Fluid Mechanics

Objectives :

To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.

Outcomes : : At the completion of this course, students should be able to

understand the properties of the fluid.

understand and solve the fluid flow problems.

understand the mathematical techniques of practical flow problems.

understand the energy exchange process in fluid machines.

Fluid Static's : Review of Basic concepts &properties of the fluid . Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces ; buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Kinematics of Flow : Types of flow-ideal & real , steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow net & its applications , method of drawing flow nets.

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

Dimensional Analysis : Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers

Introduction to boundary layer, Boundary layer development on a flat plate and its characteristics - Boundary layer thickness, displacement thickness, momentum thickness, energy thickness.

Momentum equation for boundary layer by Von karman, drag on flat plate, boundary layer separation and its control. Aerofoil theory, lift and drag coefficients, streamlined and bluff bodies.

Flow through Pipes : Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stokes' Equation, relation between shear & pressure gradient, laminar flow through circular pipes, friction factor, laminar flow between parallel plates, hydrodynamic lubrication.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References: -

1.Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; Mc Graw Hills

2. FOX , McDonald Pritchard , Fluid Mechanics Wiley students edition

3. White ; Fluid Mechanics ; Mc Graw Hills

4. Cengal; Fluid Mechanics; Mc Graw Hills

5. R Mohanty; Fluid Mechanics; PHI

6 K L Kumar Fluid Mechanics

7 Fluid Mechanics & hydraulic Machines , Modi & Seth

8 CS Jog , Fluid Mechanics Volume II CAMBRIDGE IISc Series , Third Edition

List of Experiments :

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Nozzle meter and Mouth Piece
6. Reynolds experiment for demonstration of stream lines & turbulent flow
7. Determination of meta-centric height
8. Determination of Friction Factor of a pipe
9. To study the characteristics of a centrifugal pump.
10. Verification of Impulse momentum principle.