FLUID MECHANICS AND HYDRAULIC MACHINES

Course code	20ME3301	Year	II	Semester	I
Course category	Professional Core	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

CO	Statement	Skill	BTL	Units
CO1	**Understand** the concepts of fluid properties, pressure measurement by manometers.	Understand	L2	1,2,3,4,5
CO2	**Apply** conservation laws to solve fluid flow problems in engineering applications.	Apply	L3	2
CO3	**Analyze** the various flow measuring devices and estimate the force exerted by the jet on vanes.	Analyze	L4	3
CO4	**Analyze** various hydraulic turbines and pumps with working proportions and efficiencies.	Analyze	L4	4,5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1: Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3											3	2
CO2	3	3											3	3
CO3	3	3											3	3
CO4	3	3											3	3

Course Content

Unit	Contents	Mapped CO
I	**Properties of Fluids:** Properties of fluids- Density, specific weight, specific volume, specific gravity, Viscosity-Dynamic viscosity, Kinematic Viscosity-Cohesion, Adhesion, surface tension, capillarity and vapor pressure, compressibility and elasticity. **Measurement of Pressure:** Pascal's law, Manometers–Simple Manometers-Piezometer, U-tube manometer, Single column manometers, Differential manometers-U-Tube differential manometers and inverted U-Tube differential manometers.	CO1
II	**Fluid Kinematics**: Classification of flows-steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrational, viscous and inviscid, continuity equation, Description of fluid flow, Stream line, path line, streak lines and stream tube **Fluid Dynamics**: Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend. **Closed Conduit Flow**: Reynolds's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.	CO1, CO2
III	**Measurement of Flow**: Pitot tube, Venturimeter and orifice meter –flow over rectangular, triangular, trapezoidal and stepped notches.	CO1, CO3

	Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip – velocity triangles at inlet and outlet – expressions for work done and efficiency - angular momentum principle	
IV	**Hydraulic Turbines:** Classification-Pelton wheel-Reaction Turbines-Inward and Outward radial flow reaction turbines-Francis Turbine- Axial flow reaction turbine - Kaplan turbine - Draft tube Types-Theory- and efficiency of draft tube. **Performance of Hydraulic Turbines:** Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine.	**CO1, CO4**
V	**Centrifugal Pumps:** Classification, working, work done – manomertic head - losses and efficiencies specific speed- pumps in series and parallel - performance characteristic curves, NPSH. **Reciprocating Pumps:** Main parts - Classification - Discharge - Slip - Velocity and acceleration variation in suction and delivery pipes due to piston acceleration- Effect of variation of velocity on friction in suction and delivery pipes- Effect of acceleration in suction and delivery pipes on indicator diagram- Effect of friction.	

Learning Resources
Text books
1. Hydraulics and Fluid Mechanics including hydraulic machines, by P.N.Modi and S.M.Seth, Standarard book house, 2000, New Delhi. 2. K.L.Kumar / Engineering Fluid Mechanics / S chand Publications.
Reference books
1. Fluid Mechanics and Hydraulic Machines, by R.K.Bansal, Laxmi publications (P) Ltd. 2011, New Delhi. 2. Hydraulics and Fluid Mechanics and fluid machines, by S Ramamrutham, Dhanapat rai publishing company,New Delhi 3. Fluid Mechanics and Hydraulic Machines, by R.K.Rajput, S.Chand limited publications, 2008, New Delhi. 4. Fluid Mechanics and Hydraulic Machines, by Sukumar Pati, Mc Graw Hill Education Private Limited, 2014, New Delhi. 5. Fluid Flow Machines by N.S.Govinda Rao, Tata Mc Graw Hill publishing company Ltd. 6. Fluid Mechanics and Hydraulic Machines by K.R.Arora, Standard Publishers Distributors
e- Resources & other digital material
1. https://nptel.ac.in/courses/112/105/112105171/ 2. https://nptel.ac.in/courses/112/105/112105183/ 3. https://nptel.ac.in/courses/105/101/105101082/ 4. https://nptel.ac.in/courses/105/103/105103095/