

FT204 FLUID MECHANICS & HYDRAULICS

Course Description & Objectives:

This course will enable the students to design efficient water conveyance systems principles of mechanics of fluids, water measurement and regulation. By the end of the course students will be able to gain knowledge on Bernoulli's theory, Buckingham's Pi theorem, Darcy's and Chezy's theorem, and Archimedes' principles.

Course Outcomes:

By the end of the course the students will be able to

1. Gain knowledge on Bernoulli's theory, Buckingham's Pi theorem, Darcy's and Chezy's theorem
2. Gain the knowledge on mechanical gauges, flow of fluids in the pumps, and Archimedes' principles and theory
3. Understand flow through mouth pieces, flow through orifices and pumps
4. Know the measurement of fluid pressure, measurement of discharge and measurement of time
5. Know how to determine the Coefficient of discharge from the pitot tube experiment.

UNIT I - Introduction to fluids

Fluids - definitions-classification - properties, units and dimensions - fluid pressure - Introduction - Measurement of fluid pressure - Hydraulic pressure, absolute and gauge pressure - pressure head of the liquid. Pressure on vertical rectangle surfaces - Compressible - non compressible fluids – surface tension and capillarity. Pressure measuring devices- simple, micro, inclined manometers

UNIT II - Fluid flows theorem

Mechanical gauges - piezometer - floating bodies - Archimedes' principle- stability of floating bodies. Equilibrium of floating bodies - Buoyancy of flotation - metacentric height - Kinematics of fluid flow - introduction - classification of flows - steady, uniform, non uniform, laminar and turbulent - continuity of fluid flow. Bernoulli's theorem and its applications. Practical applications of Bernoulli's theorem, Venturimeter, Pitot tube, Orifice meter and rotameter.

UNIT III - Fluid flow through pipes

Flow through simple pipes - Loss of head in pipes, Darcy's formula for loss of Head in pipes, Chezy's formula for loss of head in pipes - determination of pipe diameter - determination of discharge - friction factor – critical velocity. Flow through orifices (Measurement of Discharge) - Types of orifices, Jet of water, vena contract, Hydraulic coefficients, Experimental Method for Hydraulic Coefficients, Discharge through a rectangular orifice. Flow through Mouthpieces - Types of Mouthpieces - Loss of Head of a liquid flowing in a pipe, Discharge through a Mouthpiece - flow over weirs - Types of weirs, Discharge over a weir.

UNIT IV- Fluid flow through orifice

Flow through Orifices (Measurement of Time) - Time of Emptying a square, rectangular or circular tank through an orifice at its bottom, Time of emptying a hemispherical tank through an orifice at its bottom. Flow through Weirs (Measurement of Time) - Time of Emptying a square, rectangular or circular tank through an orifice at its bottom, Time of emptying a hemispherical tank through an orifice at its bottom. Loss of head due to contraction - enlargement at entrance and exit of the pipe-water level point gauge - Hook gauge.

UNIT V- Flow over Notches

Flow over Notches - Types of Notches, Discharge over a Rectangular Notch, Triangular Notch, Stepped Notch. Time of emptying a tank over a Rectangular Notch, Triangular Notch. Dimensional analysis and similitude - Buckingham's pi theorem - Froude Number, Reynolds number, Weber number and hydraulic similitude. Pumps-classification - reciprocating - centrifugal pumps - pressure variation, work efficiency - types of chambers - selection and sizing.

TEXT BOOKS:

1. Modi, P. M. and Seth, S.M. 1973. *Hydraulics and Fluid Mechanics*, Standard Book House, Delhi
2. Chow, V. T. 1983. *Open Channel Hydraulics*, Mc Graw Hill Book Co., New Delhi

REFERENCE BOOK:

1. Jagdish Lal, 1985. *Fluid Mechanics and Hydraulics*. Metropolitan Book Co. Private Limited., New Delhi