

Year & Sem:	Course Code:	Course Name: Fluid Mechanics and Hydraulic Machinery	No. of Credits: 4	L	T&PS	P
E2S1	ME2103			2	2	0

UNIT-I: Introduction - properties of fluids, concept of continuum. **Fluid statics** - pressure variation in a static fluid, force on submerged surfaces, stability of floating bodies. **Kinematics** – Lagrangian and Eulerian description, streamline, streakline and pathline, acceleration of a fluid element, continuity equation, stream function, rotation and angular deformation, irrotational flow, velocity potential.

UNIT-II: Inviscid flow - Euler equation, Bernoulli’s equation and its applications Reynolds transport theorem - conservation of mass, linear and angular momentum Stokes law of viscosity and Navier-Stokes equations. **Dimensional analysis and similarity** - Buckingham Pi theorem. Finite Volume method for CFD solutions; Mach number and subsonic and supersonic cases; shock;

UNIT-III: Internal flows - pipe flow, friction factor, Moody diagram, minor and major losses, pipe networks, hydraulic diameter. **External flows** - boundary layer approximation, momentum integral method, flow over a flat plate, flow separation. **Turbulence** - Reynolds experiment, Reynolds decomposition, time averaged Navier-Stokes equation, eddy viscosity.

UNIT-IV: Hydraulics Impact of jet, Velocity diagrams for impulse and reaction turbines, axial, radial and mixed flow turbines. Fundamentals of hydraulic turbine theory; Turbine performance characteristics and selection of turbines; Design of radial flow and axial flow turbines and Pelton turbines; Fundamentals of Rotodynamic pumps; Centrifugal and axial flow pumps; special duty pumps; cavitations in hydraulic machines. Applications : hydraulic jack, lift etc.

UNIT-V: Axial flow compressors: flow through cascades, cascade terminology, flow separation, radial equilibrium theory, actuator disc theory, effect of tip clearance, secondary flow, performance characteristics, surging and stalling.

UNIT-VI: Axial flow turbine: vortex theory, blade design, cooling of turbine blades, performance characteristics. profile loss, secondary flow loss, annulus loss, tip clearance loss. limiting factors in turbine design.

References/Text Books:

1. Fluid Mechanics by Frank M. White
2. Introduction to Fluid Mechanics and Fluid Machines by S.K.Som ,G.Biswas and S.Chakraborty
3. Kumar K.L., “Engineering Fluid Mechanics”.
4. P.N.Modi and Seth, “Fluid Mechanics and Hydraulic Machines”
5. R.K.Rajput, “A Text Book of Fluid Mechanics & Hydraulic Machines”
6. Bansal R.K., “Fluid Mechanics and Hydraulic Machines”,
7. Roberson J.A. & Crowe C.T., “Engineering Fluid Mechanics”, 4th ed., M/s Jaico Publishing Co., 1998.

Lecture Plan: Unit-I & -II syllabus for MID-I, Unit-III & -IV syllabus for MID-II and Unit-V & -VI syllabus for MID-III examinations.