

16ME206 FLUID MECHANICS AND HYDRAULIC MACHINES

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	W/RA	SSH/HS	CS	SA	S	BS
45	-	30	15	40	8	4	-	2



Course Description and Objectives:

This course offers basic knowledge on fluid statics, dynamics and hydraulic machines. The objective of this course is to enable the student to understand laws of fluid mechanics and evaluate pressure, velocity and acceleration fields for various fluid flows and performance parameters for hydraulic machinery.

Course Outcomes:

The student will be able to:

- identify importance of various fluid properties at rest and in transit.
- derive and apply general governing equations for various fluid flows
- understand the concept of boundary layer theory and flow separation.
- plot velocity and pressure profiles for any given fluid flow.
- evaluate the performance characteristics of hydraulic turbines and pumps.

SKILLS :

- ü *Solve problems involving fluid properties and shear forces resulting from Newtonian fluids.*
- ü *Calculate the magnitude and location of hydrostatic forces on flat plates and curved surfaces immersed in a static fluid.*
- ü *Analyze fluid systems using the integral form of the continuity, momentum, impulse momentum, and energy equation.*
- ü *Measure velocity and fluid flow rates using flow measuring devices.*
- ü *Distinguish laminar and turbulent flows through pipes.*

ACTIVITIES:

- Evaluate various fluid properties.
- Pressure measurement using manometers.
- Flow measurement using venturimeter and orifice meter.
- Determination of flowrate in realtime applications

UNIT - 1**L-9**

BASICS OF FLUID AND FLUID STATICS: Units and Dimensions, Properties of fluids - Density, Specific gravity, Specific weight, Viscosity; Compressibility, Vapour pressure, Capillarity and surface tension; Forces on immersed surfaces, Introduction about center of pressure and buoyancy, Piezometer, U-tube and Differential Manometers.

UNIT - 2**L-9**

FLUID KINEMATICS AND DYNAMICS: Flow characteristics, Concepts of system and Control volume, Continuity equation, Application of control volume to continuity, Energy equation, Euler equation, Bernoulli's equation and Momentum equation.

UNIT - 3**L-9**

FLOW THROUGH CIRCULAR CONDUITS: Laminar flow through circular tubes and boundary layer concepts, Boundary layer thickness, Hydraulic and energy gradient, Darcy equation on pipe roughness, Friction factor, Minor losses, Flow through pipes in series and in parallel.

UNIT - 4**L-9**

ROTO DYNAMIC MACHINES: Impact of jets, Fixed and moving vanes, Classification of turbines, Impulse and reaction turbines, Pelton wheel, Francis and Kaplan turbine - Working proportions, Work done, Efficiencies, Draft tube theory - efficiency.

UNIT - 5**L-9**

CENTRIFUGAL AND RECIPROCATING PUMPS: Classification, Working Principles, Manometric head losses and efficiencies, Specific speed, Pumps in series and parallel, Reciprocating pumps - Working, Discharge, Slip-indicator diagram, Air vessels.

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS**

Total hours:30

1. Impact of jets on vanes.
2. Pelton wheel.
3. Francis turbine.
4. Kaplan turbine.
5. Single stage centrifugal pump.
6. Multi stage centrifugal pump.
7. Reciprocating pump.
8. Venturimeter.
9. Orifice meter.
10. Friction factor for a given pipe line.
11. Minor losses in a pipeline.
12. Verification of Bernoulli's equation.

TEXT BOOKS :

1. P.N.Modi and Seth, "Fluid Mechanics and Hydraulic Machines", 15th edition, Standard Book House, 2002.
2. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", 5th edition, Laxmi Publications (P)Ltd., New Delhi, 1995.

REFERENCE BOOKS :

1. R.K.Rajput, "A Text Book of Fluid Mechanics and Hydraulic Machines", 3rd edition, S. Chand, 2006.
2. Frank. M. White, "Fluid Mechanics", 7th edition, McGraw Hill, 2011.
3. Fox and McDonald's, "Introduction to Fluid Mechanics", 8th edition, John Wiley and Sons 2015.

WEB LINKS:

1. <http://nptel.ac.in/courses/112105171/1>
2. <http://web.mit.edu/hml/ncfmf.html>