First Course Handout: AE-621A

1. **Objectives:** This course can mainly be considered as an introductory course in the turbulent flow physics. In this course, we will learn various important aspects of a turbulent flow, for example, various characteristics of a turbulent flow, procedures for mathematical modeling, general methodologies and analysis tools necessary to understand a turbulent flow, various types of turbulent flows usually encountered in various engineering applications, and their characteristics, etc.

2. **Prerequisites:** Although a prerequisite is not explicitly mentioned in the course of study book, but the students registering for this course are expected to understand fluid mechanics thoroughly. Prior knowledge on viscous flows will also add to the understanding of the contents.

3. **Course Contents:** Origin, examples & character of turbulence, Reynolds stress, energy relations, closure problem, phenomenology, eddy viscosity. Statistics, spectra, space-time correlations, macro & micro-scales, statistical theory of turbulence, locally isotropic turbulence, Kolmogorov's hypothesis, correlation method, spectral method, turbulent diffusion. Experimental techniques.

4. **Special Emphasis:** Main emphasis will be on the physics of a turbulent flow, and the basic tools necessary to characterize a turbulent flow.

5. **Lecture, Tutorial & Lab Schedule & Venue**:
   There will be two lectures per week. Tuesday: 5:10 pm -6:25 pm, and Thursday, 5:10 pm -6:25 pm at EEM-117.

6. **Office Hours for this course:** Monday, 4:30 pm-5:30 pm (if I am not available at my office, kindly email me with your mobile number, so that we can plan our meeting once again).

7. **Evaluation Components & Policies:** Exams: Mid-semester (30%) and Final semester (40%). Quizzes + Assignments + Attendance (30%)

8. **Course Policies: Attendance, Honesty Practices, Withdrawal** (within the limits of DOAA Guidelines). Negligible attendance record might render deregistration from the course. Assignments copying if caught might render zero marks.

9. **Books & References:** We will mainly follow the following books for various topics.

   (i) A First Course in Turbulence by Henk Tennekes and John L. Lumley, MIT Press, (Seventeenth printing, 1999)

   (ii) Turbulent Flows by Stephen B. Pope, Cambridge University Press, 2000

(iii) **Turbulence: An Introduction for Scientists and Engineers** by P. A. Davidson, Oxford University Press, 2004

(iv) **Turbulence Modeling for CFD** by David C. Wilcox, Dcw Industries, Incorporated; 3rd edition, 2006

Other suggested books for further studies:

(i) Turbulence: The Legacy of A. N. Kolmogorov by Uriel Frisch

(ii) The Theory of Homogeneous Turbulence by G. K. Batchelor

(iii) Turbulence: An Introduction to Its Mechanism and Theory by J. O. Hinze

Web sources: Will be mentioned in the class while such necessity will arise.