

FLUID MECHANICS (XE-B)

General Aptitude

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

Flow and Fluid Properties

viscosity, relationship between stress and strain-rate for Newtonian fluids, incompressible and compressible flows, differences between laminar and turbulent flows. **Hydrostatics:** Buoyancy, manometry, forces on submerged bodies.

Kinematics

Eulerian and Lagrangian description of fluids motion, concept of local and convective accelerations, steady and unsteady flows.

Integral analysis

Control volume analysis for mass, momentum and energy.

Differential Analysis

Differential equations of mass and momentum for incompressible flows: inviscid - Euler equation and viscous flows - Navier-Stokes equations, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Couette Flow and Poiseuille flow.

Inviscid flows

Bernoulli's equation - assumptions and applications, potential function, Elementary plane flows - uniform flow, source, sink and doublet and their superposition for potential flow past simple geometries.

Dimensional analysis

Concept of geometric, kinematic and dynamic similarity, some common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number.

Internal flows

Fully developed pipe flow, empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation.

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Prandtl boundary layer equations

Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. **Flow measurements:** Basic ideas of flow measurement using venturimeter, pitot-static tube and orifice plate.

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