Code No: NR312103 **NR**

III B.Tech I Semester Supplementary Examinations, November 2006
AERODYNAMICS-I
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write an elabroate note on Inviscid versus viscous flow. What are your abservations.
   (b) Develop equation of streamline in an incompressble flow.

2. (a) Explain physical meaning of the divergence of velocity i.e. $\nabla.\overrightarrow{V}$
   (b) Write Euler equation in vector form for incompressible flow. How does it differ from Navier-Stokes equations.

3. Velocity components of a 2-D inviscid incompressible flow are given as

$$\mu = 2y + \frac{y}{(x^2+y^2)^{1/2}}$$
$$\upsilon = -2x - \frac{x}{(x^2+y^2)^{1/2}}$$

   Find out stream function and the vorticity. Sketch the stream lines.

4. (a) Prove that streamlines due to a point source are equipotential lines due to a point vortex.
   (b) Explain how can you obtain flow field around an ellipse, making ue of elementary flows.

5. A long right circular cylinder of diameter a meter is set horizontally in a steady stream of velocity u m/sec and caused to rotate at ω rad/sec. Obtain an expression in terms of ω and μ and for the ratio of pressure difference between the top and bottom of the cylinder to dynamic pressure of the stream. What happens to stagnation lines if ω is increased keeping μ constant.

6. Obtain symmetrical airfoil through Kutta-Juokoweski Transformation.

7. The Camber line of a circular arc airfoil is given by
   $\frac{y}{c} = 4h\frac{x}{c}\left(1 - \frac{x}{c}\right)$
   Find the load distribution at incidence α. Show that zero lift angle α_0 = -2h.
   Sketch load distribution at this incidence showing clearly the separate effects of camber and incidence. Compare the lift curve of this airfoil with that of a flat plate.

8. Explain the formation of horse shoe vortex for a finite lifting wing with sketches and plots.

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