

UCH611: FLUID MACHINERY

L	T	P	Cr
3	1	0	3.5

Course Objectives:

To understand the construction and working of fluid machinery and their applications in process industry.

Introduction: Physical properties of hydraulic fluids, Energy and power in hydraulic systems, Frictional losses in hydraulic pipelines, Model laws and similarity coefficients, Axial thrust, Radial thrust and rotor dynamics.

Centrifugal Pumps: Characteristics of centrifugal pumps, Control of centrifugal pumps, Startup time for centrifugal pump, Rundown time for centrifugal pump, Pumping special liquids (viscous liquids, gas-liquid mixtures, hydrocarbons, and solid liquid mixtures), Minimum flowrate, Admission temperature rise

Reciprocatory pumps: Working, Design, and Applications.

Pump Selection: Parameters involved in pump selection, Types of pumps, Performance data for centrifugal pumps, Affinity laws for centrifugal pumps, The operating point of a pump and pump selection, Suction head, Net positive suction head, Net positive suction head available, Net positive suction head required, Piping system design and pump selection procedure..

Applications of Pumps in Chemical Industry: Chemical pumps, Pumps for oil and gas, Booster pumps for feed pump, Condensate pumps, Cooling water pumps, Main reactor coolant pumps and reactor circulating pumps, Safety related auxiliary pumps for nuclear power stations, Pumps for pulp and paper industry, Pumps for metallic refining industry, Pumps for fertilizer industry, Pumps for sugar industry, Pumps for water, Vibration and noise in pumps.

Fans, Blowers, Compressors, and The Flow Of Gases: Classification of Fans, Blowers, and Compressors, Flow of Compressed Air and Other Gases in Pipes, Axial flow compressors and fans: velocity diagram of compressor stage, Thermodynamics of compressor stage, Stage loss relationships and efficiency, Reaction ratio, Choice of reaction, Stage loading, Simplified off design performance, Stage pressure rise, Pressure ratio of multistage compressors, Control of flow instabilities.

Pump Materials and Corrosion: Factors affecting the corrosion, General considerations affecting the choice of the material, Forms of corrosion.

Turbines: Types, Design, and Their applications.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. perform calculations related to pumps and its operation
2. design pumps, compressors, and turbines
3. select the pumps, compressors, and turbines for various industrial needs and operations.

Textbooks:

1. *Sulzer Pumps, Centrifugal Pump Handbook, Butterworth Heinemann (2010).*
2. *Lobanoff, V. S. and Ross, R. R., Centrifugal Pumps Design and Application, Butterworth Heinemann (1992).*

Reference Books

1. *McCabe, W. L., Smith, J. C., and Harriott, P., Unit Operations of Chemical Engineering, McGraw Hill (2005).*
2. *Esposito, Anthony, Fluid Power with Applications, Prentice Hall (2008).*
3. *Finnemore, E.J. & J.B. Franzini, Fluid Mechanics with Engineering Applications, McGraw-Hill (2002).*
4. *Mott, Robert L., Untener, J.A., Applied Fluid Mechanics, Prentice Hall (2015).*
5. *Dixon, S.L., Fluid Mechanics and Thermodynamics of Turbomachinery, Butterworth Heinemann (2005).*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May includes tutorials/assignments/quiz's etc)	25