(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2630   **Roll No.**

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2012-13

AERODYNAMICS—II

Time : 3 Hours   *Total Marks : 100*

Note : *Attempt all* **FIVE** *questions.*

1. Attempt any **TWO** of the following :   **(10×2=20)**

    (a) Explain the following :

        (i)   Vortex system of a wing

        (ii)   Downwash.

    (b) The variation of circulation over a wing plan form with span 'b' is given below :

    $$\Gamma(y) = \Gamma_0 \mid 1 - (2y/b)^2 \mid^{\frac{1}{2}}.$$

    Show that :

        (i)   The wing has elliptical lift distribution.

        (ii)   The downwash is constant along the wing plan form.

        (iii) $\alpha i = CL/\pi \, AR$.

    (c) Explain Elliptical lift distribution. Discuss the aerodynamics characteristics of a finite wing having elliptical lift distribution.

2. Attempt any **TWO** of the following :   **(10×2=20)**

    (a) Obtain an expression for the downward induced velocity behind a wing of span 2s at a point at distance y from

the centre of span, the circulation around the wing at any point y being denoted by Γ.

If the circulation is parabolic, i.e. $\Gamma = \Gamma_0 (1 - y^2/s^2)$. calculate the value of the induced velocity w at mid-span, and compare this value with that obtained when the same lift is distributed elliptically.

(b) Briefly describe Linearized subsonic flow over an aerofoil considering small perturbation velocity potential equations for a compressible flow.

(c) Considering a two dimensional, steady, irrotational, isentropic flow obtain velocity potential equation.

3. Attempt any **TWO** of the following :   **(10×2=20)**

(a) Discuss Linearized supersonic flow theory and its application to supersonic airfoils.

(b) Derive the Linearized Supersonic pressure coefficient formula and with the help of suitable plot discuss the variation of Linearized pressure coefficient (Cp) with Mach number.

(c) Using Linearized theory, calculate the lift and drag coefficients for a flat plate at a 5 degree angle of attack in a Mach 3 flow.

4. Attempt any **TWO** of the following :   **(10×2=20)**

(a) An airscrew is required to produce a thrust of 4000 N at a flight speed of 120 m/s at a sea level. If the diameter is 2.5 m, estimate the minimum power which must be supplied, on the basis of ideal actuator disc.

(b) Discuss Froude's momentum theory of propulsion.

(c) What do you understand by pitch and briefly discuss various types of pitch propellers ?

5. Attempt any **ONE** of the following :   **(20×1=20)**

(a) An aircraft with high wing configuration has more longitudinal static stability than the one with low wing. Comment on this with suitable explanation. Briefly discuss the performance of an aircraft in turning flight.

(b) Define the following terms :

(i) Autorotation

(ii) Spin

(iii) Adverse Yaw

(iv) Neutral point.