

<b>XE-B</b>	<b>Fluid Mechanics</b>
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**Section 1: Flow and Fluid Properties**

**Fluid Properties:** Density, viscosity, surface tension, relationship between stress and strain-rate for Newtonian fluids.

**Classification of Flows:** Viscous versus inviscid flows, incompressible versus compressible flows, internal versus external flows, steady versus unsteady flows, laminar versus turbulent flows, 1-D, 2-D and 3-D flows, Newtonian versus non-Newtonian fluid flow.

**Hydrostatics:** Buoyancy, manometry, forces on submerged bodies and its stability.

**Section 2: Kinematics of Fluid Motion**

Eulerian and Lagrangian descriptions of fluid motion. Concept of local, convective and material derivatives. Streamline, streakline, pathline and timeline.

**Section 3: Integral Analysis for a Control Volume**

Reynolds Transport Theorem (RTT) for conservation of mass, linear and angular momentum.

**Section 4: Differential Analysis**

Differential equations of mass and momentum for incompressible flows. Inviscid flows - Euler equations and viscous flows - Navier-Stokes equations. Concept of fluid rotation, vorticity, stream function and circulation.

Exact solutions of Navier-Stokes equations for Couette flow and Poiseuille flow, thin film flow.

**Section 5: Dimensional Analysis**

Concept of geometric, kinematic and dynamic similarity. Buckingham Pi theorem and its applications.

Non-dimensional parameters and their physical significance - Reynolds number, Froude number and Mach number.

**Section 6: Internal Flows**

Fully developed pipe flow.

Empirical relations for laminar and turbulent flows: friction factor, Darcy-Weisbach relation and Moody's chart. Major and minor losses.

**Section 7: Bernoulli's Equation and its Applications, Potential Flows**

**Bernoulli's Equation:** Assumptions and applications.

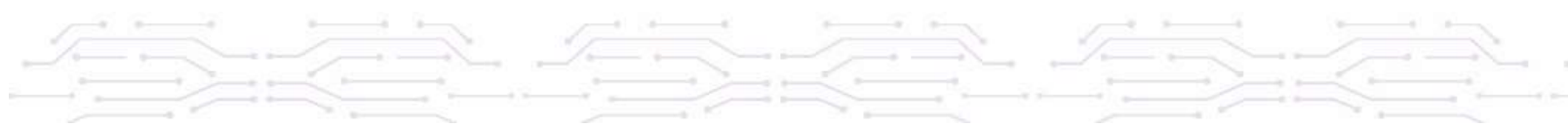
Flow measurements - Venturi meter, Pitot-static tube and orifice meter.

**Elementary Potential Flows:** Velocity potential function.

Uniform flow, source, sink and vortex, and their superposition for flow past simple geometries.

**Section 8: External Flows**

**Prandtl Boundary Layer Equations:** Concept and assumptions.



**Boundary Layer Characteristics:** Boundary layer thickness, displacement thickness and momentum thickness.

Qualitative idea of boundary layer separation, streamlined and bluff bodies, and drag and lift forces.

