Fluid Mechanics
BEG261CI

Year: II **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	1	2/2	3	80	-	-	20	25	125

Course Objective:

Course Contents:

1.0 Introduction (2 hrs)

1.1 Matter as Solid, Liquid and Gas
1.2 Application of Fluid Mechanics in Civil Engineering
1.3 Concept of continuum and control volume

2.0 Physical Properties of Fluid (5 hrs)

2.1 Density, Specific Weight, Specific Volume, Specific Gravity, Compressibility, Surface Tension, Capillarity, Vapor Pressure and Cavitation
2.2 Viscosity and Newton's Law of Viscosity
2.3 Classification of Fluid

3.0 Fluid Statics (13 hrs)

3.1 Intensity of Pressure and Pressure force
3.2 Pressure-Depth Relationship
3.3 Pascal's Law
3.4 Absolute, Gauge, Atmospheric and Vacuum Pressure
3.5 Measurement of Pressure: Barometer, Manometer and Bourdon Gauge
3.6 Pressure on Plane Submerged Surface, Pressure Diagram and Center of Pressure
3.7 Pressure on Curved Surface
3.8 Forces on Gates (Plane and Curve), Dams and Other Water Retaining Structures
3.9 Buoyancy and Floatation
3.10 Meta Center, Meta-Centric height and its determination
3.11 Condition of Equilibrium Stability of submerged and floating bodies
3.12 Fluid within a Rigid Body Subjected to Motion (Acceleration and Rotation)

4.0 Kinematics of Flow (8 hrs)

4.1 Lagrangian and Eulerian Approaches of Describing Fluid Flow
4.2 Types of flow as Steady and Unsteady, Uniform and Non-Uniform, Laminar and Turbulent
4.3 One, Two and Three dimensional Flow
4.4 Discharge and Mean Velocity of Flow
4.5 Stream Lines, Streak Lines, Path Lines, Stream Tube
4.6 Principle of Conservation of Mass

4.7 Derivation of Equation of Continuity in Cartesian Co-ordinates and Cylindrical Polar Co-ordinates
4.8 Continuity equation for two-dimensional and one-dimensional flow
4.9 Velocity and acceleration of fluid particles
4.10 Local and Convective acceleration

5.0 Dynamics of Flow (14 hrs)

5.1 Various Forces Acting on Fluid
5.2 Euler's Equation of Motion and its applicability
5.3 Integration of Euler's Equation of Motion in One Dimension to obtain Bernoulli's Equation
5.4 Energy of Steady Fluid Flow
5.5 Bernoulli's equation for real fluid
5.6 Application of Bernoulli's Equation to Orifice and Mouthpiece
5.7 Determination of hydraulic coefficients
5.8 Varying Head Flow: Emptying and Filling of Tanks
5.9 Venturimeter, Orifice-meter, Nozzlemeter and Pitot Tube
5.10 Derivation of Momentum Equation
5.11 Application of Momentum Equation to calculate Forces on Pipe Bends, Reducers, etc.
5.12 Force Exerted by Jets on Moving and Stationary Vanes of different shapes
5.13 Concept of Angular Momentum
5.14 Problems of Sprinklers

6.0 Boundary Layer Theory (3 hrs)

6.1 Concept of Boundary Layer and its application
6.2 Boundary Layer concept along a thin layer (Laminar Zone, Turbulent Zone, Transition Zone as well as Laminar Sub-layer).
6.3 Boundary Layer Thickness, Momentum Thickness and Displacement Thickness
6.4 Smooth and Rough Boundary examples

Laboratories:

(i) Newton's Law of Viscosity
(ii) Hydrostatic Forces on a Submerged Body.
(iii) Stability of a Floating Body.
(iv) Verification of Bernoulli's Theorem using Venturimeter
(v) Impact of Flow Jet
(vi) Flow through Edged Orifice

References:

- J. Lal, Fluid Mechanics and Hydraulics, Metropolitan Books Co. Pvt. Ltd. Delhi, 1987
- P. N. Modi & S. M. Seth, "Fluid Mechanics and Hydraulics, Standard Book House, 2009
- D. S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S. K Kataria & Sons, Sixth Edition, 2005
- D. P. Sangroula, "Fundamentals of Fluid Mechanics", Nepal Printing Support, Anamnagar, Kathmandu, 2008
- P. K. Bansal, "A Text Book of Fluid Mechanics, Laxmi Publishers, 2005