GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3153515
Semester –V
Subject Name: Elements of Fluid Mechanics

Type of course: Open Elective

Prerequisite: A good understanding regarding basic states of matter along with behavior of fluid under static and dynamic conditions. Mathematical background is also essential in this respect.

Rationale: This subject is intended to make students aware about types and behavior of fluid with the fundamentals underlying the operation of fluid for Environmental Science & Technology students. Apparently, the subject aims at measurement techniques involved for the pressure concepts, fluid flow and equipments used for the transportation of fluids.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to fluid flow and its application:** Fluid –Distinction between solid and fluid – Units and dimensions – Properties of fluids & its classification, Pressure, Pressure measurement scales, Manometers – different types of manometers. Fluid flow phenomena, Boundary layer, Transition length, Wake formation, Continuity equation, Bernoulli's equation, Correction factors in Bernoulli's Equation, Pump Work. Shear stress distribution, friction factor, Hagen Poiseuille's Equation, Flow through non-circular cross sections, Friction loss from sudden expansion or contraction of cross section and fittings and valves, Form friction and skin friction.	**10**
2	**Fluid Flow machinery:** Introduction to fluid flow measuring instruments like Venturimeter, Orificemeter, area meters like Rota meter, target meters, Coriolis meters, Magneticmeters. Pumps, its characteristics like developed head, Suction lift and Cavitation, Performance Evaluation of pumps, Positive displacement pumps like reciprocating, rotary pumps, Centrifugal pump.	**10**

3	**Flow past Immersed bodies:** Drag, Drag Coefficients, Stream lining, Stagnation pressure. Flow of fluid through a bed – Fluidization, Types of fluidization and applications. Motion of particles through fluids	**04**
4	**Agitation and Mixing:** Impellers and its use in various Environmental applications, Types, Flow pattern in agitated vessels, Swirling and its prevention, Power consumption in agitated vessels, Power correlations. Blending and Mixing-In process vessels	**04**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**15**	**10**	**8**	**7**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. W.L.Mc.Cabe, J.C.Smith and P.Harriot, "Unit operations of chemical engineers", McGraw Hill International edition VII.
2. Chemical Engineering Vol.I and II by Coulson and Richardson. Pergamon Press Publications.
3. Noel de.Nevers, "Fluid mechanics for Chemical Engineers", McGraw Hill International edition.
4. Fluid Mechanics – Basic Concepts and Principles. Shiv Kumar, Ane Books Private Limited
5. Fluid Mechanics by R P Vyas, Denett – Central Techno Publications
6. Fluid Mechanics and Machinery by R P Vyas, Denett– CentralTechno Publications

Course Outcomes:

After undergoing this course the students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Identify and classify fluids based on their physical properties	20
CO-2	Distinguish flow regime in various flow situations with forces acting on fluid element	20

CO-3	Understand practical application regarding transportation and metering of fluids	20
CO-4	Illustrate working characteristics of fluid transportation devices	19
CO-5	Demonstrate the case of flow past immersed bodies	15
CO-6	Differentiation of regimes and equipments used for agitation and mixing of fluids.	6

List of Experiments:

1. Verification of Bernoulli's Equation.
2. Frictional pressure drop in a circular pipe
3. Determination of Hydraulic coefficients of Orifice.
4. Calibration of Rotameter
5. Determination of discharge coefficient of V – notch.
6. Estimation of viscosity of fluid by Stoke's law
7. Frictional pressures drop in annular pipe.

List of Open Source Software/learning website:

• Reference to NPTEL lectures can be made for a better understanding regarding various unit operations.