B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00465

December, 2014

BAS-012 : AERODYNAMICS – I

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) How do the laminar and turbulent boundary layers differ from each other ? Explain with neat sketches.   *6*

    (b) State and explain the Bernoulli's equation for incompressible flow.   *4*

2. (a) Draw the propagation of disturbance waves for subsonic and supersonic conditions.   *4*

    (b) Derive the fundamental equation for thin airfoil theory. State the assumptions made.   *6*

3. Explain downwash and induced drag. Also show how induced drag affects the angle of attack.   *10*

4. Derive an expression for vorticity in terms of the velocities in x, y and z directions respectively.   *10*

5. (a) Define angular velocity, strain rate and vorticity of a fluid element. *4*

(b) Consider the velocity field given by $u = \dfrac{y}{x^2 + y^2}$ and $v = \dfrac{-x}{x^2 + y^2}$. Calculate the equation of the streamline passing through the point (5, 5). *6*

6. Explain in detail the boundary layer separation with the help of neat sketches. *10*

7. Explain the construction and working of a subsonic wind tunnel with the help of a neat diagram. *10*

8. Define the following terms : *5×2=10*

(a) Wave drag

(b) Stall velocity

(c) Aerodynamic centre

(d) Neutral point

(e) Centre of pressure

9. Write short notes on any *two* of the following :

2×5=10

(a) Drag Divergence Mach Number

(b) Newton's Law of Viscosity

(c) Fundamental Gas Laws

(d) Source and Sink Flow