



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Civil Engineering / Environmental Engineering

Subject Code: DI04000151

Subject Name: Hydraulics

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	PCC / Professional Elective - I

Prerequisite:	Proficiency in physics and mathematics
Rationale:	Hydraulics is a fundamental subject in diploma engineering, particularly for students in the civil and related disciplines. This subject equips students with essential knowledge of fluid statics, fluid dynamics, pressure measurement, flow through pipes and channels, and hydraulic machines. Such concepts are vital for designing and maintaining water supply systems, irrigation networks and hydraulic structures. Introducing Hydraulics at this level ensures that students develop analytical skills, problem-solving abilities, and technical competence needed for higher-level courses and real-world engineering applications. It bridges theoretical principles with practical engineering challenges, thus preparing engineering graduates for both industry roles and further academic pursuits.

Course Outcome:

After completion of the course, the student will be able to:

No	Course Outcomes	RBT Level
01	Measure the pressure of a fluid using various pressure measuring devices.	R, U, A
02	Compute Hydrostatic pressure for different conditions	R, U, A
03	Compute discharge and energy of flowing fluid using continuity and Bernoulli's equation	R, U, A
04	Compute head loss of fluid flowing through pipes	R, U, A
05	Compute discharge through open channel flow using various formulas	R, U, A

*Revised Bloom's Taxonomy (RBT)



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction, Pressure and pressure measurement 1.1 Terminologies and Definitions used in fluid mechanics: Fluid Mechanics, Hydrostatics, Hydro-kinematics, Hydro-Dynamics- Ideal and Real Fluid. 1.2 Properties of a fluid: Viscosity, Density, Specific Gravity, Surface Tension, Capillarity, Vapour Pressure, Elasticity. 1.3 Various types of pressure. 1.4 Measurement of pressure or difference of pressure by various methods.	05	14% (10 marks)
2.	Hydrostatics 2.1 Relationship between pressure and depth of liquid. 2.2 Pressure diagram for different conditions. 2.3 Total pressure and center of pressure 2.4 Computation of Total Pressure and depth of center of pressure	08	14% (10 marks)
3.	Hydro kinematics & Hydrodynamics 3.1 Types of flow - Laminar -Turbulent, Uniform-Non-uniform, Steady-Un-steady, Rotational and irrotational, One-, Two- and Three-Dimensional flow 3.2 Reynold's number. 3.3 Discharge & its units, Continuity Equation. 3.4 Types of Energy – Potential, Pressure, and kinematics. 3.5 Bernoulli's theorem: statement, assumptions, derivation & limitations. 3.6 Practical application of Bernoulli's theorem	12	23% (16 marks)
4.	Flow through pipes 4.1 Characteristics of flow through pipes	10	26% (18 marks)



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	<p>4.2 Major Head losses in pipe: Computation by Darcy's Weisbach equation, Use of Chezy's & Manning's formula, Nomograms.</p> <p>4.3 Computation of minor head losses in a pipe.</p> <p>4.4 Hydraulic Gradient Line (HGL) and Total Energy Line (TEL)</p> <p>4.5 Flow through pipes in series (Compound Pipe) and pipes in parallel. Equivalent Pipe.</p> <p>4.6 Discharge measurement using orifice</p> <p>4.7 Various Hydraulic Coefficient and its relation</p>		
5.	<p>Flow through Open Channel</p> <p>5.1 Definition and classification of channel</p> <p>5.2 Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius, hydraulic mean depth for rectangular and trapezoidal channel section, Froud's number,</p> <p>5.3 Determination of discharge by Chezy's equation and Manning's equation, Bazin's equation, and Kutter's equation. (Without derivation).</p> <p>5.4 Conditions for the most economical section: rectangular, Trapezoidal, and circular section of open channel. (Without derivation).</p> <p>5.5 Discharge measuring devices: Triangular and rectangular Notches.</p> <p>5.6 Computation of discharge through different types of weir: Narrow, Broad, Sharp crested weir; Cippoletti weir and Ogee weir.</p> <p>5.7 Specific energy diagram.</p> <p>5.8 Hydraulic jump.</p>	10	23% (16 marks)
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
25	35	40	-	-	-

