

# AMEV-03 MECHANICS OF FLUID

## OBJECTIVES:

- 1 To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyse and appreciate the complexities involved in solving the fluid flow problems.

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## UNIT I FLUID PROPERTIES AND FLUID STATICS

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges-forces on planes - centre of pressure - buoyancy and floatation.

## UNIT II FLUID KINEMATICS AND DYNAMICS

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation - applications - Venturi meter, Orifice meter and Pitot tube. Linear momentum equation and its application.

## UNIT III FLOW THROUGH PIPES

Viscous flow - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseuille's) - Hydraulic and energy gradient - flow through pipes - Darcy -Weisbach's equation - pipe roughness -friction factor- Moody's diagram-Major and minor losses of flow in pipes - Pipes in series and in parallel.

## UNIT IV BOUNDARY LAYER

Boundary layer - definition- boundary layer on a flat plate - thickness and classification - displacement , energy and momentum thickness - Boundary layer separation and control - drag in flat plate - drag and lift coefficients.

## UNIT V DIMENSIONAL ANALYSIS AND MODEL STUDIES

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

## OUTCOMES:

- 1 The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- 2 They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

## TEXT BOOKS:

- 1 Modi P.N and Seth S.M.," Hydraulics and Fluid Mechanics including Hydraulic Machines",Standard Book House New Delhi. 2003

- 2 Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 2001.
- 3 Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5<sup>th</sup> edition, Laxmi publications Pvt. Ltd, New Delhi, 2008.

**REFERENCES:**

- 1 Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 2000.
- 2 Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1--5.
- 3 Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
- 4 Roberson J.A and Crowe C.T., " Engineering Fluid Mechanics", Jaico Books Mumbai, 2000.
- 5 White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5<sup>th</sup> Edition, New Delhi, 2003.