



MANIPAL UNIVERSITY JAIPUR

School of Automobile Mechanical and Mechatronics Engineering
Department of Mechanical Engineering Course Hand-out
Fluid Mechanics and Hydraulic Machines| ME1401 | 4 Credits |

Session: Jan Jan19 – May 19 | Faculty: Dr. Ravi k Sharma/ Dr Mayank Modak/ Ravinder Jhorar |
Class: B.Tech (IV Sem)

Course Objectives: At the end of the course, students will be able to

- [1401.1] Describe the properties and classification of fluid and depict the effect of these properties on fluid in motion and at rest.
- [1401.2] Establish understanding about fluid pressure and flow rate measuring devices.
- [1401.3] Analyse the stability of floating and submerged bodies and distinguish between various types of flows.
- [1401.4] Modify different operating parameters to enhance the performance of hydraulic machines.
- [1401.5] Recognize different applications of fluid mechanics and fluid flow through different cross- sections.
- [1401.6] Fabricate devices which exhibit the principles of fluid mechanics and evaluate their performance for better employability.

A. Syllabus

Properties of Fluids: Introduction, Various properties, Newtonian and Non-Newtonian Fluids. Fluid Statics: Pressure and its measurement: Pressure gauge, Manometers, Pascal's law, Hydrostatic law: Forces on plane and curved surfaces, Centre of pressure; Buoyancy, equilibrium of submerged and floating bodies, metacentric height. Fluid Kinematics: Lagrangian and Eulerian description of fluid flow, Types of Fluid flow, Stream line, path line and streak lines, Continuity equation, Fluids subjected to Velocity and acceleration, vorticity, circulation, Stream function, Velocity Potential function, Cauchy Riemann equation.

Fluid Dynamics: Euler's and Bernoulli's equation, Bernoulli's theorem, Applications of Bernoulli's equation, Vortex Motion: Free and Forced.

Viscous flow: Reynold's Number, Darcy Weisback equation, Laminar flow: circular pipe (Hagen Poiseuille's equation), Parallel Plates; Flow: Pipe flow, Friction factor, Minor and major losses in pipe, Boundary layer concept, Boundary layer separation. Dimensional Analysis: Basic and derived quantities, Similitude and dimensional analysis, Buckingham π – theorem, Non-dimensional parameters and its significance.

Hydraulic Machines Rotating Elements: Classification and efficiencies of turbines, performance curve. Reciprocating Pump: - Working principle, discharge, work done, efficiency, slip.

Centrifugal Pump: Working principle, indicator diagram, components, Efficiency, Pump characteristics, multistage centrifugal pump.

B. Text Books:

- I. Frank M. White, "Fluid Mechanics" *Tata McGraw Hills Pub., Seventh Edition, 2011.*
- II. P. N. Modi and Seth, *Fluid Mechanics, Standard Book House Pub., 2002.*

References:

- I. Yunus A. Cengel, John M. Cimbala, *Fluid Mechanics, Third Edition, 2014.*
- II. A. K. Jain, "Fluid Mechanics Including Hydraulic Machines" *Khanna Publication, 12th Edition.*
- III. R. K. Bansal, "*Fluid Mechanics and Hydraulic Machines*", *Laxmi Publications, Ninth Edition, 2015.*

