ChE 223 - Fluid Mechanics

Code and Name: ChE 223 - Fluid Mechanics
Credit Hours: 3 (Lecture: 3, Tutorial: 1)

Textbook:
- Engineering Fluid Mechanics, Clayton T. Crowe, et al., 10th Ed, John Wiley & Sons, Inc, 2012

Other References:
- None

Course Description:
Introduction to fluid mechanics, Fluid Properties, Fluid Statics, Flowing Fluids and Pressure Variation, Control Volume Approach and Continuity Equation, Momentum Equation, Surface Resistance with Uniform Laminar Flow, and Flow in Conduits.

Pre-requisites: ChE 221: Chemical Engineering Thermodynamics I. GE 103: Engineering Graphics and Design.
Co-requisites: None

Course Learning Outcomes:
With relation to ABET Student Outcomes (SOs: 1-7)

1. Recognize fluid properties and fluid statics (1)
2. Outline fluid mechanics basic conservation laws: continuity (1)
3. Calculate the momentum equation variables, as well as the Navier-Stokes Eq. (1)
4. Use the energy equation in several applications (1)
5. Use dimensional analysis concept (6)
6. Show the importance of fluid mechanics in the industrial field and everyday life (4)
7. Identify the properties of fluid mechanics and head loss using Moody diagram and obtain the data from property tables (1)
8.

Topics to be covered:

- Liquids and Gases properties, The Continuum Assumption, Dimensions, Units, and Resources, Topics in Dimensional Analysis, Engineering Analysis.
- Properties Involving Mass and Weight, Ideal Gas Law.
- Properties Involving Thermal Energy, Viscosity, Bulk Modulus of Elasticity, Surface Tension, Vapor Pressure.
- Pressure, Pressure Variation with Elevation, Pressure Measurements, Forces on Plane Surfaces (Panels),
- Forces on Curved Surfaces, Buoyancy
- Descriptions of Fluid Motion, Acceleration, Euler's Equation, Pressure Distribution in Rotating Flows
- The Bernoulli Equation Along a Streamline. Rate of Flow, Control Volume Approach,
- Continuity Equation, Cavitation, Differential Form of the Continuity Equation.
- Momentum Equation: Derivation and Interpretation, Common Applications, Additional Applications,
- Navier-Stokes Equation. Energy Equation
- Buckingham Theorem & Dimensional Analysis
- Surface Resistance with Uniform Laminar Flow. Classifying Flow, Specifying Pipe Sizes,
- Pipe Head Loss, Stress Distributions in Pipe Flow, Laminar Flow in a Round Tube, Turbulent Flow and the Moody Diagram
- Solving Turbulent Flow Problems, Combined Head Loss, Nonround Conduits, Pumps and Systems of Pipes

Grading Policy:
The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.