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BAS-012

01173

B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2010

BAS-012 : AERODYNAMICS - I

Time : 3 hours *Maximum Marks : 70*

Note : *Q1 is COMPULSORY. Attempt **any six** questions from the remaining.*

1. Establish reasons for the correctness of the following statements in not more than five sentences.

(a) Cauchy-Reimann equations are always satisfied by flow for which stream function and velocity potential function exist. **2**

(b) Kutta condition gives unique way of choosing the circulation for an aerofoil and there by determine lift. **2**

(c) The continuity equation is equivalent to the statement that the divergence of velocity vector must vanish. **2**

(d) For a flow to be irrotational, a velocity potential function must exist. **2**

(e) Constant stream function and velocity potential lines in a flow net are orthogonal. **2**

2. (a) Write the generalised equation of continuity in vector form considering compressibility and variation of density with time, 5

(b) In a compressible flow $u = x^3 - y^3$ and $v = z^3 - y^3$. Determine the third component assuming that origin is a stagnation point. 5

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

(b) If for a flow $u = 3$ m/sec and $v = 6$ m/sec; determine the equation of streamlines passing through origin and the one passing through (2m,3m) 5

4. (a) What is a complex potential function ? 5

(b) Derive the complex potential for uniform stream flowing in any direction 5

5. Show that the transformation $G = \frac{1}{z}$, transforms flow parallel to x-axis into circles. Find the radius and center of the circle. 10

6. Show that the transformation of radius a (a, b), $G = z + \frac{b^2}{z}$, transforms circle to an ellipse. **10**

7. Using kutta-zhukovsky theorem of circulation and lift, derive expression for lift as $L = \rho UT$ where symbols have their usual meaning. **10**

8. Prove that as per thin aerofoil theory, solution for flat plate is $k=2u\ \alpha\ \frac{(1+\cos\theta)}{\sin\theta}$, where, k is the distribution of velocity over the elements of camberline, α is the angle of attack and U is the free stream velocity **10**

9. List and describe subsonic wind tunnels, their components and functions **10**

10. Write short notes on :

    (a) Assumption and utility of thin Aerofoil theory **5**

    (b) Optical methods of flow visualisation in wind tunnels **5**