

AEPC2003 AERODYNAMICS - I (3-0-0)

Module-I: Basic Fluid Mechanics (6 Hrs.)

Continuity, momentum and energy equations. Type of flow (steady/unsteady, laminar/turbulent, compressible/incompressible, viscous/inviscid, rotational/irrotational, 2D/3D, etc.), Euler and Lagrangian descriptions, Path lines, Streamlines and Streak lines, Angular velocity, Vorticity, Circulation, Kelvin's circulation theorem, Stream function, Velocity potential and Relationship between them.

Module-II: Two-Dimensional Inviscid Incompressible Flows (6 Hrs.)

Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Ideal Flow over a circular cylinder, D'Alembert's Paradox, Magnus effect, Kutta-Joukowski's Theorem, Starting Vortex, Kutta condition, Pressure and velocity distributions on cylinder with and without circulation in ideal and real fluid flows.

Module-III: Airfoil Characteristics (6 Hrs.)

Airfoil section geometry and wing planform geometry with its nomenclature, fundamental aerodynamic variables, Aerodynamic forces and moments and pressure coefficient, Centre of pressure, aerodynamic centre. Calculation of airfoil lift and drag, pressure distributions with different angles of attack, typical airfoil aerodynamic characteristics at low speeds. speed of sound, Mach number.

Module-IV: Airfoil and Wing Theory (6 Hrs.)

Classical thin airfoil theory for symmetric and cambered airfoils., Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horseshoe Vortex, Lifting Line Theory and its limitations.

Module-V: Viscous Flow (6 Hrs.)

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Boundary Layer growth and point of separation, Reynolds Number, Critical Reynolds Number, Boundary layer equations for a steady, two-dimensional incompressible flow, Blasius solution, Prandtl's mixing length hypothesis, Free shear layers.

Books:

- Fundamentals of Aerodynamics, Anderson, Jr. J.D. Tata McGraw- Hill Publishing Co. Ltd., New Delhi, 2007. (Special Indian Edition).
- Aerodynamics for Engineering Students, Houghton E.L and Carpenter P.W, CBS Publications and Distributors, 1993. (4th Edition).
- Aerodynamics, Clancey, L.J., Pitman, 1986
- Theoretical aerodynamics, Milne Thomson, L.H., Macmillan, 1985.