

CC XIII - FLUID DYNAMICS

UNIT I

Real Fluids and Ideal Fluids - Velocity of a Fluid at a point - Streamlines and Path lines; Steady and Unsteady Flows - The Velocity potential - The Vorticity vector - Local and Particle Rates of Change - The Equation of continuity - Worked examples - Acceleration of a Fluid - Pressure at a point in a Fluid at Rest - Pressure at a point in Moving Fluid - Conditions at a Boundary of Two Inviscid Immiscible Fluids - Euler's equations of motions - Bernoulli's equation - worked examples.

UNIT II

Some Flows Involving Axial Symmetry - Some special two-Dimensional Flows - Impulsive Motion. Some three-dimensional Flows: Introduction - Sources, Sinks and Doublets - Images in a Rigid Infinite Plane - Axi-Symmetric Flows ; Stokes stream function.

UNIT III

Some Two-Dimensional Flows: Meaning of a Two-Dimensional Flow - Use of cylindrical Polar coordinates - The stream function - The Complex Potential for Two- Dimensional, Irrotational, Incompressible Flow - complex velocity potentials for Standard Two-Dimensional Flows - Some worked examples - The Milne-Thomson circle theorem and applications - The Theorem of Blasius.

UNIT IV

The use of conformal Transformation and Hydrodynamical Aspects - stress components in Real fluid - relations between Cartesian components of stress - Translational Motion of Fluid Element - The Rate of Strain Quadric and Principal Stresses - Some Further properties of the Rate of Strain Quadric - Stress Analysis in Fluid Motion - Relations Between stress and rate of strain - The coefficient of viscosity and Laminar Flow - The Navier - Stokes equations of Motion of a Viscous Fluid.

UNIT V

Some solvable problems in Viscous Flow - Steady Viscous Flow in Tubes of Uniform cross section - Diffusion of Vorticity - Energy Dissipation due to Viscosity - Steady Flow past a Fixed Sphere - Dimensional Analysis; Reynolds Number - Prandtl's Boundary Layer.

TEXT BOOK(S)

- [1] Content and Treatment as in Text Book of Fluid Dynamics by F. Chorlton (CBS Publishers & Distributors, New Delhi-110 032) 1985.

UNIT – I	Chapter 2: Sections 2.1 to 2.9 and Chapter 3: Sections 3.1 to 3.6
UNIT – II	Chapter 3: Sections 3.9 to 3.11 and Chapter 4: Sections 4.1, 4.2, 4.3, 4.5
UNIT – III	Chapter 5 : Sections: 5.1 to 5.9 except 5.7
UNIT – IV	Chapter 5: Section 5.10 and Chapter 8: Sections 8.1 to 8.9
UNIT – V	Chapter 8: Sections 8.10 to 8.16

REFERENCE(S)

- [1] J.F. Wendt, J.D. Anderson, G.Degrez and E. Dick, Computational Fluid Dynamics : An Introduction, Springer-Verlag, 1996.
- [2] J.D. Anderson, Computational Fluid Dynamics, The Basics with Applications, McGraw Hill, 1995.
- [3] G.K. Batchelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi, 1984.
- [4] A.J. Chorin and A. Marsden, A Mathematical Introduction to Fluid Dynamics, Springer-Verlag, New York, 1993.
- [5] S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Pvt Limited, New Delhi, 1976.
- [6] R.K. Rathy, An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.