

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM

**Course Title: Hydraulics**  
**(Code: 3330603)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering	Third

#### 1. RATIONALE

For understanding the behaviour of water in various pipes, channels, notches, weirs etc. the study of this course is highly essential.

The Civil Engineering technicians must be able to measure flow of water in different situations and must be able to compute the discharge. And accordingly he can apply this ability while performing his job on the field, with ease and confidence.

This course will be helpful to students for understanding the fundamentals of Water Resources Management and Hydraulic Structures

#### 2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

1. Apply concepts of Hydraulics in Civil Engineering Application
2. Measure different Hydraulic parameters like pressure & velocity

#### 3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	1	2	6	70	30	20	30	150

**Legends:** **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** - Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

**Note:** It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

#### 4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit – I Introducti on, Pressure and pressure measurem ent</b>	1a.Explain Terminology 1b. Convert pressure from one expression / unit to another expression/ unit 1c. Describe different methods for Measuring Pressure. 1d. State the Properties of Liquid.	1.1 Technical terms used in Hydraulics – Fluid Mechanics, Hydraulics, Hydrostatics, Hydro kinematics Hydro Dynamics-Ideal and Real Fluid. 1.2 Properties of liquid – Viscosity-Density-Specific Gravity-Surface Tension-Capillarity Vapour Pressure-Elasticity. 1.3 SI units used in hydraulics 1.4 Various types of pressure – Atmospheric Pressure-Gauge Pressure-Absolute Pressure Vacuum Pressure-Separation Pressure 1.5 Measurement of pressure 1.5.1 Measurement of light pressure by Pizometer tube 1.5.2 Measurement of moderate pressure by “U” tube Manometer (Positive and Negative pressure) 1.5.3 Measurement of Gauge pressure and Vacuum pressure 1.5.4 Measurement of difference pressure using “U” tube Manometer and inverted “U” tube Manometer 1.5.5 Conversion of one pressure to another pressure
<b>Unit – II Hydrostati cs</b>	2a Explain Relation between pressure and depth of liquid 2b.Compute Total Pressure and Centre of pressure	2.1 Relation between pressure and depth of liquid 2.1.1 Establish above relationship 2.1.2 Pressure diagram for different conditions 2.2 Total pressure and center of pressure 2.2.1 Total pressure and center of pressure from pressure diagram for horizontal, vertical and inclined immersed surfaces 2.2.2 Conversion of one pressure to another pressure (using S.I.units) 2.2.3 Computation of Total Pressure and depth of centre of pressure
<b>Unit – III Hydro kinematics &amp; Hydrodyn amics</b>	3a. Explain different types of flow 3b. Derive Continuity Equation 3c. Define energy 3d Apply Bernoulli’s theorem to measure the pressure.	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 3.2.1 Definition 3.2.2 Computation to identify type of flow 3.3 Continuity Equation

Unit	Major Learning Outcomes	Topics and Sub-topics
	3e.Measure Discharge.	3.3.1 Statement and derivation 3.4 Types of Energy – Potential, Pressure and kinematics 3.5 Bernoulli's Equation 3.5.1 Statement and derivation 3.5.2 Assumptions and limitations 3.5.3 Applications (Pitot tube , Venturimeter, orifice meter, Ventruflume) 3.6 Momentum Equation 3.6.1 Statement and explanation
<b>Unit – IV Hydraulic coefficient, notches and weirs</b>	4a. Compute Hydraulic Coefficient 4b. Calculate flow through notches and weirs. 4c.List types of Notches and weirs.	4.1 Definition and types of orifice 4.2 Various Hydraulic Coefficient and its relation 4.2.1 Coefficient of Contraction, Velocity, Discharge. 4.3 Experimental derivation of Hydraulic coefficients. 4.4 Types of notches and weirs 4.4.1 Derivation of equation for discharge measurement through rect. and V notch. 4.5 Computation of discharge through notches 4.5.1 Rectangular Notch 4.5.2 V -Notch. 4.6 Computation of discharge through weirs 4.6.1 Discharge through narrow crested and broad Crested weir. 4.6.2 Discharge through cipoletti weir.
<b>Unit – V Flow through pipes</b>	5a. Explain Energy (Head) losses 5b. Draw Hydraulic Gradient Line (HGL) and Total Energy Line (TEL) 5c. Design Pipeline	5.1 Characteristics of flow through pipes 5.2 Major and Minor Energy (Head) losses in pipe Flow- frictional loss, loss of head at entry , exit, Sudden enlargement and contraction and at bend. 5.2.1 Computation of major head by Darcy Weisbach Equation. 5.3 Hydraulic Gradient Line (HGL) and Total Energy Line (TEL) 5.4 Design of Pipeline-using formula & Nomogram 5.5 Compound pipe and equivalent size.
<b>Unit – VI Flow through Open Channel</b>	6a. Analyse uniform flow 6b. Understand Specific Energy Diagram 6c. Mesure Velocity of flow And calculate discharge.	6.1 Characteristics of open channel flow 6.1.1 Comparison of pipe flow and channel flow. 6.1.2 Field examples of open channel 6.2 Analyse uniform flow 6.2.1 Froud's number, 6.2.2 Hydraulic mean depth- concept & computation 6.2.3 Use of Chezy's and Manning's formulae.

