
Graduate Certificate in Hydraulic Engineering

* Fluid Mechanics

Fluid Mechanics is the branch of physics that deals with the behavior of fluids, including both liquids and gases. The following are some key terms and vocabulary related to Fluid Mechanics in the context of the Graduate Certificate in Hydraulic Engineering:

1. Fluid: A fluid is a substance that flows and takes the shape of its container. It can be either a liquid or a gas.
2. Pressure: Pressure is the force exerted by a fluid on a unit area. It is a scalar quantity and is measured in units of force per unit area, such as Pascals (Pa) or pounds per square inch (psi).
3. Hydrostatic pressure: Hydrostatic pressure is the pressure exerted by a fluid at rest. It is proportional to the depth of the fluid and the density of the fluid.
4. Dynamic pressure: Dynamic pressure is the pressure exerted by a fluid in motion. It is proportional to the velocity of the fluid and the density of the fluid.
5. Total pressure: Total pressure is the sum of hydrostatic pressure and dynamic pressure.
6. Fluid statics: Fluid statics is the study of fluids at rest.
7. Fluid dynamics: Fluid dynamics is the study of fluids in motion.
8. Viscosity: Viscosity is the measure of a fluid's resistance to flow. It is a measure of the internal friction of a fluid.
9. Laminar flow: Laminar flow is the smooth, orderly flow of a fluid in which the fluid moves in parallel layers.
10. Turbulent flow: Turbulent flow is the disordered, chaotic flow of a fluid in which the fluid moves in a random, disorganized manner.
11. Reynolds number: The Reynolds number is a dimensionless quantity that is used to determine whether a fluid flow is laminar or turbulent. It is calculated as the ratio of inertial forces to viscous forces.
12. Bernoulli's equation: Bernoulli's equation is a fundamental equation in Fluid Mechanics that relates the pressure, velocity, and elevation of a fluid in motion.
13. Continuity equation: The continuity equation is a fundamental equation in Fluid Mechanics that relates the flow rate, velocity, and cross-sectional area of a fluid.
14. Energy equation: The energy equation is a fundamental equation in Fluid Mechanics that relates the energy of a fluid in motion, including potential energy, kinetic energy, and pressure energy.
15. Potential flow: Potential flow is the idealized flow of a fluid in which the velocity is the gradient of a scalar potential function.
16. Vorticity: Vorticity is a measure of the rotation of a fluid.
17. Boundary layer: The boundary layer is the thin layer of fluid in the vicinity of a solid boundary where the fluid velocity changes from the free stream value to zero.
18. Separation: Separation is the separation of the boundary layer from the solid boundary, leading to the formation of a wake.

19. Control volume: A control volume is a fixed volume in space through which fluid flows.

20. Conservation laws: Conservation laws are fundamental principles in Fluid Mechanics that state that certain physical quantities, such as mass, momentum, and energy, are conserved.

Examples and practical applications:

- * The pressure exerted by a column of water in a water tank can be calculated using hydrostatic pressure.
- * The lift on an airplane wing can be explained using Bernoulli's equation and the concept of dynamic pressure.
- * The drag on a car can be reduced by minimizing the formation of turbulent flow and separation.
- * The flow rate of water in a pipe can be calculated using the continuity equation.
- * The energy loss in a pipe due to friction can be calculated using the energy equation.

Challenges:

- * Understanding the concept of viscosity and its effect on fluid flow.
- * Distinguishing between laminar and turbulent flow and calculating the Reynolds number.
- * Applying Bernoulli's equation and the continuity equation to solve Fluid Mechanics problems.
- * Analyzing the boundary layer and separation in fluid flow.
- * Understanding the concept of potential flow and its applications.
- * Understanding the conservation laws in Fluid Mechanics and their implications.

It is important to note that this is not an exhaustive list, and there are many other key terms and concepts in Fluid Mechanics. However, understanding these key terms and concepts is a crucial step in developing a solid foundation in Fluid Mechanics. With practice and experience, these concepts can be applied to solve real-world problems in Hydraulic Engineering.