Fluid Mechanics

Course Code	Credit Hours
CE-211	2-1

Course Description

This course will enable students to learn basics of fluid mechanics for civil engineering applications including properties of fluids, fluid statics, forces on immersed bodies, fluid kinematics, hydrodynamics, flow measuring devices in pipes and open channels. An introduction will be given to the basic principles of fluid mechanics in stationary fluids and in motion. The course will provide detailed guidance on enable students to perform various experiments in Fluid Mechanics laboratory.

Text Book:

1. J. F. Douglas, J. A. Swaffield “Fluid Mechanics” Fourth Edition.
2. E. John Finnemore and Joseph B. Franzini “Fluid Mechanics with Engineering Applications” 10th Edition.

Reference Book:

1. Streeter, Wylie, Bedford “Fluid Mechanics” Ninth Edition
2. Dr Andrew Sleigh “An Introduction to Fluid Mechanics” May 2001 (School of Civil Engineering, University of Leeds)
3. R E. Featherstone “Civil Engineering Hydraulics” Third Edition

Prerequisites :

Nil

Assessment System for Theory

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

Assessment System for Lab

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assessment/ Viva	20%

Teaching Plan

Theory:

Week	Topics	Reading/ Assignment/ Homework	CLO No.	Assessment
1-2	**Introduction** • Solids and fluids (liquids and gases) Units and dimensions • Physical properties of fluids; density, specific weight, specific volume, specific gravity, surface tension, compressibility • Viscosity and its measurement Newton's equation of viscosity, Hydrostatics • Kinematics Hydrodynamics Hydraulics	Chapter 1 of Textbook 1 Assignment 1	1	Quiz 1
3-4	**Fluid Statics** • Pressure intensity and pressure head, Pressure and specific weight relationship, Absolute and gauge pressure Measurement of pressure • Piezometer, manometer, Pressure transducers • Differential manometer and Borden gauge	Chapter 2 of Textbook 1	1	Quiz 2
5-6	**Forces on Immersed Bodies** • Forces on submerged planes & curved surfaces and their applications • Buoyancy and floatation • Equilibrium of floating and submerged bodies	Chapter 2 of Textbook 1 Assignment 2	1	
7-8	**Fluid Kinematics** • Steady and unsteady flow	Chapter 4 of	2	Quiz 3

	•	Laminar and turbulent flow	Textbook 1		
	•	Uniform and non-uniform flow			
	•	Path lines, streamlines and stream tubes			
	•	Velocity and discharge			
	•	Control volume			
	•	Equation of continuity for compressible and incompressible fluids			
9	**Mid Semester Exam**				
10-11	**Hydrodynamics**				
	•	Different forms of energy in a flowing liquid	Chapter 4 of Textbook 1 Assignment 3	2	Quiz4
	•	Bernoulli's equation and its application			
	•	Energy line and Hydraulic Gradient Line			
	•	Introduction to density currents, free and forced vortex			
	•	Forces on pressure conduits, Reducers and bends			
	•	Forces on stationary and moving plates / blades			
	•	Torques in rotating machines			
12-13	**Flow Measurement**				
	•	Orifices and mouthpieces, sharp-crested weirs and notches, Pitot tube and pitot static tube	Chapter 25 of Textbook 1	2	Quiz 5
	•	Venturimeter, orificemeter			
14-15	**Steady Flow through Pipes**				
	•	Darcy-Weisbach equation for head losses in pipe lines	Chapter 6 of Textbook 1 Assignment 4	2	
	•	Hydraulic grade lines and energy lines			
	•	Pipes in series and parallel			
	•	Transmission of energy through pipes			
	•	Introduction to computer aided analysis of pipe networks			
16	**Uniform Flow in Open Channels**				

	•	Chezy's and Manning's equations, Bazin's and Kutter's equations	Chapter 6 & 7 of Textbook 1	2	Quiz 6
	•	Most economical rectangular and trapezoidal sections			
17-18	**End Semester Exam**				

Practical

Sr.	Practical	Assessment Methodology	Learning Domain/ Taxonomy Level
1	To prepare layout plan of Fluid Mechanics Laboratory.	Lab Manual, Lab Quiz, Lab Rubrics	P3, A3
2	To measure the physical properties of a liquid (oil).		
3	To determine the meta-centric height of a floating body (model of a ship) and to locate position of center of buoyancy, metacenter and center of gravity.		
4	To measure the hydrostatic force of a submerged body and to locate its centre of pressure..		
5	To verify the Bernoulli's theorem in the laboratory.		
6	To determine the coefficient of discharge for a Venturi meter.		
7	To determine the coefficient of discharge for Rectangular and V-Notches.		
8	To determine the hydraulic coefficients for various types of orifices.		