

## ME 635 Turbulence

Syllabus - Spring 2008

Tuesday 7:00PM-9:20PM, C0136

Instructors: William W. Liou, Ph.D.  
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Office Hours: M 4PM-5PM (William W. Liou)

### Text Book:

*A First Course in Turbulence* by H. Tennekes and J.L. Lumley, MIT Press, 1972. Eighteenth printing, 2001.

### Course Description

The physical nature of turbulence will be introduced. Dimensional analyses, the basic equations for studying the turbulent transport of momentum and heat and their dynamical significance will be described. Characteristics of turbulent wall- and free-shear layers will be introduced. Probabilities and statistics related to turbulence and experimental methods in fluid flow will be covered.

### Grading

Homework Assignments: 30%  
Test #1: 20%  
Project: 20%  
Final Exam: 30%

### Tentative List of Subjects

1. Introduction
2. Dimensional Analysis
3. Origins of turbulence
4. Diffusivity of turbulence
5. Length scales in turbulent flows
6. The Reynolds equations
7. Elements of kinetic theory of gases
8. Estimation of the Reynolds stress
9. Kinetic energy of the mean and turbulence
10. Vorticity dynamics
11. Boundary-free shear flows
12. Wall-bounded shear flows
13. Probabilities and statistics

Correlations, properties of spatial correlation, Reynolds Stress, Taylor's frozen field hypothesis, integral time scale, power spectral density, interpretation of spectra, Fourier transform, spectral density function, linear systems and filters, autocorrelation, integral time scale, laboratory measurement.

### Notes:

- (1) No make-up exams will be given for reasons other than documented medical emergencies. In any case, the students must inform the instructor prior to the test. The points for that test will be added to the final exam. If a student misses more than one test, the other test will be graded as zero.
- (2) Solve homework problems on engineering paper. Solve one problem on each page. All the assignments will be collected and graded. Hand in your paper before the class.
- (3) Late homework penalty: 30% for one day late, 60% for two days and no credit for more than two days late.
- (4) You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate Catalog that pertain to academic integrity. These policies include cheating, fabricating, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Judicial Affairs. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.