Devi Ahilya Vishwavidyalaya, Indore, India Institute of Engineering & Technology				**III Year B.Tech. (Mechanical) (Full Time)**		
Course Code & Name	**Instruction Hours per semester and Credits**					
6RMPC3 FLUID MACHINES	**Classroom Instruction (CI)**	**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per semester**	**Total no. of Hours Per semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**120**	**4**
	20	**10**	**20**	**70**		

Learning Objectives

The course is designed:

1. To Apply fundamental fluid mechanics principles.
2. To develop skills in dimensional analysis and similitude
3. To understand the design and performance of hydraulic turbines
4. To analyze and evaluate pump systems
5. To develop knowledge of pressure transients in fluid system.

Pre requisite(s): Fluid Mechanics, Applied Mechanics, Engineering Thermodynamics, Applied Mathematics I/II/III

COURSE CONTENTS

UNIT- I

Fundamental Principles: Newton's Laws of Motion and Reynolds Transport Theorem; Conservation of Momentum: Linear Momentum Equation, Angular Momentum Equation; Forces on stationary and moving vanes, Forces on closed conduits: Reducer and Expanders, Bends, Torque on Sprinklers

UNIT-II

Modelling and Similitude: Dimensional Homogeneity, Dimensionless parameters, Methods to find Dimensionless numbers, Buckingham π Theorem applications, Similitude: Modelling Criteria; Modelling Laws; Distorted Models. Conservation of Mass and Momentum

UNIT-III

Turbines: Hydraulic Turbines: Impulse and Reaction Turbines; Velocity triangles, Euler's Equation of Work Done, Efficiencies; Pelton, Francis, Kaplan, Propeller and Bulb turbine: Constructional details and Performance characteristics, Unit quantities, Specific Speed; Governing; Comparison with other Turbines: Steam Turbines, Gas Turbines, Jet Engines

UNIT-IV

Pumps: Rotodynamic Pumps: Centrifugal, Axial; Constructional details, Performance Characteristics, Losses and Efficiencies, Net Positive Suction Head, Specific speed, Pumps in series and parallel; Multistage and Specific purpose pumps

Positive Displacement Pumps: Types; Reciprocating Pumps: Indicator Diagram, Acceleration Head, Friction head, Air-Vessels, Double Acting Pumps

UNIT-V

Cavitations and Water Hammers: Cavitations: Definition and Genesis, Effects on pumps and turbines, Thoma-Cavitation Factor, Measurement of Cavitation: Apparatus, Cavitation test, Prevention; Water Hammer: Physical phenomenon, fundamental equation, arithmetic integration, Prevention; Surge tanks; types and Role

LIST OF PRACTICAL ASSIGNMENT

1. To determine the coefficient of impact of water jet on vanes
2. Performance evaluation of Pelton wheel using Pelton Wheet test rig
3. Performance evaluation of Kaplan Turbine using Kaplan Turbine test rig
4. Performance evaluation of Centrifugal Pump using Centrifugal Pump test rig
5. Performance evaluation of Reciprocating Pump using Reciprocating Pump test rig.
6. Measure forces on different shapes model using a wind Tunnel.
7. Performance evaluation of Francis Turbine using Francis turbine test rig
8. Numerical Study of modelling and similitude of rotodynamic fluid machines.
9. Study the phenomenon of water hammer in pipes

BOOKS RECOMMENDED:

[1] Douglas John F., *Fluid Mechanics*, Pearson Education, 2005.
[2] Dixon S.L., *Fluid Mechanics and Thermodynamics of Turbomachinery,* Elsevier, 5e, 2002, London.
[3] Modi and Seth, Hydraulics and *Fluid Mechanics including Hydraulic Machines,* Rajsons Publication Pvt Ltd, N Delhi, 5e, 2000.
[4] Lal Jagdish, *Hydraulic Machines,* Metropolitan Book Company, 1995.

Course Outcomes (COs)

CO	After completion of the course, students will be able to:
CO1	Apply conservation laws and fluid mechanics principles to analyze forces, momentum transfer, and torque in hydraulic systems such as conduits, vanes, and sprinklers
CO2	Perform dimensional analysis and modeling using Buckingham π theorem and similitude laws to design, interpret, and evaluate physical models of fluid flow.
CO3	Compute the performance of hydraulic turbines (Pelton, Francis, Kaplan, etc.) by interpreting velocity triangles, efficiency parameters, governing methods, and comparing them with other energy-conversion devices.
CO4	Analyze and design pump systems including rotodynamic and positive displacement pumps, assessing constructional details, performance characteristics, efficiencies, and operational configurations (series, parallel, multistage).
CO5	Diagnose pressure transients in fluid systems such as cavitation and water hammer by understanding their causes, measurement techniques, and prevention strategies to ensure safe and efficient operation of fluid machinery.

CO-PO-PSO Mapping

Course Name: **Fluid Machine** Course Code: **6RMPC3**

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	0	0	0	0	1	2	2	2	0
CO2	3	3	2	3	2	0	0	0	0	1	2	2	2	0
CO3	3	3	3	2	2	1	2	0	0	1	2	2	2	0
CO4	3	3	3	2	3	1	2	0	0	1	2	2	2	0
CO5	3	3	2	3	2	2	3	0	0	1	2	2	2	1
Avg	3	3	2.4	3	2.4	0.8	1.4	0	0	1	2	2	2	0.2