

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**Course Title: FLUID MECHANICS AND HYDRAULIC MACHINES
(Code: 3331903)**

Diploma Programme in which this course is offered	Semester in which offered
MECHANICAL ENGINEERING	3rd Sem

1. RATIONALE :

Fluids Mechanics is branch of science which deals with the behaviour of fluid at rest as well of motion and subsequent effects. The numbers of fluid in engineering applications are enormous. Applications encompasses various engineering uses like water flow in pumps, turbines, flow through pipes, ships, etc. in addition to other applications like in breathing, blood flow, etc.

2. COMPETENCY

- Use hydraulic and pneumatic equipments (Pumps, Turbines, Press, Accumulator, Lifts etc.) comprising of hydraulic and pneumatic elements (pumps, motors, valves, cylinders, etc).

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Fluid and fluid properties	1a.Explain the effect of fluid properties on a flow system.	1.1 Concept and classification of Fluid. 1.2 Properties of fluid. 1.3 Newton’s law of viscosity. 1.4 Simple Numerical Examples.
Unit – II Fluid statics	2a. Select and use pressure measuring devices.	2.1 Laws of fluid statics. 2.2 Types, working and applications of pressure measuring devices (Manometers and Mechanical gauges) with simple Numerical examples. 2.3 Selection criteria for pressure measuring devices.
Unit – III Fluid kinematics	3a. Identify type of fluid flow patterns. 3b. Describe and use Continuity equation to one dimensional fluid flow situations.	3.1 Concept of control volume. 3.2 Fluid Flow i. Continuity and Energy Equation. ii. Momentum Equations and its application in Impact of Jet. 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.

<p>Unit – IV</p> <p>Fluid dynamics and Flow Measurement</p>	<p>4a. Explain and Apply Fluid equations (Energy, Momentum and Bernoulli's) in simple Industrial situations.</p> <p>4b. Select and use flow measuring devices based on given situation.</p>	<p>4.1 Fluid energy-types and interrelations.</p> <p>4.2 Euler's Equation.</p> <ol style="list-style-type: none"> i. Concept and definition. ii. Understanding Various terms in Euler's Equation (No derivation) <p>4.3 Bernoulli's Equation.</p> <ol style="list-style-type: none"> i. Concept and definition. ii. Limitations and assumptions. iii. Derivation from Euler's Equation. iv. Applications. <p>4.4 Flow Measurement.</p> <ol style="list-style-type: none"> i. Parameters and units of measurements. ii. Devices- classifications, principle, working, applications without derivation. (Pitot tube, Venturi meter, Flow nozzle, Rotameter, Orifice, Notch). <p>4.5 Selection criteria for flow measuring device</p> <p>4.6 Simple Numerical Examples on all of above.</p>
<p>Unit – V</p> <p>Flow through pipes</p>	<p>5a. Explain water hammer and surge tank</p> <p>5b. Select pipe of appropriate size based on given situation.</p>	<p>5.1 Introduction to Pipe and Pipe flow.</p> <p>5.2 Reynolds's experiment, friction factor, Darcy's equation Moody's chart.</p> <p>5.3 Water hammer effect.</p> <p>5.4 Selection criteria for pipes and pipe sizes</p> <p>5.5 Simple numerical examples</p>
<p>Unit – VI</p> <p>Hydraulic pumps & prime movers</p>	<p>6a. Select and use an appropriate pump with reference to given application.</p> <p>6b. Estimate performance parameters of a given Centrifugal and Reciprocating Pump.</p> <p>6c. Interpretate characteristic curves of a given pump.</p> <p>6d. Select an appropriate turbine with reference to given situation.</p>	<p>6.1 Pumps.</p> <p>6.1.1 Concept and Classification of Pumps.</p> <p>6.1.2 Detailed Study(Construction, Working and application) of</p> <ol style="list-style-type: none"> i. Centrifugal Pump ii. Reciprocating Pump iii. Turbine Pump iv. Submersible Pump v. Rotary Positive Displacement Type pumps vi. Gear Pump

		<p>6.1.3 Performance (Efficiency, Discharge, Head, Specific Speed and Power Consumption) of Centrifugal Pump and Reciprocating Pump with Simple Numerical Example.</p> <p>6.1.4 Characteristic Curves of Submersible and Centrifugal Pumps.</p> <p>6.1.5 Need For Priming of Centrifugal Pump.</p> <p>6.1.6 Selection of Pumps.</p> <p>6. 2 Hydraulic Prime Movers (Turbine).</p> <p>6.2.1 Classification, Construction, Working Principle and Application of</p> <ol style="list-style-type: none"> i. Pelton Wheel ii. Francis Turbine iii. Kaplan Turbine <p>6.2.2 Performance of prime movers</p> <p>6.2.3 Selection of Prime movers.</p>
<p>Unit – VII</p> <p>Hydro pneumatics elements and devices</p>	<p>7a.Select and use proper hydro-pneumatic devices/equipments.</p>	<p>7.1 Types, working, specifications, symbols and applications of hydraulic and pneumatic elements like:</p> <ol style="list-style-type: none"> i. Cylinder. ii. Valve. iii. Manifolds etc. <p>7.2 Hydraulic Devices</p> <ol style="list-style-type: none"> i. Hydraulic Press. ii. Hydraulic Accumulator iii. Hydraulic Lift iv. Hydraulic Ram v. Hydraulic Crane vi. Hydraulic Coupling vii. Hydraulic Intensifier. <p>(Explain working of each with labelled diagram, their specifications and Applications)</p>

