GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Environmental Engineering
Subject Code: BE03013021
Subject Name: Basics of Environmental Hydraulics

w.e.f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Professional Core Course

Prerequisite:	System of units, Laws of motion, Basic idea of force
Rationale:	To impart fundamental knowledge of hydraulics as applicable in Environmental Engg

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Relate the properties of fluids with context of environmental hydraulics.
02	Examine the application of hydrostatics, kinematics & dynamics & flow measurement techniques.
03	Solve the problems related to flow through pipes, orifice and mouthpiece for conveyance of water.
04	Identify field application of notches, weirs & open channel in environmental hydraulics.

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

CourseContent:

Unit No.	Content	No. of Hours	% of Weightage
1	**Properties of Fluid:** Types of Fluid, Properties of Fluid, Fluid as a Continuum, Control Volume Concept	**02**	**10**
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 on horizontal, vertical and inclined surfaces, curved surface.	**06**	**15**
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 Floe through branch pipe	**06**	**15**
5	**Flow through orifice and mouthpiece:**Classification of orifices & concept of vena contracta, 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 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	**09**	**15**
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	**10**	**15**
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	15	15	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: EvaluateC: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. A Textbook of Fluid mechanics and Hydraulic Machine by Dr. R. K. Bansal, Laxmi Publications
2. Fluid mechanics V.L.Streeter and E.B. Wylie, Mcgraw Hill, 1985, New York
3. Theory and applications of fluid mechanics K Subramanya, Tata Mcgraw Hill Publishing Co, 1993, New Delhi
4. Introduction to fluid mechanics E.J. Shaughnessy, I.M. Katz, and J.P Schaffer, SI Edition 2005, Oxford University press, New Delhi.
5. Fluid Mechanics, F.M. White 5th edition, McGraw Hill, New York.
6. Fluid Mechanics & Hydraulic Mechanics by Dr.P.N. Modi & Sheth
7. Hydraulic Fluid Mechanics & Fluid Mechanics By S. Ramamruthan
8. Engineering Fluid Mechanics By R.J. Grade & A.C Mirajgaoker

(b) Open sources of software and website: Virtual Lab, NPTEL

Suggested Course Practical List: Students will have to perform following experiments in laboratory and prepare the laboratory manual.

1. Measurement of viscosity (Verification of Stokes law)
2. Study of pressure measurement devices
3. Study Characteristics of Laminar and Turbulent flows (Reynolds experiment)
4. Calibration of flow measuring devices –Venturi Meter
5. Calibration of flow measuring devices – Orifice meter
6. Calibration of Rectangular and V notch.

List of Laboratory Resources Required:

- Viscometer
- Pitot tube
- Venturi meter
- Manometer

- **List of suggested activities for Problem Based Learning:**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Laboratory Visit- pollution parameters analysis laboratory of State Government/ Central Government /Gujarat Pollution Control Board/Water Supply Board	Visit = 5hrs, Report preparation = 3hrs Total = 8hrs	Based on the report submitted. The report should contain observations and calculations of laboratory data.
2.	Technical Video based learning related to subjects offered during semester	Duration of video : 5hrs Report preparation : 5hrs Total = 10hrs	Multiple choice questions based Assessment
3.	Explore applications of Water GeM, Sewer GeM, EPANET Software	Duration=5 hrs	Based on report preparation using Software input data.
4.	Secondary data compilation and its analysis related to pollution/environment attributes from relevant International/Central/State Government Websites	Duration=5 hrs	Technical Presentation of data using statistical methods in form of report/presentation
5.	Preparation of working/Nonworking model for flow measuring devices	Duration=10 hrs	Based on project display considering technical aspects
6.	Poster presentation on laboratory practices, firefighting systems, water supply systems, sewerage systems	Duration=5 hrs	Based on poster/chart preparation and presentation skills
7	Survey related to water demand of residential area/ institutional area/commercial area/hospitals, survey on water distribution system	Duration=5 hrs Report preparation = 5hrs Total=10 hrs	Based on data collection and its report presentation
8	Mock-drill for chemistry laboratory safety using Institute firefighting facilities	Duration=5 hrs	Based on Active participation student
9	Participation in Workshop/seminar related to environmental engineering	Duration = 6 hrs	Based on participation certificate
10	Preparation of technical report from reference book on given topic	Duration=5 hrs	Based on Report preparation

11	Assignments/numericals related to subject	Duration=10 hrs	Based on submission of given assignments
12	Self-learning through online courses related to subjects	Duration=10 hrs	Multiple choice questions-based Assessment

Note:

- All the suggested activities should be related to the subject.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity.
- Rubrics for the evaluation can be prepared by the faculty.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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