

**Course Name** : Civil Engineering Group. **Course Code:** CE/CS/CR/CV

**Semester** : Fourth

**Subject Title** : Hydraulics

**Subject Code:** 9049

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
03	01	02	03	80	20	--	25#	25@	150

**Rationale:**

Hydraulics is a branch of engineering science deals with behavior of fluids at rest as well as in motion. Man encountered the problems in the field of water supply, irrigation, Navigation are resulted in the development of Hydraulics.

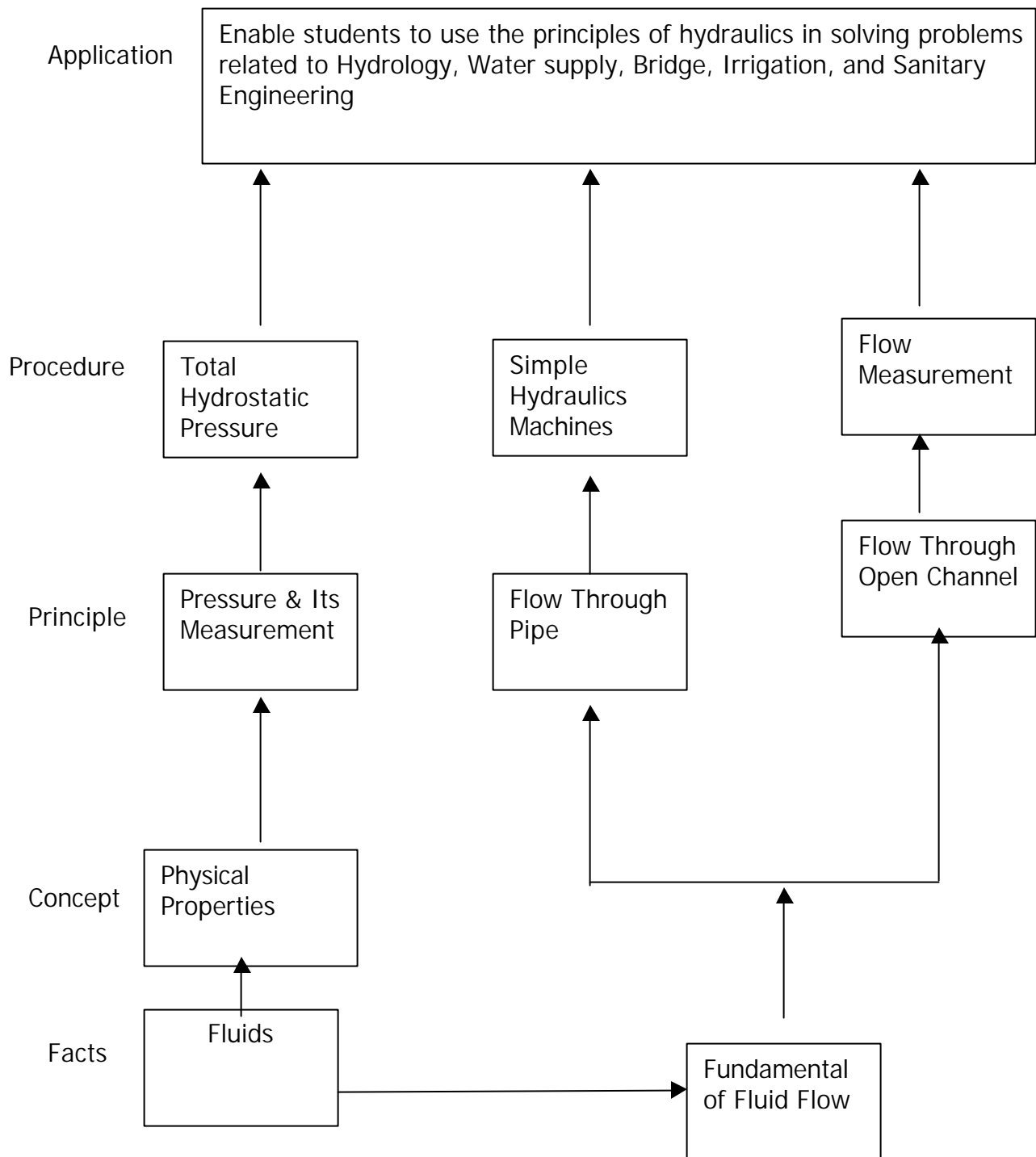
Physical properties of water will play and important role in the through pipes, open channels. The empirical formulae developed in hydraulics have found useful application in several problems. The measurements of flow of water in pipes are useful in water supply system and assessment of water in irrigation field.

