

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT****COURSE CURRICULUM****FUNDAMENTALS OF FLUID MECHANICS****(Code :3340102 )**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Aeronautical Engineering	Fourth

**1. 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 thereby developing an understanding of fluid dynamics in variety of fields. Applications of these basic equations have been highlighted for flow measurements. This course will lay sound foundation for aerodynamics.

**2. LIST OF COMPETENCIES**

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

→ **Select, operate and maintain fluid machinery based on fluid laws and characteristics.**

**3. TEACHING AND EXAMINATION SCHEME.**

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				
				<b>Theory Marks</b>		<b>Practical Marks</b>		<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
04	00	02	06	70	30	20	30	

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

**4. DETAILED COURSE CONTENTS**

<b>Unit</b>	<b>Major Learning Topics and Sub-topics</b>	<b>Outcomes (in cognitive domain)</b>
<b>UNIT- I INTRODUCTION</b>	1.a 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 viscosity. 1.4 Simple numerical examples.
<b>UNIT- II FLUID STATICS &amp; ITS APPLICATIONS</b>	2.a 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.
<b>UNIT- III FLUID KINEMATICS</b>	3.a Identify type of fluid flow patterns. 3.b 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 (without derivation) 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
<b>UNIT- IV FLUID DYNAMICS AND FLOW MEASUREMENT</b>	4.a Explain and Apply Fluid equations (Energy, Momentum and Bernoulli's) in simple Industrial situations. 4.b Select and use flow measuring devices based on given situation.	4.1 Fluid energy-types and interrelations. 4.2 Euler's equation. i. Concept and definition. ii. Understanding various terms in Euler's equation 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.
<b>UNIT– V FLOW THROUGH PIPES</b>	5.a Explain water hammer and surge tank 5.b Select pipe of appropriate size based on given situation.	5.5. 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.

### 5. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY).

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	INTRODUCTION	04	03	03	03	9
II	FLUID STATICS & ITS APPLICATIONS	08	03	03	08	14
III	FLUID KINEMATICS	09	03	04	08	15
IV	FLUID DYNAMICS AND FLOW MEASUREMENT	10	04	07	08	19
V	FLOW THROUGH PIPES	09	03	05	05	13
<b>TOTAL</b>		40	16	22	32	70

**Legends:** R = Remember U= Understand; A= Apply and above levels (Bloom’s revised taxonomy).

### 6. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The tutorial exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned competencies.

SR. NO.	UNIT NO.	EXPERIMENT
1	I	Demonstrate various fluid properties.
2	II	Demonstrate and Measure pressure using: i. Various manometers. ii. Various Pressure gauges.
3	IV	Verify Bernoulli’s theorem.
4	IV	Measure fluid flow by Venturimeter and Nozzle.
5	IV	Measure fluid flow by Orifice meter and “V” notch.
6	III & V	Estimate Reynolds number using given test rig.
7	V	Determine major and minor head loss through pipes.

**7. SUGGESTED LIST OF STUDENT ACTIVITIES.**

Following is the list of proposed student activities like:

**SR.NO. ACTIVITY**

- 1 Prepare a tabulated summary for types of fluid which is available around you. (Summary includes properties of fluid indicated in unit -1).
- 2 List out any five pressure measuring devices available in market with its specifications and current market price.
3. Prepare a tabulated summary for types of pipes available in market. (Summary include type, specification, size range, material, rate and applications).
4. Course/library/internet/lab based mini-projects etc.

**NOTE** These could be individual or group-based.

**8. SUGGESTED LEARNING RESOURCES.****A. List of Books:**

SR. NO.	TITLE OF BOOK	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.	Fluid mechanics& hydraulic	A.R. Basu	Dhanpat Rai
4.	Fundamental of fluid CO. mechanics(in S.I. units)	Dr. D.S. Kumar	Ketson Pub. house
5.	Fluid mechanics & hydraulic machines	S.C. Gupta	PERSON Education

**B. List of Major Equipment/ Instrument**

- a. Different manometers.
- b. Pitot tube.
- c. Various mechanical pressure gauges.
- d. Hydraulic test rig-comprising facilities to verify Bernoulli's theorem , to measure fluid flow by Venturimeter ; nozzle; orifice meter , rota meter, "V" notch and major and minor head loss through pipes.
- e. Reynolds's experiment test rig

**C. List of Software/Learning Websites**

- a. [www.youtube.com/watch?v=VyR8aeioQrU](http://www.youtube.com/watch?v=VyR8aeioQrU)
- b. [http://www.youtube.com/watch?v=R6\\_q5gxf4vs](http://www.youtube.com/watch?v=R6_q5gxf4vs)
- c. [howstuffworks.com](http://howstuffworks.com)
- d. <http://www.elearningsofttech.com/elearning-solutions-subjectsengineering-degree-diploma-courses/hydraulics-fluid-mechanics/>
- e. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IITKANPUR/FLUID-MECHANICS/ui/TOC.htm>

- f. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IITKANPUR/machine/ui/TOC.htm>
- g. [https://www.youtube.com/watch?v=F\\_7OhKUYV5c&list=PLE17B519F3ACF9376](https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376)
- h. <https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5>

## **9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**

### **Faculty Members from Polytechnics.**

- **Prof. ANKIT PATEL**, H.O.D., Aeronautical Dept. Parul institute of engg. & tech-Diploma studies.
- **Prof. KARNAIL SAINI**, Lecturer. Aeronautical Dept. Parul institute of engg. & tech-Diploma studies.

### **Coordinator and Faculty Members from NITTTR Bhopal.**