

# 19ME213

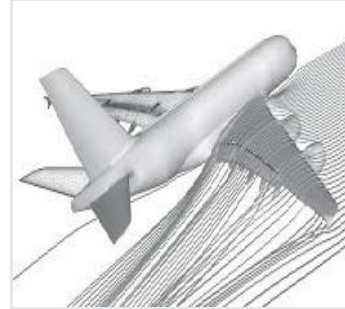
# MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	5	40	-	-	-	-



Source:

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**PRE-REQUISITE COURSE:** Engineering Mathematics - 1(F)

## 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:

Upon completion of the course the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Identify importance of various fluid properties at rest and in transit.	1,2,3,4,5,6
2	Derive general governing equations for various fluid flows.	1,2,3,4,5,6,9,10
3	Interpret the concept of boundary layer theory and flow separation.	1,2,3,4,5,9,10
4	Develop velocity and pressure profiles for any given fluid flow.	1,2,3,4,5
5	Evaluate the performance characteristics of hydraulic turbines and pumps	1,2,3,4,5,6,10

## SKILLS:

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

- UNIT-I** **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 centre of Pressure and Buoyancy, Piezometer, U-tube and Differential Manometers.
- UNIT-II** **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 equation and Momentum equation.
- UNIT-III** **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; Dimensional analysis & model investigation applied to flow systems, Buckingham Pi theorem, Dimensionless numbers in fluid flow.
- UNIT-IV** **L-9**  
**ROTO DYNAMIC MACHINES:** Impact of jets, Fixed and moving vanes, Classification of turbines, Impulse and Reaction turbines, Pelton wheel, Francis turbine, Kaplan turbine - working proportions; Work done, Efficiencies, Draft tube theory - efficiency; Governing of turbines.
- UNIT-V** **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, Cavitation.

## LABORATORY EXPERIMENTS

### LIST OF EXPERIMENTS

**TOTAL HOURS: 30**

1. Determine density of different fluids using hydrometer.
2. Determine coefficient of discharge of fluid using venturimeter.
3. Determine coefficient of discharge of fluid using Orifice meter.
4. Simulate the flow in a pipeline by using ANSYS.
5. Determine major losses for a given pipeline by using ANSYS.
6. Verification of Bernoulli's equation.
7. Performance test on Pelton wheel.
8. Performance test on Kaplan turbine.
9. Performance test on Reciprocating pump.
10. Performance test on Single stage centrifugal pump.

### TEXT BOOKS:

1. P.N.Modi and Seth, "Fluid Mechanics and Hydraulic Machines", 15<sup>th</sup> edition, Standard Book House, 2002.
2. Sukumar Pati, "Fluid Mechanics and Hydraulic Machines", 1<sup>st</sup> edition, McGraw-Hill, New Delhi, 2012.

### REFERENCE BOOKS :

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