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



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References/Suggested Learning Resources:

(a) Books:

Sr. No	Title of Book	Author	Publication with place, year and ISBN
1	Hydraulics, Fluid Mechanics and Hydraulic machine	R K Bansal	S.Chand
2	Hydraulics, Fluid Mechanics and Hydraulic machine	S.Ramamrutham	Dhanpat Rai
3	Hydraulics, Fluid Mechanics and Hydraulic machine	R. S. Khurmi	S.Chand
4	Fluid Mechanics	A K Jain	Khanna Publishers
5	Hydraulics and Hydraulic machine	Prof.V.P.Priyani	Charotar Publication
6	Journal of experiments in Hydraulics	Rao and Hasan	New Height
7	Hydraulic laboratory	Rao and Hasan	New Height
8	Fluid Mechanics	Dr.M.L.Mathur	Std.Publication
9	Fluid Mechanics & Hydraulics	S.C.Gupta	Pearson Education

(b) Open source software and website:

List of **open-source (or free-to-use)** software tools that can be used for teaching or learning **Hydraulics**:

1. www.nptel.iitm.ac.in.
2. <https://www.vlab.co.in/>
3. <https://phet.colorado.edu/>
4. www.waterbouw.tudelft.nl/
5. <https://watersupply.gujarat.gov.in/>
6. <https://guj-nwrws.gujarat.gov.in/>



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Suggested Course Practical List:

Sr. No.	Practicals	Unit No.	Approx. Hrs. required
1	Measure the pressure of water in pipe using (a) Piezometer (b) Different types of manometers	1	2
2	Determine discharge through a given venturimeter.	3	4
3	Validate Bernoulli's Theorem using Bernoulli's Apparatus.	3	4
4	Demonstrate use of Reynold's number	3	2
5	Determine coefficient such as C_c , C_v , and C_d for different types of orifices	4	4
6	Determine loss of head in various diameters of pipes and effect of material of pipe on head loss	4	4
7	Compute coefficient of discharge for V notch	5	4
8	Compute coefficient of discharge for rectangular notch	5	4
	Total hours		30 Hrs.

List of Laboratory/Learning Resources Required:

Sr. No.	Learning Resources	Practical No.
1	Piezometer	1
2	U-Tube Manometer	1
3	Venturimeter	2
4	V-notch	7
5	Rectangular notch	8
6	Pipes- PVC, G.I.,	6
7	Measuring Tank	1 to 8
8	Stop Watch	1 to 8
9	Gauge	1
10	Hydraulic Bench	1,2,5,6,7 & 8



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Suggested Project List:

- Student will visit nearby Canal Structure and Submit report consisting flow data, cross sections, hydraulic data etc. for the same.
- Student will Survey an industry / Department for handling or using pressure measuring devices.
- Student will visit nearby hydraulic structure and submit report field application venutrimeter, notch. & orifice.
- Case study and collection of different hydraulic parameters of open channel.
- Develop practical to find out types of flow(laminar flow, turbulent flow, Critical flow, Subcritical flow and Supercritical flow) based on Froude Number & Reynolds Number.
- Determine loss of head of any single building in your campus.
- Find out number of weirs within state/district using Internet sources and list different hydraulic parameters.

Suggested Activities for Students: If any

- Working model of Hydraulic jack and brakes.
- Measure pressure & flow using advance instrument like sensors.
- Demonstrate different types of fluids.
- Demonstrate the different types of energy
- Prepare a report on field application TGL & HGL.
- List out various software available for hydraulic design.
- Use of a computer program (software or Excel worksheets) to compare the results of software and laboratory observations .
