MAK691E (14423) Mechanics of Turbulence Fall 2018/2019

Lecturer : Prof. Dr. Bedii Özdemir
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Ofice Hours : Thu: 13:30-17:00, Fri: 13:30-17:00

Lecture Hours : Fri: 8:30 am - 11:29 am (MOB 212)

Contents
Nature of Turbulent Motion, Dimensional Analysis and Length Scales, Vorticity Dynamics, Shear Flows, Statistical Description of Turbulence, Spectral Dynamics, Recent Developments in Turbulence Theory.

Reference Book
- Pope, S 2000 Turbulent Flows, Cambridge Uni. Press.

References
- Tennekes and Lumley 1950 A First Course in Turbulence, Academic Press.
- Hinze, 1945 Turbulence, Academic Press.
- Batchelor, G 1952, Theory of Homogeneous Turbulence, Cambridge Uni. Press.
- Townsend, A. A. 1955 Structure of Turbulent Shear Flows, Cambridge Uni. Press.
- Monin and Yaglom 1971 Statistical Fluid Mechanics, Volumes I and II, MIT Press.
- Özdemir, İ. B. 1995 Turbulence Course Notes

Course Objectives
To introduce;
- onset and development of turbulent flows and their classifications,
- theory and basic concepts of turbulence, and methods of analyses of turbulent flows,
- description of well-established and known approaches and theories and their scope.

Course Outcomes
To develop skills;
- and basic knowledge to model turbulence physics,
- necessary to analyze turbulent flows and solve relevant problems,
- to design flow systems with turbulence.

Course Plan

Week	Topics
1	Onset of turbulence, intermittency and transition.
2	Definitions of turbulent parameters, Reynold's decomposition.
3	Equations of turbulent motion and the closure problem; Homogeneous, isotropic turbulence; Concept of eddy.
4	Dimensional analysis and length scales.
5	Energy cascade; Reynolds number similarity and self-preservation.
6	1st Midterm **26 October 2018**
7	Vorticity equation; Vortex stretching and tilting.
8	Intermittency and entrainment; Free shear flows; Jets, mixing layers, and wakes.
9	Wall-bounded shear flows, Boundary 1ayers and wall jets; Coherent structures in jets and boundary layers.
10	Probability density and joint statistics; Spatially and temporally stationary flows and evolving flows.
11	2nd Midterm **7 December 2018**
12	Ergodicity; Correlation functions; Central limit theorem.
13	Fourier transform and aliasing in one-dimensional spectra.
14	Spectrum of turbulence; Inertial subrange and Kolmogorov's -5/3 law; Some other spectrum functions.
15	Summary of the semester

Exams & Course Work

Midterms	2	40%
Homework Assignments	3	20%
Final Exam (or Term Project)	1	40%

Note: ***Please follow*** **www.akis.itu.edu.tr** ***for any announcement*****.**