**Objectives:**

The student will able to:

1. Compute the total hydro static pressure & center of pressure.
2. Describe the principle of pressure measuring devices.
3. Identify the concept of fluid flow.
4. Compute the loss of water flowing through pipes.
5. Design most economical channel section.
6. Describe working of the velocity measuring devices.

## Learning Structure:



## Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p><b>Properties Of Fluid</b></p> <p>1.1 Definition of fluid, Difference in behavior of fluid with respect to solids. Introduction to fluid mechanics and hydraulics, Branches of hydraulics- Hydrostatics and hydrodynamics, Importance of Hydraulics with respect to Irrigation and Environmental engineering.</p> <p>1.2 Physical properties of fluid Mass density, Weight density, Specific volume, Specific gravity, Surface tension and capillarity, Compressibility, Viscosity, Newton's law of viscosity – Dynamic and kinematics viscosity. Ideal and Real liquids</p>	04	06
02	<p><b>Hydrostatic Pressure</b></p> <p>2.1 Free liquid surface, Definition of pressure and its SI unit Hydrostatic pressure at point, Pascal's law Variation of pressure in horizontal and vertical direction in static liquid Pressure diagram.</p> <p>2.2 Total hydrostatic pressure and center of pressure, Determination of total pressure &amp; center of pressure on vertical &amp; inclined faces of dams, sluice gates, sides and bottom of water tanks, Determination of total hydrostatics pressure &amp; center of pressure on sides and bottom of tank containing two liquids. Determination of net hydrostatic pressure and center of pressure on vertical surface in contact with liquid on either side. Numerical Problems.</p>	08	12
03	<p><b>Measurement Of Liquid Pressure In Pipes</b></p> <p>Concept of pressure head and its unit, Conversion of pressure head of one liquid in to other devices for pressure measurements in pipes – Piezometer, U-tube manometer, Bourdon's pressure gauge. Principle of working and limitations. Measurement of pressure difference using differential manometer – U-tube differential manometer and inverted U-tube differential manometer. Numerical Problems.</p>	04	08
04	<p><b>Fundamentals Of Fluid Flow</b></p> <p>4.1 Concept of flow, Gravity flow and pressure flow. Types of flow – steady and Unsteady, uniform and non-uniform , Laminar and turbulent. Various combinations of flow with practical examples, Reynolds number and its application, Stream line and equi-potential line. Flow net and its uses</p>	06	08

	4.2 Discharge and its units Continuity equation for fluid flow. Datum head, pressure head, velocity head and total head, Bernoulli's theorem, Loss of head and modified Bernoulli's theorem, Impulse momentum theorem Numerical Problems.		
05	<p><b>Flow Of Liquid Through Pipes</b></p> <p>5.1 Loss of head due to friction, Darcy-Weisbach Equation Friction factor, relative roughness. Moody's diagram and its use. Common range of friction factor for different types of pipe material.</p> <p>5.2 Minor loss of head in pipe flow- loss of head due to sudden Contraction, sudden expansion, gradual contraction &amp; expansion, at entrance and exit of pipe in various pipe fittings. Pipes in series and parallel Equivalent pipe – Dupuit's equation</p> <p>5.3 Hydraulic gradient line and Energy gradient line, Siphon pipe. Water hammer in pipes – cause effects and remedial measures Use of Nomograms for design of water distribution system. Numerical</p>	07	12
06	<p><b>Flow Through Open Channel</b></p> <p>6.1 Types of channels- artificial &amp; natural, purposes of artificial channel, Different shapes of artificial channels Geometrical properties of channel section – wetted area, wetted Perimeter, hydraulics radius Prismatic channel sections, steady- uniform flow through prismatic channel section.</p> <p>6.2 Chezy's equation and Manning's equation for calculation of discharge through an open channel, common range of values of Chezy's constants and Manning's constant of different types of channel surfaces. Most economical channel section, conditions for most economical channel sections.</p> <p>6.3 Froud's number and its significance. Critical, sub-critical and supercritical flow in channel Hydraulic jump its occurrence in field, uses of hydraulic jump.</p>	07	16
07	<p><b>Flow Measuring Devices</b></p> <p>7.1 Velocity measuring devices for open channels.Floats-surface, sub-surface and float rod Pitot tube – principle, expression for velocity Current meter-cup type &amp; propeller type</p> <p>7.2 Discharge measuring devices for channels Notches - Types of notches, expression for discharge. Francis formula, end contraction and velocity of approach</p>	08	12

