

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ENVIRONMENTAL ENGINEERING (13)

BASICS OF ENVIRONMENTAL HYDRAULICS

**SUBJECT CODE:** 2141307

B.E. 4<sup>TH</sup> SEMESTER

**Type of course:** Applied Science

**Prerequisite:** None

**Rationale:** To impart fundamental knowledge of hydraulics as applicable in Environmental Engg

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	2	0	5	70	20	10	30	0	20	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	Properties of Fluid : Types of Fluid, Properties of Fluid, Fluid as a Continuum ,Control Volume Concept	02	5
2	Hydrostatics: Fluid Pressure at a point, Pressure-height relationship, Absolute, gauge and atmospheric pressure, Measurement of pressure using various types of manometer, Intensity of pressure, Centre of pressure Pressure on horizontal, vertical and inclined surfaces, curved surface.	04	10
3	Basics of Fluid Kinetics & Dynamics: Different types of flow, Continuity Equation, Euler's Equation Bernoulli's Equation and its application, Flow measurement using pitot tube, venturi meter and pipe orifices	04	10
4	Flow Through Pipes: Major and minor losses of energy in pipes , Hydraulic gradient and total energy line, Flow through pipes in series, in parallel, equivalent pipe Flow through branch pipe	06	15
5	Flow through orifice and Mouthpiece Classification of orifices & concept of venacontracta, Hydraulic Coefficient, Discharge through small orifice, large orifice, fully-submerged orifice & partially-submerged orifice, Time of emptying a tank through an orifice of rectangular tank, hemi-spherical tank and circular horizontal tank, Classification of mouthpieces, Discharge through an external cylindrical mouthpiece, convergent-divergent and an internal mouth piece	08	20
6	Flow Through Notches and Weirs Classification of notches and weirs, Discharge through a rectangular	08	20

	notch or weir, triangular notch or weir, trapezoidal notch or weir and stepped notch, Velocity of approach , Empirical formula for discharge through rectangular weir, cipolletti weir or notch , Discharge over a broad-crested weir, narrow-crested weir and submerged weir Time emptying a tank with rectangular and triangular weir or notch		
7	Flow through open channel Types of open channel and types of flow, Empirical formula for determination of flow through open channel Most efficient cross section for rectangular channel, trapezoidal channel and triangular channel	08	20

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
<b>10</b>	<b>10</b>	<b>20</b>	<b>15</b>	<b>15</b>

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Fluid mechanics V.L.Streeter and E.B. Wylie, Mcgraw Hill, 1985, New York
2. Theory and applications of fluid mechanics K Subramanya, Tata Mcgraw Hill Publishing Co, 1993, New Delhi
3. Introduction to fluid mechanics E.J. Shaughnessy, I.M. Katz, and J.P Schaffer, SI Edition 2005, Oxford University press, New Delhi.
4. Fluid Mechanics, F.M. White 5<sup>th</sup> edition, McGraw Hill, New York.
5. Fluid Mechanics by Dr. D.S. Kumar
6. Fluid Mechanics & Hydraulic Mechanics by Dr.P.N. Modi & Sheth
7. Fluid Mechanics By Dr. A.K. Jain
8. Hydraulic Fluid Mechanics & Fluid Mechanics By S. Ramamruthan
9. Engineering Fluid Mechanics By R.J. Grade & A.C Mirajgaoker

**Course Outcome:**

After learning the course the students should be able to:

1. Solve the problems related to properties of fluids.
2. Apply the concepts of fluid statics and dynamics.
3. Apply the concepts of flow measurement and use of flow measuring devices.
4. Solve the problems related to flow through pipes and channels.
5. Solve the problems based on flow through weirs, notches, orifices and mouthpieces.

**List of Tutorials:**

Following is the list of assignments.

1. Assignments on Properties of Fluid
2. Assignments on Hydrostatics
3. Assignments on Basics of Fluid Kinetics & Dynamics
4. Assignments on Flow Through Pipes
5. Assignments on Flow through orifice and Mouthpiece
6. Assignments on Flow Through Notches and Weirs
7. Assignments on Flow through open channel
8. Actual flow measurement through pipes, orifices, weirs notches
9. Actual pressure measurement in pipes

**Active Learning Assignments (ALA) :** Preparation of power-point slides: which may include videos, animations, pictures, graphics for better understanding of theory and practical work. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus can be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of faculty and the department.