

22BEAS112 FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS

Hours Per Week :

L	T	P	C
1	2	2	3

PREREQUISITE KNOWLEDGE: Basics of fluid mechanics and flow principle.

COURSE DESCRIPTION AND OBJECTIVES:

This objective of this course is to acknowledge basic principles, fundamental concepts and theories of fluid mechanics to familiarize the behaviour of the fluids at rest as well as in motion and the main of the course is to impart knowledge on static, kinematics and dynamic aspects of fluids..

MODULE-1

UNIT-1

4L+8T+8P=20 Hours

FLUID PROPERTY:

Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies..

UNIT-2

4L+8T+8P=20 Hours

FLUID FLOW:

Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon.

PRACTICES:

- Study of manometers and pressure gauges.
- Verification of Bernoulli's theorem.
- Determination of coefficient of discharge of venturi-meter and orifice meter.
- Determination of coefficient of friction in pipeline.
- Determination of coefficient of discharge for rectangular and triangular notch.
- Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice.
- Determination of coefficient of discharge for mouth piece.

MODULE-2

UNIT-1

4L+8T+8P=20 Hours

TYPES OF FLOW:

Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, one plate moving, discharge, average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient.

source: <https://cde.nus.edu.sg/cee/research/laboratories/hydraulic-engineering-laboratory/>

UNIT-2**4L+8T+8P=20 Hours****CHANNEL DESIGN:**

Flow through orifices (Measurement of Discharge, Measurement of Time), Flow through Mouthpieces, Flow over Notches, Flow over weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels, Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.

PRACTICES:

- Measurement of force exerted by water jets on flat and hemispherical vanes; Determination of meta-centric height.
- Determination of efficiency of hydraulic ram.
- Performance evaluation of Pelton and Francis turbine.
- Study of current meter.
- Velocity distribution in open channels and determination of Manning's coefficient of rugosity.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply properties of fluids like viscosity, density, specific weight etc.	Apply	1	1, 2, 5
2	Apply pressure in fluid-flowing pipes and vessels.	Apply	1	1, 2, 8, 9, 10
3	Analyzes of open channels for irrigation purposes.	Analyze	2	1, 4, 5, 6
4	Creative continuity equation and energy equations in flow 5 measurement.	Create	2	1, 2, 4, 5, 8
5	Evaluate various kind of pressure measuring instruments.	Evaluate	2	1, 4, 5, 6

TEXT BOOKS:

1. Khurmi, R .S. "A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines S. Chand & Company Limited" New Delhi, 2005.
2. Modi P M and Seth S.M. "Hydraulics and Fluid Mechanics. Standard Book House" Delhi, 2005.

REFERENCE BOOKS:

1. Chow V T "Open Channel Hydraulics" McGraw Hill Book Co., New Delhi, 2008.
2. L. Jagadish "Fluid Mechanics and Hydraulics" Metropolitan Book Co.Pvt. Ltd., New Delhi, 2011.

SKILLS:

- ✓ Differentiate between Newtonian and non-Newtonian fluids.
- ✓ Determine fluid pressure using different types of gauges.