PAE4I101 AERODYNAMICS – I

UNIT 1.   REVIEW OF BASIC FLUID MECHANICS

Continuity, momentum and energy equations.

UNIT 2.   TWO DIMENSIONAL FLOWS

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

.UNIT 3.   AIRFOIL THEORY

Cauchy-Riemann relations, Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.

UNIT 4.   AIRFOIL AND WING THEORY

Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations.

UNIT 5.   VISCOUS FLOW

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady, two dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Blasius solution, Basics of Turbulent flow, Prandtl's mixing length hypothesis, Free shear layers.

TEXT BOOKS

1.   Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New
       York, 1998.

REFERENCES

1.   Houghton, E.L., and Carruthers, N.B., "Aerodynamics for Engineering students",
       Edward Arnold Publishers Ltd., London, 1989.
2.   Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.
3.   Clancey, L.J., "Aerodynamics", Pitman, 1986