

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2018-2019)

Semester IV [Second year]

CE(ES)401	Introduction to Fluid Mechanics		2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: <div><div>1.</div><div>define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems;</div><div>2.</div><div>describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems;</div><div>3.</div><div>practically apply tables and diagrams, and equations that define the associated laws;</div><div>4.</div><div>calculate and optimize operational parameters of hydraulic problems;</div><div>5.</div><div>explain the correlation between different operational parameters;</div><div>6.</div><div>select engineering approach to problem solving based on the acquired physics and mathematical knowledge.</div></div>			
Prerequisite	Introduction to Civil Engineering, Physics.			
Module 1	Properties of fluids: Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.			3L
Module 2	Fluid statics: Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.			4L
Module 3:	Fluid Kinematics: The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends.			6L
Module 4:	Fluid Dynamics: Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line.			7L
Module 5:	Dimensional Analysis: Buckingham Pi Theorem, determination of Pi terms, correlation of experimental data, examples.			3L
Module 6	Flow through Pipes: Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.			7L
Module 7	Pipeline Systems: Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks.			7L
Module 8	Hydraulic Machines: Basics of hydraulic machines, specific speed of pumps and turbines.			3L
Reference	Sl.	Book Name	Author	Publishing House
	1	Fluid Mechanics	Sadhu Singh	Khanna Publishing House
	2	A Textbook of Fluid Mechanics	R. K. Bansal	Laxmi Publications (P) Ltd., New Delhi.
	3	Hydraulics & Fluid Mechanics Including Hydraulics Machines	P. N. Modi and S. M. Seth	Standard Book House, New Delhi, 2017.
	4	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill Education Private Limited, New Delhi, 2012.
	5	Fluid Mechanics	F. M. White	Tata McGraw Hill Education India Private Limited, 2017.
	6	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India)