

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VI Examination-Nov/Dec-2011

Subject code: 160101

Date: 21/11/2011

Subject Name: Aerodynamics II

Time: 10.30 am -1.00 pm

Total marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Prove $K = 2U \alpha [1 + \cos \theta / \sin \theta]$ for the thin symmetrical flat plate aerofoil and the aerodynamic coefficient for a flat plate. **07**

(b) Find out the lift coefficient and moment coefficient for the flapped aerofoil? **07**

Q.2 (a) Explain the vortex filament, Biot-Savart Law and Helmholtz's Theorem in brief. **07**

(b) A wing is untwisted and of elliptic planform with a symmetrical aerofoil section, and is rigged symmetrically in a wind-tunnel at incidence α_1 to a wind stream having an axial velocity V . In addition, the wind has a small uniform angular velocity ω , about the tunnel axis. Show the distribution of circulation along the wing is given by

$$K = 4sV [A_1 \sin \theta + A_2 \sin 2 \theta]$$

And determine A_1 and A_2 in terms of the wing parameters. Neglect wind-tunnel constrains.

OR

(b) Explain in detail Prandtl's Classical Lifting line theory. **07**

Q.3 (a) Explain following aerofoil characteristic in brief **07**

1. Lift coefficient versus incidence
2. Drag coefficient versus Lift coefficient
3. Drag coefficient versus (Lift coefficient)²

(b) Explain vortex sheet method for low speed flow over airfoil. Explain its merit and demerit. **07**

OR

- Q.3 (a)** Explain in detail the Numerical Vortex Panel Method for lifting flow over arbitrary bodies. How lift is related to circulation? **07**
- (b)** Explain aerofoil nomenclature with neat sketch. **07**
- Q.4 (a)** Explain applications of Linearized theory to Supersonic Airfoil **07**
- (b)** How will you calculate drag on supersonic airfoil? **07**
- OR**
- Q.4 (a)** Explain flow development on two-dimensional aerofoil as M_∞ increase beyond M_{crit} . **07**
- (b)** Explain in brief Prandtl-Glauert rule-the application of linearized theories of subsonic flow. **07**
- Q.5 (a)** Explain behavior of fuselage and wing in compressible and incompressible case **07**
- (b)** Explain Aerodynamics of horizontal & vertical tail. **07**
- OR**
- Q.5 (a)** Explain Wings of finite span with figure. **07**
- (b)** Discuss Influence of downwash on tail plane and ground effect **07**
