

# Content Product

## Detailed syllabus

### MECHANICS OF FLUIDS

#### UNIT I - FLUID PROPERTIES AND FLUID STATICS

**Introduction to fluid mechanics** - Introduction to fluid, Distinction between solid and fluid, Liquid and gas as a fluid, Fluid mechanics, Applications of fluid mechanics in civil engineering. **Properties of fluid** - Density, Specific volume, Specific weight, Specific gravity, Temperature, Viscosity Newton law of viscosity, Compressibility, Surface tension, Capillarity, Vapour pressure, Units and dimension, Problems on properties of fluids. **Concept of fluid static pressure** -Fluid statics Pressure, Hydrostatic Law, Pascal law, Pressure head, Absolute pressure, Gauge pressure, Atmospheric pressure and relationship, Problems. **Pressure measuring instruments** - Measurement of pressure, Simple manometers, U-tube manometer, Single column manometers, Differential manometers, Inverted U tube differential manometer, Problems on manometer. **Centre of pressure** - Centre of pressure, Vertical plane surface submerged in liquid, Horizontal plane surface submerged in liquid, Inclined plane surface submerged in liquid, Moment of inertia for various sections, Problems. **Buoyancy and floatation** – Buoyancy, Archimedes Principle, Centre of buoyancy, Problems, Meta centre, Analytical method for meta centre height, Problems, Conditions of equilibrium of a floating and submerged bodies.

#### UNIT II - FLUID KINEMATICS AND DYNAMICS

**Introduction to fluid kinematics** - Fluid kinematics, Types of flow, Scalar and vector fields, Velocity and acceleration field, Problem related to velocity and acceleration. **Continuity equation** -Continuity equation, Rate of flow or discharge, continuity equation in three dimension, Problems. **Flow visualization** -Flow visualization, Stream lines, Path lines, Streak lines, Vortex flow. **Velocity potential and stream function** -Velocity potential function, Stream function, Relation between stream function and velocity potential function, Equipotential line and stream line, Flow net, Circulation and vorticity, Problems on velocity potential function and stream function. **Fluid dynamics** - Introduction to fluid dynamics, Equations of motion, Euler equation of motion, Bernoulli's equation, Problems on Bernoulli's equation. **Applications of Bernoulli's equation** - Venturimeter, Discharge through venturimeter, Orifice meter, Pitot tube, Problems on applications of Bernoulli's equation. **Linear momentum equation** - The momentum equation, Momentum equation uses, Problem.

#### UNIT III- FLOW THROUGH PIPES

**Flow of viscous fluid through circular pipe** - Laminar flow, Shear stress and Pressure gradient relation for flow of viscous flow through circular pipe, Problems. **Flow of viscous fluid between two parallel plates**—Shear stress and pressure gradient relation for flow of viscous fluid between two parallel plates, Problems. **Flow through pipes** -Loss of energy in pipes, Major loss in pipe, Pipe roughness, Moody chart, Minor energy losses, Loss of head due to sudden enlargement, Loss of head due to sudden contraction, Loss of head at the entrance of a pipe, Loss of head at the exit of a pipe, Loss of head due to an obstruction in a pipe, Other minor losses in pipe, Hydraulic gradient and total energy, Problems on losses of flow in pipe. **Flow through pipes in series and parallel** - Flow through parallel pipes, Flow through pipes in series, Equivalent pipe, Problems.

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### UNIT IV - BOUNDARY LAYER

**Boundary layer** - Introduction to boundary layer, Classification of boundary layer, Zones of boundary layer. **Important parameters of boundary layer** -Boundary layer thickness  $\delta$ , Displacement thickness  $\delta^*$ , Momentum thickness  $\theta$ , Energy thickness, Boundary layer characteristics, Problems. **Drag force** - Drag force and lift, Drag force on a flat plate due to boundary layer, Turbulent boundary layer on flat plate, Total drag on a flat plate due to laminar and turbulent boundary layer, Problems. **Boundary layer separation** - Separation of boundary layer, Effect of pressure gradient, Location of separation point and disadvantages, Control on boundary layer separation, Problem based on boundary layer separation.

### UNIT V - DIMENSIONAL ANALYSIS AND MODEL STUDIES

**Dimensional analysis** -Introduction, Dimensions and units, Fundamental dimensions, Important technical terms, Problem based on dimensional analysis, Benefits of dimensional analysis. **Methods of dimensional analysis**—Rayleigh's method, Buckingham  $\pi$  –theorem, Procedure for solving problems by Buckingham  $\pi$  theorem, Problems. **Dimensionless numbers** -Types of forces acting on moving fluid, Important dimensionless numbers. **Model and similitude** -Model analysis, Similitude. **Model laws or similarity law** -Introduction, Reynolds model law, Froude model law, Euler's model law, Weber model law, Mach model law, Problem based on Reynold's model law, Problem based on Froude model law, Problem based on Euler's model law, Model testing of partially sub-merged bodies, Classification of models, Problem based on scale ratio for distorted model.