No. of Printed Pages : 3

BAS-015

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B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2014

BAS-015 : AERODYNAMICS - II

Time : 3 Hours *Maximum Marks : 70*

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

1. (a) Derive an expression for induced drag co-efficient and induced angle of attack of a finite wing for elliptical lift distribution. 5+5
   (b) Differentiate between finite and infinite wing with suitable sketch and plot.

2. (a) Why a Golf ball is dimpled ? 5+5
   (b) What is Helmholtz's theorem ?

3. (a) Describe in brief the expansion Hodograph. 5+5
   (b) Explain the formation of wing-tip vertices.

4. (a) What is a detached shock wave ? When it is formed ? 5+5
   (b) How laminar flow airfoil geometry is different from a conventional airfoil ?

5. (a) Explain briefly the procedure to be followed for analysis of a supersonic nozzle using method of characteristics. 5+5
   (b) Discuss in brief the optimum, under - expanded and over - expanded convergent divergent nozzles.

6. A nozzle is a device for increasing the velocity of a steady flowring stream. At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. **10**

(a) Find the velocity at exit from the nozzle.

(b) If the inlet area is 0.1 m^2 and the specific volume at inlet is 0.187 m^3/kg, find the mass flow rate.

(c) If the specific volume at the nozzle exit is 0.498 m^3/kg, find the exit area of the nozzle.

7. (a) Show that the sonic velocity in an ideal gas depends on the temperature and the nature of the gas. **5+5**

(b) What is a shock ? Where does it occur in a nozzle ?

8. Show that for an ideal gas the fractional change in pressure across a small pressure pulse is given by : **10**

$$\frac{dp}{p} = \gamma \frac{dV}{C}$$

and that the fractional change in absolute temperature is given by :

$$\frac{dT}{T} = (\gamma - 1) \frac{dV}{C}$$

where symbols carry usual meaning.

9. (a) Discuss in brief the forces on an Airfoil. **5+5**

(b) Explain Lifting Line theory of Prandtl.

10. (a) Describe Area-velocity Relations in One-Dimensional Isentropic flow. Also prove that 5+5

$$\frac{dA}{A} = \left(M^2 - 1\right) \frac{dV}{V}$$

where symbols carry usual meaning.

(b) Define the following :

(i) Laminar Boundary Layer
(ii) Boundary Layer Thickness
(iii) Laminar Sub-layer
(iv) Skin Friction
(v) Turbulent Boundary Layer