BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2ME08: FLUID MECHANICS AND MACHINES
CREDITS - 4 (LTP:3,0,1)

Course Objective:

1. To develop the governing equations for fluid flow by using conservation principles and apply them to practical problems.
2. To apply principles of Fluid Mechanics to analyze Fluid machines.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Marks Distribution				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Topic	Teaching Hours
1	**Fluid Statics and Kinematics:** Hydrostatic force acting on plane surface, types of fluid flow, frames of reference, discharge and mean velocity, continuity equation, continuity equations in three dimensions, velocity and acceleration, streamlines and the stream functions, velocity potential and potential function, relation between stream function and velocity potential; flow nets, linear translation, linear deformation, angular deformation, circulation and vorticity, stream function and velocity potential for uniform flow, vortex flow.	06
2	**Fluid dynamics:** Introduction, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid –Bernoulli's theorem, kinetic energy correction factor, principle of venturimeter and orificemeter, pitot tube, theory of small orifices discharging to atmosphere, elementary theory of notches and weirs, Momentum equation, momentum correction factor.	08
3	**Dimensional Analysis and Similarities:** Dimension, Units, dimension reasoning, dimensional quantities, dimensional homogeneity, Buckingham π-theorem, dimensionless numbers, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, kinematic similarity, model testing-Model laws, Undistorted and Distorted models.	04
4	**Viscous Flow:** Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Navier-Stokes equation of motion, Flow of viscous fluid between two parallel fixed plates, methods of measurement of viscosity.	04
5	**Turbulent Flow:** Introduction to major and minor losses in flow through pipe, expression for coefficient of friction – Darcy-Weisbach Equation, Moody's diagram, resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.	04

Unit No.	Topic	Teaching Hours
6	**Compressible Flow:** Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties.	03
7	**Hydraulic Turbines:** Classification; moment of momentum equation to estimate work done on blade; Construction, working and analysis of Pelton, Francis and Kaplan turbine; Efficiencies of turbine; Governing, Performance, Cavitation and Scale effect of hydraulic turbine.	07
8	**Hydraulic Pumps:** Classification; Construction of roto-dynamic pumps, manometric head, efficiencies and performance of centrifugal pump; pressure rise in pump impeller; multistage pump; cavitation in pump.	06
	Total	**42**

List of References:

1. Frank .M. White, "*Fluid Mechanics",* McGraw Hill Publishing Company Ltd.
2. Streeter V.L., Benjamin Wylie, "*Fluid Mechanics*", Mc Graw Hill Book Co., New Delhi.
3. D.S. Kumar, *"Fluid Mechanics and Fluid Power Engineering",* S.K.Kataria& Sons
4. R.K. Bansal*, "Fluid Mechanics and Hydraulic Machines",*Laxmi Publications
5. Munson, *"Fundamentals of Fluid Mechanics",* Wiley India Pvt. Ltd
6. S K Som, Gautam Biswas, S Chakraborty, *"Introduction to Fluid Mechanics and Fluid Machines"*, Tata McGraw-Hill Education, 3rd edition, 2013
7. YunusCengel& John Cimbala, *"Fluid Mechanics: Fundamentals and Applications"*, Tata McGraw Hill, New Delhi.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Apply kinematics and dynamics of practical fluid flow problems.
2. Use concept of dimensional analysis.
3. Apply practical situations of viscous flow and turbulent flow.
4. Outline compressible fluid flow problems.
5. Analyze performance of hydraulic turbine and its sizing.
6. Outline roto-dynamic pumps for construction, operation, performance and sizing.