III CHE233 Fluid and Particle Mechanics - I

Course Outlines

- **Title:** Fluid and Particle Mechanics - I
- **Code Number:** CHE 233
- **Semester:** 3rd
- **Credit hours:** 3
- **Pre-requisites course requirements/ skills:** NA
- **Learning Outcomes:**

  Upon successful completion of the course, the students will be able to:

  1. Acquire the knowledge of basic concepts regarding the fluid flow.
  2. Analyze the problems of compressible/incompressible fluid flow and the mechanisms of fluids motion with the applications of momentum and energy equations.
  3. Solve the problems related to fluid flow and its applications.

- **Contents**

  Unit I: Fluid Statics

  1.1 Introduction to Fluid Statics and Dynamics
  1.2 Hydrostatic Equilibrium
  1.3 Head of fluid
  1.4 Barometric equation
  1.5 Applications of Fluid Statics (Manometer, Continuous Gravity and centrifugal decanter)

  Unit II: Fluid Flow

  2.1 Classification and Nature of fluids
  2.2 Laminar and Turbulent Flow
  2.4 Boundary Layer
  2.5 Basic Equations of Fluid flow (Mass, Momentum and energy relationships)
  2.6 Flow and Pressure Measurement (Pressure gauges, Pitot tube, Orifice-meter, Venturi meter, Rotameter etc.)

  Unit III: Flow of liquids in Pipes and open Channels

  3.1 Fluid flow characteristics in pipes
  3.2 Pressure drop for Newtonian Fluids

3.3 Reynolds Number, Shear rate and shear Stress
3.4 Friction losses through pipes, ducts and fittings
3.5 Pipe roughness
3.6 Flow through curved pipes
3.7 Flow through open channels

Unit IV: Flow of Compressible Fluids

4.1 Isothermal and non-isothermal flow of an ideal gas
4.2 Adiabatic flow of an ideal gas in a horizontal pipe
4.3 Flow of non-ideal gases

Unit VI: Pumping of Fluid

5.1 Pumping equipment for liquids
5.2 Pump types (Reciprocating, Positive displacement and centrifugal)
5.3 Operating characteristics of pumps
5.4 Pumping equipment for gases
5.5 Fans, Blowers and Compressors
5.6 Power required for pumping of liquids and gases

- **Teaching-learning Strategies**

  The teaching and learning strategy has been designed on the understanding of concepts and the ability to critically analyze and apply the learned content through lectures, discussion, activities, case studies using computer, multi-media and writing board instructional aids.
  Lectures: 3 hours per week

- **Assignments- Types and Number with calendar**

  A minimum of two assignments to be submitted before the written exam of final term

- **Assessment and Examinations**

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written examination at the mid-point of the semester.
2.	Formative Assessment	25%	It includes: classroom participation, attendance and assignments..
3.	Final Assessment	40%	Written examination at the end of semester.

- **Textbooks and reference readings**

1. Chhabra, R., Shankar, V., (2017) “Coulson and Richardson's Chemical Engineering: Volume 1a: Fluid Flow, Fundamentals and Applications”, 7th Edition, Butterworth-Heinemann.
2. McCabe W.L., Smith J.C., Harriott P. (2005), Unit Operations of Chemical Engineering, (7th ed.), McGraw Hill.
3. Daugherty, R. L., Franzini, J. B., Finnemore, E.J., (1989), Fluid mechanics with engineering application, McGraw Hill.
4. Holland, F., Bragg, R. (1995), Fluid flow for Chemical Engineers, (2nd ed.), Elsevier.
5. White, F. M., Xue, H. (2022), Fluid Mechanics, (9th ed.), McGraw Hill.
6. Noel de Nevers (2005), “Fluid Mechanics for Chemical Engineers”, McGraw Hill.