BAS-015

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00155 **December, 2014**

BAS-015 : AERODYNAMICS – II

Time : 3 hours   *Maximum Marks : 70*

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

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1. (a) Show with suitable derivation that flow behind the normal shock is always subsonic.

   (b) Explain in brief the theory of detached shock wave in front of a blunt body.   *5+5*

2. (a) Derive the fundamental equation of the Prandtl's lifting line theory.

   (b) Show that for an elliptical lift distribution, induced drag coefficient

   $$C_{Di} = \frac{C_L^2}{\pi AR}$$, where C_L is lift coefficient and

   AR is aspect ratio of wing.   *5+5*

3. (a) Explain with diagram, the features and method of swinging a cricket ball.

   (b) Write a note on boundary layer separation. How is it different for laminar and turbulent flows? *5+5*

4. (a) Bring out any two important differences between shock waves and expansion waves in a supersonic flow.

   (b) Show that for an elliptical lift distribution, the downwash is constant over the span of the wing. *5+5*

5. (a) What will be the velocity of a fluid leaving a nozzle, if the velocity of approach is very small?

   (b) How is sonic velocity defined in terms of pressure and density of the fluid? *5+5*

6. (a) What is Mach number? What do you understand by choking in nozzle flows?

   (b) What is a Fanno line? Why do the end states of a normal shock lie on the Fanno line? *5+5*

7. (a) Explain Biot-Savart law.

   (b) Explain downwash in brief. *5+5*

8. A stream of air flows in a duct of 100 mm diameter at a rate of 1 kg/sec. The stagnation temperature is 37°C. At one section of the duct the static pressure is 40 kPa. Calculate the Mach number, velocity and stagnation pressure at this section. *10*

9. (a) Discuss in detail the lift and drag characteristics of airfoil.

(b) What is the effect of pressure gradient on boundary layer separation ? Also explain "Prandtl Number in Hydrodynamic Boundary Layer". *5+5*

10. A shock wave generated by an explosion propagates through a still atmosphere. If the pressure downstream of the shock wave is 700 kPa, estimate the shock speed and the flow velocity downstream of the shock. *10*

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