Fluid Mechanics

Course Code	Credit Hours
CE-211	2-1

Course Description

This course is designed to equip the student with the basic knowledge of the Fluid Mechanics and to enable him to apply its principles to solve the fluid flow problems, especially those arising in civil, environmental, and agricultural engineering disciplines. The course can broadly be divided into fluid statics, fluid kinematics and equations of conservation of fluid mass, momentum, and energy. The knowledge of the foregoing is used to solve a variety of engineering problems to harness the student skills in problem solving.

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

Week No	Topics/Learning Outcomes
1	Shear stress in moving fluid, Newton law of viscosity, difference b/w solids and fluids, Newtonian and Non-Newtonian fluid, Liquids & gases, Molecular structure of materials, continuum concept of a fluid. Problems.
2	Properties of fluids (mass density, specific weight, relative density, viscosity, coeff. of dynamic & kinematic viscosity, causes of viscosity in liquids and gases. Surface tension & capillarity, vapour pressure, cavitation. Problems.
3	Pressure & head: statics of fluid systems, pressure, Pascal law for pressure, pressure variation vertically under gravity in a static fluid, pressure equality at same level. Problems.
4	Gauge pressure and absolute pressure, hydrostatic paradox, manometer. Problems.
5	U-tube manometer, inverted U-tube manometer. Buoyancy. Fluids in relative equilibrium. Problems.
6-7	Action of fluid pressure on a surface, resultant force, and center of pressure on a plane surface under uniform pressure, resultant force and center of pressure on a curved surface under uniform pressure. Problems.
8	Resultant force and center of pressure on a plane surface immersed in a liquid. Pressure diagrams. Force on curved surface due to hydrostatic pressure. Problems.
9	**Mid Semester Exam**
10	Moving Fluids: fluid flow, path line, streak line, streamline, stream tube, uniform & non-uniform flow, steady & unsteady flow, frames of reference, real & ideal fluids, compressible & incompressible flow, one-, two- & three-dimensional flow. Problems.
11	Analyzing fluid flow, motion of a fluid particle, acceleration of a fluid particle, motion in a curved path, motion of a fluid particle in three dimensions.

	Laminar & turbulent flows. Discharge & mean velocity. Continuity of flow, continuity equation for a 3-dimensional flow in Cartesian coordinates. Problems.
12	Momentum eq & its applications: momentum & fluid flow, momentum equ. For two- & three-dimensional flows. Problems.
13	Forces on pipe bends, forces on plates, forces on stationary and moving curved vanes. Problems.
14	Momentum correction factor. Acceleration of fluid in a pipeline sans elasticity. Euler equation of motion along a streamline. Angular motion. Problems.
15	The energy eq & its applications: mechanical energy of a flowing fluid, HGL (hyd grade line), TEL (total energy line), Syphon, Pitot tube. Problems.
16	Changes of pressure in a tapering pipe, Venturi meter, small orifices discharging to atmosphere, large orifices, notches & weirs, power of a stream of fluid. Problems.
17-18	**End Semester Exam**

Practical

Experiment No	**Description**
1	To analyze the behavior of water under pressure (Pascal's Law)
2	To determine the density of water.
3	Calibration of Bourdon-type pressure gauge.
4	To determine the hydrostatic thrust acting on a plane surface immersed in the water when the surface is partially submerged or fully submerged.
5	To locate the position of the metacenter of a floating body by determining its distance from the Centre of gravity.
6	To investigate Bernoulli's theorem for a steady flow in pipes.
7	OEL: Determination of a hydrostatic thrust on a trapezoidal plane surface.
7	To investigate the flow characteristics of the Venturi meter, Orifice plate, and Variable area flow meter, including accuracy and energy losses.
8	To study the impact of a jet on various deflectors.
9	To determine the sink speed of spheres in fluid.
10	To investigate the behavior of flow lines when they encounter solid bodies

	of different shapes in their path.
11	To determine the co-efficient of discharge, velocity, and contraction of a small orifice.