

Branch Name:	Mechanical Engineering
Program Code:	ET402
Course Title:	Fluid Mechanics and Hydraulic Machines
Course Code:	2ET4020303
Pre-requisite Course:	-----

Course Objectives:

1. To understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's, energy and momentum equations.
2. To determine the co-efficient of discharge of venturi meter, notch, orifice etc.
3. The student will be able to understand the working and performance characteristics of various hydraulic machines like pumps and turbines.
4. To understand the application and working of various hydraulic devices generally used in industries.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
4	0	2	5	60	40	20	30	150

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction of fluid and its properties • Concept and classification of fluid. • Properties of fluid • Newton's law viscosity. • Simple numerical examples.	04	07
2	Fluid statics • Laws of fluid statics. • Types, working and applications of pressure measuring devices (Manometers and mechanical gauges) . • Selection criteria for pressure measuring devices.	07	12
3	Fluid kinematics • Concept of control volume. • Fluid flow a. Continuity and energy equation. b. Momentum equations (without derivation) and its application in impact of Jet. (The detail applications should be dealt in Unit VII.) c. Types of fluid flow. d. Flow patterns for ideal, laminar, turbulent and compressible fluid flow of one dimension. • Simple numerical problems on all above.	07	12
4	Fluid dynamics and flow measurement • Fluid energy-types and interrelations. • Euler's equation. a. Concept and definition. b. Understanding various terms in Euler's equation (No derivation). • Bernoulli's equation. a. Concept and definition. b. Limitations and assumptions. c. Derivation from Euler's equation. d. Applications.	12	22

	- Flow measurement. - Parameters and units of measurements related to following devices. - Devices- classifications, principle, working, applications with derivation. (Pitot tube, Venturi meter, Flow nozzle, Rota meter, Orifice, Notch). - Selection criteria for flow measuring device. - Simple numerical examples on all above.		
5	Flow through Pipes - Introduction to pipe and pipe flow. - Reynolds's experiment, friction factor, Darcy's equation, Moody's chart. - Water hammer effect. - Selection criteria for pipes and pipe sizes. - Simple numerical examples.	06	10
6	Hydraulic pumps & turbines - Concept and classification of pumps. - Detailed study (construction, working and applications) of - Centrifugal pump. - Reciprocating pump. - Submersible pump. - Rotary positive displacement type pumps like Gear pump and Van pump. - Vacuum pump. - Performance (efficiency, discharge, head, specific speed and power consumption) of centrifugal pump and reciprocating pump with simple numerical example. - Characteristic curves of centrifugal pump and reciprocating pump. - Need for priming of centrifugal pump. - Selection of pumps. Hydraulic prime movers (Turbine). - Classification, construction, working principle and applications of: - Pelton wheel. - Francis turbine. - Kaplan turbine. - Selection criteria of prime movers.	12	22
7	Hydro pneumatic elements and devices - Types, sketch, working, specifications, symbols and applications of hydraulic and pneumatic elements like: - Cylinder. - Valve. - Manifolds, etc. - Hydraulic devices- - Hydraulic press. - Hydraulic accumulator. - Hydraulic lift - Hydraulic ram - Hydraulic crane - Hydraulic intensifier. (Explain working of each with labelled schematic diagram, their specifications and Applications)	04	08
8	Impact of Jets - Impact of jet on flat and curved-stationary and moving plates. - Work done and efficiency calculations.	04	07

List of Practical:

1. Performance verification of Bernoulli's theorem
2. Flow measurement by Venturi meter.
3. Measure the fluid flow over Notch.
4. Measurement of Head losses in flow through pipes.
5. Study of different flows by Reynold's experiment.
6. Performance of Impulse turbine (Pelton wheel)
7. Study of reaction turbine (Francis & Kaplan turbine).
8. Performance testing of Centrifugal pump.
9. Performance testing of Reciprocating pump.
10. Finding the faults, reactions and remedies for C. F. pump.
11. Study of Hydraulic Devices.

Reference Books:

1. Fluid mechanics & hydraulic Machines. R.K.Bansal, Lakshmi publication
2. Fluid mechanics & hydraulic Machines. (in S.I. units), R.S.Khurmi, S.Chand & Co.Ltd
3. Hydraulic & Hydraulic machines, R.C. Patel & A.D. Pandya, Acharya Book Depot
4. Fundamental of fluid mechanics, Dr. D.S. Kumar, Ketson Pub. house

List of Open-Source Software/learning website:

1. www.youtube.com/watch?v=VyR8aeioQrU
2. http://www.youtube.com/watch?v=R6_q5gxf4vs
3. howstuffworks.com
4. <http://www.elearningsofttech.com/elearning-solutions-subjects-engineering-degree-diploma-courses/hydraulics-fluid-mechanics/>
5. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FLUID-MECHANICS/ui/TOC.htm>
6. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/TOC.htm>
7. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
8. <https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5>
9. <http://www.youtube.com/watch?v=0p03UTgpnDU>
10. <http://www.youtube.com/watch?v=A3ormYVZMXE>
11. <http://www.youtube.com/watch?v=TjzKpke0nSU>
12. <http://www.youtube.com/watch?v=vl7GteLxgdQ>
13. m. <http://www.youtube.com/watch?v=cIdMNOysMGI>

Course Learning Outcomes (CLO):

1. Describe fluid pressure and its measurement.
2. Understand various parameters associated with fluid flow.
3. Determine head loss of fluid flow through pipes.
4. Select relevant hydraulic pumps for different applications.
5. To apply and explain fluid equations in simple industrial situations.
6. To implement to develop different types of skills to select, operate and maintain fluid machinery based on fluid laws and characteristics.

Mapping of CLO with PO and PSO

Course	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	H	L											M			
CLO2	H	L	M		M							L	M	M		
CLO3	M	M	M										L	L		
CLO4	M												M	L		
CLO5	M	L			M							L	M	L		
CLO6	H	M				L							L		M	

H: High, M: Medium, L: Low