Amirkabir University of Technology
Tehran Polytechnic

Department of Aerospace Engineering

Fluid Mechanics — Fall 2019

Instructor: Dr. Mehran Tadjfar

Course Objectives: To provide understanding of fluid mechanics concepts and principles with an introduction to Navier-Stokes equations for second year undergraduate students.

Textbook: White, F. Fluid Mechanics. McGraw-Hill with supplemental class notes provided by the instructor.

Grading:
10% Homeworks
10-25% Projects ?
65-85% Exams: Midterm 10 Azar 98, Final 26 Dey 98

- The Concept of a Fluid.
- Fluid as a Continuum:
  - Thermodynamic Properties of a Fluid.
  - Stress and Viscosity.
  - Characteristic Parameters.
  - Reynolds Number Influence.
  - Compressibility: Mach Number, Cavitation, and Flow Regimes.
- Flow Patterns: Streamlines, Streamtubes, Streaklines, Pathlines, and Timelines.
- Forces on a Fluid Element:
  - Forces in a Pressure Gradient Field.
  - Forces in a Gravity Field.
  - Forces due to Viscous Stresses.
  - Hydrostatic Pressure Distribution.
  - Standard Atmosphere Model.
  - Hydrostatic Forces on Plane and Curved Surfaces.
  - Pressure Distribution in Rigid Body Motion.
- Physical Laws of Fluid Mechanics:
  - Reynolds' Transport Theorem.
  - Conservation of Mass.
  - The Linear Momentum Equation.
  - The Energy Equation.
- Differential Form of the Conservation Equations:
  - Substantial or Total Derivative.
  - Kinematics of Flow Field.
- Pipe's Flow:
  - Darcy-Weisbach Equation.
  - Moody's Chart and Minor Losses.
- Drag on A Flat Plate:
  - Self-Similarity of velocity profiles.
  - Local Wall Shear Stress.
  - Laminar Flow and Blasius Solution.
  - Structure of a Turbulent Boundary Layer.
  - Tripping of Laminar Boundary Layer.
- More Topics (if time allows) will be added.