

AMSF-07 ENGINEERING FLUID MECHANICS AND MACHINERY

UNIT-1 SCOPE OF FLUID MECHANICS

- 1.1 Dimensions and units- Definition of fluid- Fluid properties- density, specific weight, pressure, viscosity, surface tension and capillarity, compressibility- Rheological classification of fluids.
- 1.2 Fluid Statics- Pressure at a point- Basic equation of fluid statics- Hydrostatic equations for incompressible and compressible fluids
- 1.3 Hydrostatic force on a submerged plane and curved surfaces- Buoyancy and equilibrium of floating bodies
- 1.4 Absolute and gauge pressure - Pressure measurement by manometers and pressure gauges.

UNIT-2 FLUID KINEMATICS AND FLUID DYNAMICS

- 2.1 Continuum Lagrangian and Eulerian approaches
- 2.2 Classification of fluid motion- path line, stream line, streak line, stream tube, one, two and three dimensional flow,
- 2.3 Velocity field- acceleration of fluid particle in a velocity field- Continuity equation (one and three dimensional differential forms)
- 2.4 Equation of stream line- stream function- velocity potential function- circulation- flow net
- 2.5 Fluid dynamics- equations of motion- Euler's equation along a streamline-
- 2.6 Bernoulli's equation- applications- venturimeter, orifice meter, Pitot tube.
- 2.7 Dimensional analysis- Buckingham's Pitheorem- applications-similarity laws and models.

UNIT-3 INCOMPRESSIBLE FLUID FLOW

- 3.1 Viscous flow- Navier- Stoke's equation (statement only)
- 3.2 Shear stress, pressure gradient relationship
- 3.3 Laminar flow between parallel plates-
- 3.4 Laminar flow through circular tubes (Hagen Ponselle's)
- 3.5 Hydraulic and energy gradient- flow through pipes-
- 3.6 Darcy-weisbach equation- pipe roughness- friction factor
- 3.7 Moody's diagram- minor losses- flow through pipes in series and in parallel- power transmission.
- 3.8 Boundary layer flows, boundary layer thickness, boundary layer separation- drag and lift coefficients. Flow through fixed and fluidized beds.

UNIT-4 HYDRAULIC MACHINES

- 4.1 Definition and classification- exchange of energy
- 4.2 Euler's equation for turbo machines- head and specific work- components of energy transfer- degree of reaction.
- 4.3 Hydro turbines: definition and classification- Francis turbine- Kaplan turbine- working principle- work done- specific speed- efficiency- performance curve for turbines.

- 4.4 Pumps: definition and classification- Centrifugal pump: working principle, velocity triangles, specific speed, efficiency and performance curves
- 4.5 Reciprocating pumps: working principle, indicator diagram and performance curves- cavitation in pumps– Rotary pumps: working principle of gear and vane pumps.

References Books:

1. Kumar, K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
2. McCabe, W.L, Smith J. and Harriot.P. “Unit Operations in Chemical Engineering”, McGraw Hill, Sixth Edition 2000.
3. Vasandani, V.P., Hydraulic Machines – Theory and Design, Khanna Publishers, 1992
4. Streeter, V.L. and Wylie, E.B, Fluid Mechanics, McGraw Hill, 1983.
5. Edward J. Shaughnessy Jr., Ira M. Katz, and James P. Schaffer., Introduction to Fluid Mechanics, Oxford University Press, 2005.

