Undergraduate Certificate in Hydro Power Engineering

Fluid Mechanics for Hydro Applications

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Adhesion:
Adhesion is the property of water molecules to stick to the surface of solid materials. In hydro applications, adhesion plays a crucial role in ensuring that water flows smoothly through pipes and channels without leaking.

Bernoulli's Equation:
Bernoulli's equation is a fundamental principle in fluid mechanics that describes the relationship between pressure, velocity, and elevation in a flowing fluid. It states that the total mechanical energy of a fluid remains constant along a streamline. The equation is expressed as:

\[P + 0.5 \rho v^2 + \rho gh = constant \]

where P is the pressure, \(\rho\) is the density of the fluid, v is the velocity of the fluid, g is the acceleration due to gravity, and h is the elevation.

Cavitation:
Cavitation is the formation of vapor bubbles in a liquid due to rapid changes in pressure. In hydro applications, cavitation can cause damage to equipment such as pumps and turbines by eroding the surface of components.

Drag Force:
Drag force is the resistance experienced by an object moving through a fluid. In hydro applications, drag force is a critical factor in determining the efficiency of hydroelectric turbines and the design of underwater structures.

Euler's Equation:
Euler's equation is a differential equation used to describe the flow of an inviscid fluid. It is derived from the Navier-Stokes equations and is commonly used in fluid dynamics to analyze the behavior of fluids in motion.

Fluid Dynamics:
Fluid dynamics is the study of how fluids behave when they are in motion. In hydro applications, understanding fluid dynamics is essential for designing efficient hydroelectric systems and predicting the performance of water turbines.

Head Loss:
Head loss refers to the decrease in pressure that occurs as a fluid flows through a pipe or channel. In hydro applications, head loss is a critical parameter that affects the efficiency of hydraulic systems and the

selection of pump and turbine designs.

Hydraulic Jump:
A hydraulic jump is a phenomenon that occurs when a fast-moving fluid abruptly slows down and increases in depth. In hydro applications, hydraulic jumps are commonly observed in spillways and hydraulic structures to dissipate the energy of flowing water.

Hydrodynamics:
Hydrodynamics is the branch of fluid mechanics that deals with the study of moving fluids, such as water. In hydro applications, hydrodynamics is used to analyze the behavior of water in rivers, lakes, and hydraulic structures.

Hydrostatic Pressure:
Hydrostatic pressure is the pressure exerted by a fluid at rest due to the weight of the fluid above it. In hydro applications, hydrostatic pressure plays a crucial role in determining the stability of dams, reservoirs, and other water structures.

Incompressible Flow:
Incompressible flow is a type of fluid flow in which the density of the fluid remains constant throughout the flow field. In hydro applications, water is often treated as an incompressible fluid due to its relatively low compressibility.

Laminar Flow:
Laminar flow is a type of fluid flow characterized by smooth, orderly layers of fluid moving in parallel without mixing. In hydro applications, laminar flow is desirable for minimizing energy losses and ensuring efficient water transport.

Navier-Stokes Equations:
The Navier-Stokes equations are a set of partial differential equations that describe the motion of viscous fluids. In hydro applications, the Navier-Stokes equations are used to predict the behavior of water in hydraulic systems and optimize the design of turbines and pumps.

Reynolds Number:
The Reynolds number is a dimensionless parameter that characterizes the flow regime of a fluid. In hydro applications, the Reynolds number is used to determine whether the flow is laminar or turbulent and to predict the transition between different flow regimes.

Turbulent Flow:
Turbulent flow is a type of fluid flow characterized by chaotic, irregular motion and mixing of fluid particles. In hydro applications, turbulent flow is often encountered in rivers, waterfalls, and hydraulic structures, leading to increased energy losses and flow resistance.

Viscosity:
Viscosity is a measure of a fluid's resistance to deformation or flow. In hydro applications, viscosity plays a crucial role in determining the frictional losses in pipes, channels, and hydraulic components, affecting the

overall efficiency of the system.

Water Hammer:
Water hammer is a sudden increase in pressure that occurs in a fluid-filled pipeline when the flow of water is abruptly stopped or redirected. In hydro applications, water hammer can cause damage to pipes, valves, and other hydraulic equipment if not properly managed.

Well Hydraulics:
Well hydraulics is the study of groundwater flow and the behavior of aquifers in response to pumping. In hydro applications, well hydraulics is essential for optimizing the design and operation of wells, pumps, and water extraction systems.