Code No: 07A42101 **R07** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
II B.TECH II SEM–REGULAR/SUPPLEMENTARY EXAMINATIONS MAY - 2010
AERODYNAMICS - I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Derive an expression for velocity induced at point by a semi-infinite straight vortex filament. [16]

2. (a) Explain difference between
   i. A point vortex
   ii. A constant strength vortex panel
   iii. A linearly varying strength vortex panel

   Make a comparison of the 3 in judgment and bring out the conclusions.

   (b) A planar horse shoe vortex is placed symmetrically along OX on the X-axis With its BV aligned with Y-axis. Determine a general expression for the downwash in the plane of symmetry. [8+8]

3. Consider a thin flat plate at 5 degree angle of attack. Calculate
   (a) the lift coefficient,
   (b) the moment coefficient about the leading edge,
   (c) moment coefficient about the quarter chord point,
   (d) moment coefficient about the trailing edge. [4+4+4+4]

4. What is extended lifting line theory? Explain a numerical solution for a finite wing of given planform and geometric twist, with different airfoil sections at different spanwise stations. [16]

5. With the aid of Kutta - Zukovsky transformation explain how a circle can be transformed into a cambered airfoil. [16]

6. (a) Explain the normal and axial forces and lift and drag forces on an airfoil. Derive the relationships between them.
   (b) How is the aerodynamic moment generated?
   (c) Explain whether forces alone or moment alone are possible over an airfoil. [6+5+5]

7. A constant source distribution of strength $\sigma(x)=\sigma=50$ is placed along X-axis (X1=3.0 to X2=3.5). Obtain the velocity potential $\phi(x,z)$ and velocity components(y,v) at point P(4.5,7.5). Represent the source panel and the point P on a diagram. Explain the situation like this occurring for a non-lifting problem of this choice. [16]

8. Consider the lifting flow over a circular cylinder with a diameter of 0.5 m. The freestream velocity is 25 m/s, and the maximum velocity on the surface of the cylinder is 75 m/s. Assume sea level density, and calculate the lift per unit span on the cylinder. [16]

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