

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (CIVIL ENGINEERING)
SEMESTER	4
COURSE TITLE	HYDRAULICS
COURSE CODE	09CI0409
COURSE CREDITS	4

Objective:

- 1 Introduce key terminologies and definitions in fluid mechanics for foundational understanding.
- 2 Equip students with the knowledge to measure the pressure of a fluid and calculate hydrostatic pressure for various conditions.
- 3 Teach the application of continuity and Bernoulli's equations to compute discharge and energy of flowing fluid.
- 4 Enable students to analyze head loss in fluid flow through pipes.
- 5 Provide the necessary methods and formulas to compute discharge through open channel flow.

Course Outcomes: After completion of this course, student will be able to:

- 1 Understand the key terminologies and definitions in fluid mechanics.
- 2 Measure the pressure of a fluid and calculate hydrostatic pressure for different conditions.
- 3 Use continuity and Bernoulli's equation to compute discharge and energy of flowing fluid.
- 4 Analyze head loss of fluid flowing through pipes.
- 5 Compute discharge through open channel flow using various formulas.

Pre-requisite of course:Not required

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction and Properties of Fluid Terminologies and Definitions used in Fluid Mechanics: Fluid Mechanics, Hydrostatics, Hydro-kinematics, Hydro-Dynamics, Ideal and Real Fluid, Properties of Fluid – Density, Specific Gravity, Viscosity, Surface Tension, Capillarity, Vapor Pressure, Elasticity.	4

Contents : Unit	Topics	Contact Hours
2	Pressure Measurement & Hydrostatics Various types of pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure, Measurement of pressure by different methods, Hydrostatics - Relationship between pressure and depth of liquid, Pressure diagram for different conditions, Total pressure and centre of pressure & Computation of Total pressure and depth of centre of pressure for vertical plane surface	10
3	Hydro kinematics and Hydrodynamics Types of flow- Laminar, Turbulent, Uniform and Non-uniform, Steady and unsteady flow, Rotational and irrotational, One-Two and Three-Dimensional flow, Reynolds number & Numerical Problems, Discharge and its unit, Continuity Equation, Types of Energy – Potential, Kinetic and Pressure, Bernoulli's Theorem – statement, assumption, derivation and limitation and Practical application of Bernoulli's applications	8
4	Flow through Pipes Characteristics of flow through pipes, Major loss in pipe – Frictional loss and its calculation by Darcy's Weisbach Equation, Minor losses in pipe – loss at entrance, exit, sudden enlargement and contraction and fittings, Hydraulic Gradient Line and Total Energy Line and its application, Flow through pipe in series (compound pipe) and parallel, Discharge measurement using orifice, Hydraulic Coefficients and their interrelationship	10
5	Flow through Open Channel Definition and classification of channel, Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius, hydraulic mean depth, Froude's number, Discharge through open channels using Chezy's formula and Manning's formula (Without derivation), Most economical channel sections - Rectangular, Trapezoidal and Circular (Without derivation), Discharge measuring devices: Triangular and rectangular Notches, Computation of discharge through different types of weir: Narrow, Broad, Sharp crested weir; Cipolletti weir and Ogee weir, Specific energy diagram and Hydraulic jump	10
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 Compute the physical properties of given liquids (tap water, muddy water, oil and mercury).	2
2	Experiment 2 Measure the pressure of water in pipe using (a) Piezometer (b) Different types of manometers	2
3	Experiment 3 Determine discharge through a given venturimeter	4

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	Experiment 4 Validate Bernoulli's Theorem using Bernoulli's Apparatus	4
5	Experiment 5 Demonstrate the use of Reynold's number	4
6	Experiment 6 Determine coefficient such as C_c , C_v , and C_d for different types of orifices	4
7	Experiment 7 Determine coefficient such as C_c , C_v , and C_d for different types of orifices	4
8	Experiment 8 Compute coefficient of discharge for rectangular and triangular notch	4
Total Hours		28

Textbook :

- 1 Fluid Mechanics,, Dr. A. K. Jain,, Khanna Publications, 1998
- 2 Fluid Mechanics and Hydraulic Machines:, R K Rajput, S. Chand & Company Ltd., 2016

References:

- 1 Fluid Mechanics and Hydraulic machines,, Fluid Mechanics and Hydraulic machines,, Dr. R. K. Bansal,, Laxmi Publications Pvt., 2010
- 2 Hydraulics Fluid Mechanics and Fluid Machines,, Hydraulics Fluid Mechanics and Fluid Machines,, S.Ramamrutham,, Dhanpat Rai Publications, 2005

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
25.00	35.00	40.00	0.00	0.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc
- 2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.

Instructional Method:

- 3 Practical examination will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.
- 4 Students will use supplementary resources such as videos, e-courses, virtual laboratory.

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc26_ae04/preview
- 2 https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_me06
- 3 <https://me.iitp.ac.in/Virtual-Fluid-Laboratory/>
- 4 <https://fm-iitk.vlabs.ac.in/List%20of%20experiments.html>
- 5 <https://watersupply.gujarat.gov.in/>
- 6 <https://guj-nwrws.gujarat.gov.in/>