	<p>Weirs - Broad crested weir, ogee spillway, and expression for discharge. Flumes - Venturi flume, standing wave flume, expression for discharge. Velocity area method for measurement of discharge through open channels. Discharge measuring devices for pipes.</p> <p>7.3 Venturimeter – Component parts, principle of working, Study and use of Water meter</p> <p>Flow through orifice Orifice- Definition and use, Types of orifice based on various criteria. Coefficient of contraction, coefficient of velocity and coefficient of discharge, Relationship between them. Discharge through small sharp-edged circular orifice Determination of hydraulic coefficient of orifice. Numerical</p>		
08	<p><b>Hydraulic Machines</b></p> <p>Pumps - Definition and types. Suction head, delivery head, static head and manometric head. Centrifugal pump - component parts and their functions, principle of working, priming. Reciprocating pump - component parts and working. Submersible pump and Jet pump. Selection and choice of pump. Computation of power required for pumps. Turbines - Definition and types.</p>	04	06
	Total	48	80

**Practical:**

Skills to be developed:

Intellectual Skills:

- a. Interpret test results
- b. Calculate quantities of parameters
- c. Draw graphs

Motor Skills :

- a. Measure different parameters accurately
- b. Adjust levels by operating valves

**List of Practical:**

1. Measurements of pressure and pressure head by Piezometer, U-tube manometer
2. Measurement of pressure difference by U-tube differential manometer. Study of bourdon's gauge
3. Verification of Bernoulli's theorem
4. Reynolds experiment to study types of flow.
5. Determination of Darcy's friction factor for a given pipe
6. Determination of Minor losses in pipes (any two)
7. Study and use of Moody's diagram, Nomogram of Manning's equation
8. Determination of Manning's constant or Chezy's constant for given rectangular channel section.
9. Demonstration of Hydraulic jump
10. Determination of coefficient of discharge for given rectangular or triangular notch.
11. Determination of coefficient of discharge for a given Venturimeter.
12. Demonstration and use of Pitot tube and current meter
13. Determination of hydraulic coefficients for sharp edge orifice.
14. Study & use of water meter.
15. Study of a model of centrifugal and reciprocating pump.
16. Use of characteristic curves/ nomograms /charts / catalogs from manufactures for selection of pump for the designed discharge and head (Refer IS: 9694)

**Learning Resources:****Books:**

Sr. No.	Author	Title	Publisher
01	Dr. P.N.Modi & Dr. S.M.Seth	Hydraulics & Fluids Mechanics	Standard Book House, Dehli
02	S.Ramamrutham	Hydraulics & Fluids Mechanics	Dhanpat Rai & Sons, Delhi
03	R.S.Khurmi	A Text Book of Hydraulics, Fluids Mechanics Hydraulics Machines	S.Chand & Company Ltd. New Delhi
04	R.K.Rajput	A Text Book of Fluids Mechanics Hydraulics Machines	S.Chand & Company Ltd. New Delhi
05	Dr. Jagdish Lal	Fluids Mechanics Hydraulics	Metropolitan Book Co. Private Ltd. New Delhi
06	S.K.Likhi	Hydarulics Laboratory Manual	T.T.T.I. Chandhigrah