Unit	Major Learning Outcomes	Topics and Sub-topics
		6.2.4 Most economical sections of channel 6.2.4.1 Rectangular, Trapezoidal and circular shapes. 6.3 Specific Energy Diagram 6.4 River Gauging 6.4.1 Measurement of mean velocity using surface float, velocity rod and current meter.

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction, Pressure and pressure measurement	7	3	4	4	11
II	Hydrostatics	5	3	4	-	7
III	Hydro kinematics & Hydrodynamics	8	2	7	7	16
IV	Hydraulic coefficient, notches and weirs	8	2	5	7	14
V	Flow through pipes	7	3	4	4	11
VI	Flow through Open Channel	7	3	4	4	11
<b>Total</b>		<b>42</b>	<b>16</b>	<b>28</b>	<b>26</b>	<b>70</b>

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

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

## 6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	To measure the pressure of water in pipe by (a) Piezometer (b) Different types of manometers	4
2	III	To determine discharge through a given venturimeter.	4
3	IV	To determine $C_c$ , $C_v$ , and $C_d$ for different types of orifices	4
4	IV	Computation of coefficient of discharge for V notch and Preparation of calibration graph for interpolation and extrapolation	4

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
5	IV	Computation of coefficient of discharge for Rectangular notch and Preparation of calibration graph for interpolation and extrapolation	4
6	V	Determination of loss of head in various diameter of pipes and effect of material of pipe on loss of head	4
7	III	Demonstrations of Bernoulli's Apparatus	2
8	III	Demonstration of Reynold's number	2
<b>Total</b>			<b>28</b>

1	I	Tutorial on Pressure measurement	2
2	II	Tutorial on Hydrostatics	2
3	III	Tutorial on Hydrodynamic and Hydro kinematics	4
4	IV	Tutorial on Hydraulic coefficient, notches and weirs	2
5	V	Tutorial on Flow through pipes	2
6	VI	Tutorial on Flow through Open Channel	2
<b>Total</b>			<b>14</b>

## 7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

1. Student will visit nearby Canal Structure and Submit report for the same.
2. Student will Survey for Pressure Measuring devices.
3. Student will do market survey for pipes of different materials.
4. Student will solve tutorial examples

## 8. SUGGESTED LEARNING RESOURCES

### (A) List of Books:

S. No.	Title of Books	Author	Publication
1	Hydraulics, Fluid Mechanics and Hydraulic machine	R. S. Khurmi	S.Chand
2	Hydraulics, Fluid Mechanics and Hydraulic machine	R K Bansal	S.Chand
3.	Hydraulics, Fluid Mechanics and Hydraulic machine	S.Ramamrutham	Dhanpat Rai
4.	Fluid Mechanics	A K Jain	Khanna Publishers
5.	Journal of experiments in Hydraulics	Rao and Hasan	New Height
6.	Hydraulic laboratory	Rao and Hasan	New Height
7.	Fluid Mechanics	Dr.M.L.Mathur	Std.Publication

8	Fluid Mechanics & Hydraulics	S.C.Gupta	Pearson Education
9.	Hydraulics and Hydraulic machine	Prof.V.P.Priyani	Charotar Publication

### B. List of Major Equipment/Materials

1. Piezometer
2. U-Tube Manometer
3. Venturimeter
4. V-notch
5. U-notch
6. Pipes- PVC, G.I.,
7. Measuring Tank
8. Stop Watch
9. Gauge
10. Mercury

Or Hydraulic Bench equipped with all above equipments

### C List of Software/Learning Websites

1. [www.waterbouw.tudelft.nl/](http://www.waterbouw.tudelft.nl/)
2. [www.learnrstv.com](http://www.learnrstv.com)
3. [www.shiksha.com](http://www.shiksha.com) , IIT, Roorkee
4. [www.blackwellpublishing.com](http://www.blackwellpublishing.com)
5. [www.hrpwa.org](http://www.hrpwa.org)
6. [www.creativeworld9.com](http://www.creativeworld9.com)
7. [nptel.iitm.ac.in](http://nptel.iitm.ac.in)

### 9. Instructional strategies:

Unit No.	Topic	Instructional strategy / Key Resources
Unit-I	Pressure Measure Measurement	3-D Sketch or PPT Visit Laboratory
Unit-III	Bernaulli's Theorem	Visit Laboratory Bernaulli's Apprattus
Unit-III	Weirs	Visit nearby Weir PPT
Unit-V	Head loss due to friction	Visit Laboratory Pipes of different dia. And materials
Unit-VI	Flow through Channel	Visit nearby Canal PPT
Unit-VI	River Gauging TUTORIALS	Video film HANDOUTS

**10. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculty Members from Polytechnics**

1. Shri P.A. Pandya, Lecturer in Civil Engg. Deptt. – Govt. Polytechnic, Himatnagar
2. Shri H. R. Mehta, Lecturer in Civil Engg. Deptt. – C. U. Shah Polytechnic, Surendranagar
3. Shri Anil K. Belani, Lecturer in Civil Engg. Deptt. – Tolani F. G. Polytechnic, Adipur
4. Smt. Rina K. Chokshi, Head, Civil Engg. Deptt. – Parul Institute of Engg. And Tech. (Diploma Studies), Limda, Vadodara.

**Coordinator and Faculty Members from NITTTR Bhopal**