

FLUID MECHANICS AND HYDRAULIC MACHINES

Course Code	23ME3402	Year	II	Semester	II
Course Category	Professional Core	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre-requisites	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	Blooms	Units
CO1	Understand the concepts of fluid properties, pressure measurement by manometers and hydraulic machinery.	Understand	L2	1,2,3,4,5
CO2	Apply conservation laws to solve fluid flow problems.	Apply	L3	2
CO3	Apply principles of boundary layer theory and dimensional analysis in fluid mechanics.	Apply	L3	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

	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 No	Contents	Mapped CO
UNIT-1	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-	CO1

	Tube differential manometers and inverted U-Tube differential manometers.	
UNIT-2	<p>FLUID KINEMATICS: Classification of flows-steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, continuity equation, Description of fluid flow, Stream line, path line, streak lines and stream tube</p> <p>FLUID DYNAMICS: Euler's and Bernoulli's equations for flow along a stream line, Reynolds transport theorem, momentum equation and its application on force on pipe bend.</p> <p>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.</p>	CO1, CO2
UNIT-3	<p>BOUNDARY LAYER THEORY: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.</p> <p>DIMENSIONAL ANALYSIS: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.</p>	CO1, CO3
UNIT-4	<p>BASICS OF TURBO MACHINERY: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.</p> <p>HYDRAULIC TURBINES: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.</p>	CO1, CO4
UNIT-5	<p>PERFORMANCE OF HYDRAULIC TURBINES: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, surge tank.</p> <p>CENTRIFUGAL PUMPS: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.</p> <p>RECIPROCATING PUMPS: Working, Discharge, slip, indicator diagrams.</p>	
Learning Resources		
Text books:	<ol style="list-style-type: none"> 1. Y.A. Cengel, J.M.Cimbala, Fluid Mechanics, Fundamentals and Applications, 6/e, McGraw Hill Publications, 2019. 2. Frank M White, Fluid Mechanics, McGraw Hill Publishers. 	
Reference	1. Hydraulics and Fluid Mechanics including hydraulic machines, by	

books	P.N.Modi and S.M.Seth, Standard book house, 2017, New Delhi. 2. RK Bansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications (P)Ltd, 2019. 3. Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016. 4. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria & Sons, 2013. 5. D. Rama Durgaiah, Fluid Mechanics and Machinery, 1/e, New Age International, 2002.
Online Learning Resources:	1. https://archive.nptel.ac.in/courses/112/105/112105206/ 2. https://archive.nptel.ac.in/courses/112/104/112104118/ 3. https://www.edx.org/learn/fluid-mechanics 4. https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in 5. www.coursera.org/learn/fluid-powerera