GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Aeronautical Engineering

Subject Name: **Aerodynamics - II**
Subject Code: **160101**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
4	1	0	5	70	30	50

Sr. No.	Course Contents	Total Hrs
1.	**Two-Dimensional Incompressible flow over Airfoils** • Introduction – Airfoil nomenclature and characteristics • Low speed flow over airfoils – Vortex sheet • The Kutta condition • Kelvin's circulation theorem and starting vortex • The Vortex Panel Numerical Method for Lifting flow over bodies • Viscous flow over airfoil – Estimation of airfoil drag for laminar flow & Turbulent flow. Transition and flow separation • Modern Low speed airfoils • Flow over airfoil – the real case	10 Hrs
2.	**Two-Dimensional Airfoil Theory** • Introduction • Thin Airfoil Theory – Development and General thin airfoil theory • Solutions of the general equation for Symmetric airfoil, Cambered Airfoil and Flapped airfoil • Conformal Transformation – The basic principles • Transformation of flow patterns • The Kutta-Zhukovsky transformation • Transformation of circle to straight line and Ellipse • Transformation of circle into symmetric airfoil • Transformation of circle into cambered airfoil • The lift of the Zhukovsky airfoil section • The exact Zhukovsky transformation process and its numerical solution	16 Hrs
3.	**Incompressible Flow over Finite Wings – Finite Airfoil Theory** • Introduction to finite wing, downwash and induced drag • The Vortex System • Laws of Vortex motion - The vortex filament, Biot-Savart Law and Helmholtz's Theorem • Prandtl's Classical Lifting line theory • Determination of load distribution on a given wing – General theory General solution, load distribution for minimum drag	14 Hrs

	• Influence of downwash on tail plane and ground effect • The lifting-surface theory & the vortex lattice method • A numerical non-linear lifting line method • Delta wings	
4.	**Subsonic compressible Flow over Airfoil s: Linear Theory** • Introduction • The Velocity potential equation • The linearized Velocity potential Equation • Prandtl-Glauert Compressibility Correction • Critical Mach number, • Drag divergence Mach number: the sound barrier , Area rule & supercritical airfoil	6 Hrs
5.	**Linearized Supersonic Flow:** • Introduction and Derivation of the Linearized Supersonic Pressure coefficient • Applications of Linearized theory to Supersonic Airfoil • Supersonic Airfoil drag	6 Hrs
6.	**Aerodynamics of fuselage & wing** • Slender bodies & Fuselage in compressible & incompressible flow • The wing fuselage system in compressible & incompressible flow • Aerodynamics of horizontal & vertical tail • The flap wing of infinite span (profile theory) • Flaps on the wing of finite span & on the tail unit.	8 Hrs

Text Books:

1. Fundamentals of Aerodynamics by J. D. Anderson, TMH Publication
2. Aerodynamics for Engineering Students by E.L.Houghton & N.B. Carrathur, Edward Arnold (Publishers) Ltd, Published by Gulab Vazirani for Arnold Publishers (India) Pvt. Ltd New Delhi

Reference Books:

1. Aerodynamics by L. J. Clancy
2. Aerodynamics for Engineers by Bertin & Smith
3. Theoretical Aerodynamics by Milne Thomson