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Fluid and fluid properties	04	2	2	2	06
2	Fluid statics	08	2	4	4	10
3	Fluid kinematics	08	2	4	4	10
4	Fluid dynamics and flow measurement	10	4	4	4	12
5	Flow through pipes	06	2	4	2	08
6	Hydraulic pumps & prime movers	10	2	4	6	12
7	Hydro pneumatics elements and devices	10	2	6	4	12
Total		56	16	28	26	70

6. Notes:

- i) This specification table shall be treated as only general guideline for students and Teachers. The actual distribution of marks in the question paper may vary from above Table.
- ii) If midsem test is part of continuous evaluation, unit numbers I, II, IV and V are to be Considered. It is also compulsory for student to complete experiment.no.1 to 5 to eligible for midsem test.
- iii) Ask the questions from each topic as per marks weightage. Optional questions must be asked from the same topic. That is weightage of compulsory attendance part of Questions will be equal to marks allotted to each topic.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency.

Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Demonstrate various fluid properties.	2
2	II	Measure pressure using: i. Various manometers. ii. Various Pressure gauges. Demonstration of pressure measuring device such as different Mano meter and mechanical gauges	4
3	IV	Verify Bernoulli's theorem.	2
4	IV	Measure fluid flow by Venturimeter and Nozzle.	4
5	IV	Measure fluid flow by Orifice meter and "V" Notch.	2

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
6	III & V	Estimate Reynolds number using given test rig.	2
7	V	Determine Major and Minor Head Loss through pipes	2
8	VI	Perform testing of centrifugal pump as per BIS	2
9	VI	Perform testing of Reciprocating pump as per BIS	2
10	VI	Perform testing of Pelton wheel.	2
11	VII	Demonstration of Hydraulic and Pneumatic Devices	2
12		Seminar presentation(individual activity)	2
Total			28

8. NOTES:

1. It is compulsory to prepare log book of exercises. It is also required to get each Exercise recorded in logbook, checked and duly dated signed by teacher.
2. Student activities are compulsory and are also required to be performed and noted in logbook.
3. Term work report must not include any photocopy/ies, printed manual/pages, lithos, etc. It must be hand written / hand drawn by student only.
4. For 20 marks ESE, students are to be assessed for competencies achieved.

9. SUGGESTED LIST OF STUDENT ACTIVITIES

1	Prepare a tabulated summery for types of fluid which is available around you. (Summery includes properties of fluid indicated in chapter-1)
2	List out any five pressure measuring devices available in market with its specifications and current market price.
3.	Prepare a tabulated summery for types of pipes available in market. (Summery includes type, specification, size range, material, rate and applications).
4	Identify any one hydraulic pump and one prime mover available in market in a group of five students with detail specifications and current price.

10. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
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	Prof.R.C.Patel& A.D.Pandya	Acharya Book Depot
4	Fluid mechanics& hydraulic	A.R.Basu	DHANPAT RAI&

5	Fundamental of fluid mechanics(in S.I. units)	Dr. D.S.Kumar	Ketson Pub. house
6	Fluid mechanics& hydraulic machines	S.C.Gupta	PERSON Education
7	Hydraulic Machines & Fluidies	Dr.Jagdishlal book co.	Metropolitan
8	Industrial Pneumatic control	Z.J.Lansky	Marcel Dekker,Inc

(B) List of Major Equipment/Materials

1. Different Manometer
2. Hydraulic Test Rig.
3. Centrifugal Pump Test Rig.
4. Reciprocating pump Test Rig.
5. Hydraulic prime movers (Pelton wheel) Test Rig.
6. Working Models and Charts of Hydraulic Devices.
7. Reynolds's Experiment Test Rig.

(C) List of Software/Learning Websites, concerned subject.

- www.youtube.com/watch?v=VyR8aeioOrU
- http://www.youtube.com/watch?v=R6_q5gxf4vs

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE:

Faculty Members from Polytechnics

1. H.R.SAPRAMER(Sr.Lecturer in Mechanical)
2. M.P.JAKHANIYA(Sr.Lecturer in Mechanical)
3. V.P.PATEL(Lecturer in Mechanical)
4. H.K.PATEL(Lecturer in Mechanical)

Coordinator and Faculty Members from NITTTR Bhopal