

Subject: Fluid Mechanics

Class: Second Year

Hours: 1 hour (Theoretical) , 2Hours (Practical)

Objectives:

This subject will introduce fluid mechanics and establish its relevance in civil engineering. Develop the fundamental principles underlying the subject. Demonstrate how these are used for the design the pipe network and related apparatus and the simple hydraulic components.

Week	Theoretical Syllabus
1	SI Units, dimensions , symbols , abbreviations
2-3	Development of fluid mechanics, properties of fluids; density, specific weight, viscosity, compressibility, surface tension, capillarity etc. Characteristics of flow; discharge, velocity, pressure, shear etc.
4-5	Fluid static's; absolute and gauge pressure, pressure measurement; Bourdon gauge, piezometer column, simple manometer, differential manometers. Hydrostatic forces on plane and curved surfaces, center of pressure.
6-7	Kinematics of fluid flow; classification of types of flow; streamlines, stream tube, path lines, flow net; continuity equation.
8-10	Energy equation for steady flow; potential, kinetic and flow energy; hydraulic grade line and energy line; cavitations; power; solution of flow problems; jet trajectory.
11- 13	Momentum in fluid flow; impulse momentum principle; momentum correction factor ; forces on pressure conduits ; forces on stationary blades ; forces on moving blades ;jet reaction ; application of momentum equation to fluid flow problems .
14 -16	Steady flow in pressure conduits ; laminar and turbulent flow; critical flow ; general equation for conduit friction

	;friction for laminar flow ; friction for turbulent flow ; pipe roughness ; friction factor charts ; empirical equations for pipe flow; economical diameter of pipes.
17-18	Minor head losses; loss at entrance, losses due to contraction; losses due to expansion ; loss in pipe fittings ; loss in bend and elbows, etc .
19-20	Solution of practical pipeline problems; pipeline with pumps.
21-22	Equivalent pipes; branching pipes; pipes in series; pipes in parallel. Hazen- Williams's formula.
23-24	Pipe networks; Hardy cross method; computer aided pipe - network analysis.
25-26	Fluid measurements ; measurement of fluid properties ; measurement of static pressure ; velocity measurement by different methods ; measurements of discharge ; nozzles ; coefficients of contraction ; coefficients of velocity; coefficients of discharge; Venture tube ;nozzle meter ; elbow meter; rote meter.
27-28	Hydraulic similitude; geometric similarity; kinematics similarity ; dynamic similarity; Reynolds number , Froude number , Mach number , Weber number, Euler number; scale ratios ; models ; dimensional analysis .
29- 30	Unsteady flow problems; discharge with varying head. Unsteady flow in pipes. Water hammer. Surge tanks.

References :

- 1. Douglas, J.F. et al; 2011 (Fluid Mechanics). Prentice Hall.**
- 2. Durgaiiah D. R.; 2002 (Fluid Mechanics and Machinery). New Age international publishers.**
- 3. White, F. M.; 1994 (Fluid Mechanics).3rd ed. McGraw-Hill, New York.**
- 4. Khurmi, R.S.; 1994 (Hydraulics, Fluid Mechanics and Hydraulic Machines). S. Chand and Co. Ltd.**