

Subject Code: 1ET4020303	Subject Title: Fluid Mechanics and Hydraulic Machines
Pre-Requisite	--

Rationale:

The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behaviour at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow. Hydraulic machinery plays an important role in the conversion of hydraulic energy to mechanical energy and vice-versa. Hydraulic turbines are used for meeting our day-to-day power demands. Also different types of pumps are essential equipment in all the industries. It is also tried to develop an understating of hydraulic & pneumatic devices generally used in industries through this course. Hydraulic systems have a wide range of applications in machine tools, material handling, marine, mining, metal processing, equipment and other fields. Similarly pneumatic control is extensively used as an effective method of automation technique.

Course Objective: -

- 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 venturimeter, notch, orifice etc.
- 3 The student shall 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 pneumatic devices generally used in industries

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
4	-	2	5	60	40	20	30

Subject Contents

SR. NO.	TOPIC	TOTAL HOURS	WEIGHTAGE (%)
1.	Fluid and fluid properties 1.1 Concept and classification of fluid. 1.2 Properties of fluid 1.3 Newton's law viscosity. 1.4 Simple numerical examples.	04	10
2.	Fluid statics 2.1 Laws of fluid statics. 2.2 Types, working and applications of pressure measuring devices (Manometers and mechanical gauges) . 2.3 Selection criteria for pressure measuring devices.	07	10
3.	Fluid kinematics 3.1 Concept of control volume. 3.2 Fluid flow i. Continuity and energy equation. ii. Momentum equations (without derivation) and its application in impact of Jet.(The detail applications should be dealt in Unit VII.) iii. Types of fluid flow. iv. Flow patterns for ideal, laminar, turbulent and compressible fluid flow of one dimension. 3.3 Simple numerical problems on all of above.	07	15
4.	Fluid dynamics and flow measurement 4.1 Fluid energy-types and interrelations. 4.2 Euler's equation. i. Concept and definition. ii. Understanding various terms in Euler's equation (No derivation). 4.3 Bernoulli's equation. i. Concept and definition. ii. Limitations and assumptions. iii. Derivation from Euler's equation. iv. Applications. 4.4 Flow measurement. i. Parameters and units of measurements related to following devices. ii. Devices- classifications, principle, working, applications without derivation. (Pitot tube, Venturi meter, Flow nozzle, Rota meter, Orifice, Notch). 4.5 Selection criteria for flow measuring device. 4.6 Simple numerical examples on all of above.	10	20
5.	Flow through pipes 5.1 Introduction to pipe and pipe flow. 5.2 Reynolds's experiment, friction factor, Darcy's equation, Moody's chart. 5.3 Water hammer effect. 5.4 Selection criteria for pipes and pipe sizes. 5.5 Simple numerical examples.	06	10

6.	Hydraulic pumps & prime movers 6.1 Concept and classification of pumps. 6.2 Detailed study(construction, working and applications) of i. Centrifugal pump. ii. Reciprocating pump. iii. Submersible pump. iv. Rotary positive displacement type pumps like Gear pump and Van pump. v. Vacuum pump. 6.3 Performance (efficiency, discharge, head, specific speed and power consumption) of centrifugal pump and reciprocating pump with simple numerical example. 6.4 Characteristic curves of centrifugal pump and reciprocating pump. 6.5 Need for priming of centrifugal pump. 6.6 Selection of pumps. Hydraulic prime movers (Turbine). 6.7 Classification, construction, working principle and applications of: i. Pelton wheel. ii. Francis turbine. iii. Kaplan turbine. 6.8 Selection criteria of prime movers.	12	20
7.	Unit – VII Hydro pneumatic elements and devices 7.1 Types, sketch, working, specifications, symbols and applications of hydraulic and pneumatic elements like: i. Cylinder. ii. Valve. iii. Manifolds, etc. 7.2 Hydraulic devices- i. Hydraulic press. ii. Hydraulic accumulator. iii. Hydraulic lift iv. Hydraulic ram v. Hydraulic crane vi. Hydraulic intensifier. (Explain working of each with labeled schematic diagram, their specifications and Applications)	10	15

Course Outcome:

The students will be able to

- 1 Identify how properties of fluids change with temperature and their affect on pressure and fluid flow.
- 2 Describe fluid pressure and its measurement.
- 3 Select a pump type and pump size to meet capacity and other pumping requirements.
- 4 To apply and explain fluid equations in simple industrial situations.
- 5 To implement with the aim to develop different types of skills to select, operate and

- maintain fluid machineries based on fluid laws and characteristics.
6 To Verify fluid flows, fluid characteristics and types of fluid.

List of Practical/ Experiments

Sr. No.	Practical/Exercises
1	Performance verification of Bernoulli's theorem
2	Flow measurement by Venturimeter
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.

List of References:

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 Software/Learning Websites, concerned subject:

- www.youtube.com/watch?v=VyR8aeioQrU
- http://www.youtube.com/watch?v=R6_q5gxf4vs
- howstuffworks.com
- <http://www.elearningsofttech.com/elearning-solutions-subjects-engineering-degree-diploma-courses/hydraulics-fluid-mechanics/>

- e. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FLUID-MECHANICS/ui/TOC.htm>
- f. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/TOC.htm>
- g. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
- h. <https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5>
- i. <http://www.youtube.com/watch?v=0p03UTgpnDU>
- j. <http://www.youtube.com/watch?v=A3ormYVZMXE>
- k. <http://www.youtube.com/watch?v=TjzKpke0nSU>
- l. <http://www.youtube.com/watch?v=vl7GteLxgdQ>
- m. <http://www.youtube.com/watch?v=cIdMNOysMGI>