysis of enstrophy budget, role of vortex stretching
4. Kolmogorov (1941) similarity hypotheses
5. Intermittency and the refined similarity hypotheses
6. Fourier-spectral description: evolution equation for energy spectrum
7. Interscale energy transfer, triadic interactions
8. Lagrangian description and fluid particle dispersion
9. Mixing of passive scalars, including similarity theory
10. Direct and large-eddy simulations of turbulence: survey of important results, subgrid scale modeling
11. Reynolds stress modeling: exact equations and model constraints
12. Reynolds stress modeling: pressure-strain correlations, lower order models
13. Introduction to the probability density function approach
14. Rotating turbulence
15. Compressible turbulence