

INSTITUTE	FACULTY OF ENGINEERING AND TECHNOLOGY
PROGRAM	BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
SEMESTER	3
COURSE TITLE	FLUID MECHANICS & HYDRAULIC MACHINES
COURSE CODE	01ML0301
COURSE CREDITS	4

Objective:

- 1 To study fundamental physics principles (mass and momentum) applied to fluid motion
- 2 A universal methodology used across many engineering and science disciplines to manage complexity and scale
- 3 To study a specific, complex engineering application of fluid dynamics principles focused on energy transfer in rotating machinery

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply fluid properties and governing parameters to solve engineering problems in fluid mechanics
- 2 Analyze hydraulic systems by employing the fundamental principles of fluid statics
- 3 Apply appropriate assumptions to classify types of flows and solve governing fluid flow equations.
- 4 Evaluate the applicability of dimensional analysis techniques for modeling and solving real-life fluid flow problems
- 5 Analyze the performance of different types hydraulic turbine
- 6 Analyze the performance of different types of hydraulic pump

Pre-requisite of course: Nil

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25
Contents : Unit	Topics						Contact Hours
1	Introduction to Fluid Statics Definition of fluid, Fluid properties, Classification of fluids, Pascal's Law and Hydrostatic Law, Pressure and its variation in a static Fluid, Measurement of static fluid pressure: Manometers						4

Contents : Unit	Topics	Contact Hours
2	Fluid Kinematics and Dynamics Description of fluid motion – Lagrangian and Eulerian approach, Types of flows, Control volume, Material derivative and acceleration, Streamlines, Pathlines and Streaklines, Circulation and Vorticity, Stream function and velocity potential function, Vortex flow, Continuity equation, Euler’s equation of motion, Bernoulli’s equation, Practical applications of Bernoulli’s equation in flow measurement devices like venturi meter, orifice meter and pitot tube, elementary Theory of notches	10
3	Viscous Flow and Turbulent Flow Reynolds number, flow of viscous fluid through circular pipe Hagen Poiseuille formula, Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, power absorbed in viscous flow through journal, foot step and collar bearing, movement of piston in dashpot, methods of measurement of viscosity, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes, Darcy Weisbach equation, major and minor losses in pipes, pipe friction, parallel, series and branched pipes, series and branched pipes	10
4	Dimensional Analysis Dimensional homogeneity, Rayleigh’s method, Buckingham p theorem, non-dimensional numbers, Model laws and distorted models, Modelling and similitude	5
5	Hydraulic Turbine Classification of hydraulic turbines, Heads and efficiencies, Velocity triangles, Axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines – working and design principles	6
6	Centrifugal Pumps and Reciprocating Pumps Centrifugal Pumps: working principle, work done by the impeller, manometric head and efficiencies specific speed, performance characteristic curves, NPSH, Reciprocating Pumps: working principle, work done, slip, indicator diagram	7
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 To determine the different types of flow Patterns by Reynolds’s experiment	2
2	Experiment 2 Verification of Bernoulli’s theorem	2
3	Experiment 3 To determine the friction factor for different pipes	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	Experiment 4 To determine the loss coefficients for different pipe fittings	2
5	Experiment 5 To determine the coefficient of discharge through orifice meter, venturi meter and rotameter	2
6	Experiment 6 To determine the coefficient of discharge through open channel flow over rectangular notch and V notch	2
7	Experiment 7 To determine metacentric height of floating body	2
8	Experiment 8 To perform experiment of Pelton turbine	2
9	Experiment 9 To perform experiment of Kaplan turbine	2
10	Experiment 10 To perform experiment of Francis turbine	2
11	Experiment 11 To perform experiment of centrifugal pump	2
12	Experiment 12 To perform experiment of reciprocating pump	2
Total Hours		24

Textbook :

- 1 Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons, 2015
- 2 Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 2019

References:

- 1 Fluid Mechanics and Hydraulic Machines, Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S. Chand & Co, 2015
- 2 Fluid Mechanics, Fluid Mechanics, Frank M. White, McGraw Hill Publishing Company Ltd, 2016
- 3 Fundamentals of Fluid Mechanics, Fundamentals of Fluid Mechanics, Munson, Wiley India Pvt. Ltd, 2020
- 4 Fluid Mechanics: Fundamentals and Applications, Fluid Mechanics: Fundamentals and Applications, Yunus A. Çengel, John M. Cimbala, McGraw-Hill, 2018
- 5 Fluid Mechanics and Fluid Power Engineering, Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons, 2015

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
0.00	0.00	45.00	35.00	20.00	0.00

Instructional Method:

- 1 Power Point Presentations

Supplementary Resources:

- 1 <http://nptel.iitm.ac.in/>
- 2 <https://swayam.gov.in/>
- 3 <http://media.efluids.com/galleries/all>