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00424

B.Tech. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2013

BAS-012 : AERODYNAMICS - I

Time : 3 hours *Maximum Marks : 70*

Note : Q. 1 is compulsory. Attempt any six questions from the remaining.

1. Write short notes on :

   (a) Magnus effect 2

   (b) Kutta Condition 3

   (c) d' Alembert's paradox 3

   (d) Jet flap 2

2. Derive the complex potential for the following :

   (a) Uniform flow in any direction 3

   (b) Doublet at origin with axis along O_x 3

   (c) Straight line vortex (axis normal to the plane of the flow at the origin) 4

3. Using Kutta-Zhukovsky theorem of circulation and lift, derive expressions for lift as $L' = \rho U \Gamma$ where symbols have their usual meaning. 10

4. (a) Derive $Cp = 1 - 4 \sin^2\theta$ for non-lifting flow over a circular cylinder. 6

(b) Find the maximum velocity for the non-lifting flow over a circular cylinder. 4

5. (a) Prove that streamlines can be represented by the equation $\frac{dy}{dx} = \frac{v}{u}$ 5

(b) If a flow $u = 3$ m/s and $v = 6$m/s, determine the equation of streamlines passing through the origin. 5

6. Prove that :

(a) Constant stream function and velocity potential lines in a flow net are orthogonal. 5

(b) Explain schlieren system of flow visualization in wind tunnels. 5

7. Describe flow visualization techniques used in subsonic wind tunnels. 10

8. List and describe types of supersonic wind tunnels, their components and functions. 10

9. Prove that as per thin aerofoil theory, solution for flat plate is $K = 2u \frac{1 - \cos\theta}{\sin\theta}$, where K is the distribution of velocity over the angle of attack and u is the free stream velocity. 10