B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2011

BAS-012 : AERODYNAMICS - I

Time : 3 hours   *Maximum Marks : 70*

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

1. Establish reason for the correctness of the following statements in not more than five sentences and one sketch/plot in addition.

    (a) In conformal transformations, length ratios are inversely proportional to the velocity ratios.   2

    (b) A complex potential function describes complete picture of the flow of inviscid fluid.   2

    (c) A bound vortex formation round a finite wing provides picture of its lifting capacity.   2

    (d) If a flow is irrotational, than there exists a scalar function ϕ such that curl (Grod ϕ) is zero.   2

    (e) The thin aerofoil theory is applicable to ideal flow and satisfies Kutta condition.   2

2. (a) What are the different divisions of fluid mechanics ? Explain their significances. 5

   (b) Convert standard atmospheric pressure in heights in meters of water and mercury. 5

3. (a) What are Langrangian and Eulerian approaches ? 5

   (b) Does a velocity field given by $v = 5x^3\hat{i} - 15x^2y\hat{j} + t\hat{k}$ represent possible fluid motion of an incompressible fluid. 5

4. (a) What are the conditions for 5

   (i) Flow to exist

   (ii) Flow to be irrotational and

   (iii) both exists and is irrotational in terms of single equation ?

   (b) Prove that in flow net the lines Ψ = constant and ϕ = constant form an orthogonal network where ψ and ϕ denote stream function and potential function respectively. 5

5. (a) Derive equation of velocity in complex potential function form. 5

   (b) Derive complex potential of uniform flow parallel to x - axis. 5

6. Apply and find the streamline picture of transformation $G = z^2$ to flow parallel to x - axis. **10**

7. (a) What are the applications and assumptions of thin aerofoil theory ? **5**

   (b) Prove that $V\left[\dfrac{\mathrm{d}y_c}{\mathrm{d}x} - \alpha\right] = \dfrac{1}{\pi}\displaystyle\int_{0}^{c}\dfrac{K\mathrm{d}x}{x-x_1}$ **5**

8. Describe flow visualisation techniques used in subsonic wind tunnels **10**

9. List and describe types of supersonic and hypersonic wind tunnels. **10**

10. Write short notes on

    (a) Optical methods in flow visualisation in supersonic wind tunnels **5**

    (b) Kutta - Zhukhovsky condition **5**