No. of Printed Pages : 3 **BAS-015**

B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2013

BAS-015 : AERODYNAMICS - II

00841

Time : 3 Hours *Maximum Marks : 70*

Note : *Question No.* ***one*** *is* ***compulsory****. Attempt* ***any six*** *question from the remaining questions* ***q. 2*** *to* ***q. 9****. Use of Gas Table is* ***permitted****.*

1. Fill in the blank : **2x5=10**

(a) Down ward component of velocity in the vicnity of wing is known as _____.

(b) The combination of bound vortex and trailing vortex is known as _____.

(c) Reflected shock wave is _____ than the incident shock.

(d) Flow behind the oblique shock wave is _____.

(e) Ratio of displacement thickness to momentum thickness is known as _____.

2. State Biot-savart Law and Prove that Downwash is constant for elliptical lift distribution. **4+6=10**

3. (a) Consider a finite wing with an aspect ratio of 8 and a taper ratio of 0.8. The airfoil section is thin and symmetric. Calculate the lift and induced drag coefficient when it is at angle of attack of 5° assume $\delta = \tau = 0.055$

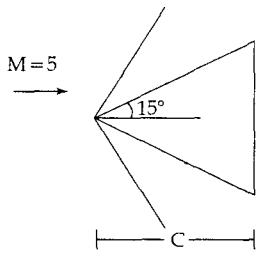
(b) Derive an expression for speed of sound when sound wave is propogating in a gas across the normal shock wave. **5+5=10**

4. (a) A De-Laval nozzle has to be designed for an exit Mach No of 1.5 with exit diameter of 200mm. Find ratio of throat area/exit area. The reservoir conditions are given as P_0=1atm, T_0=20°C. Find also the maximum flow rate through the nozzle. **5+5=10**

(b) Consider a normal shock in air where the upstream flow properties are U_1=68m/s, T_1=280°K and P_1= 1atm. Calculate velocity, temperature and pressure downstream of the shock.

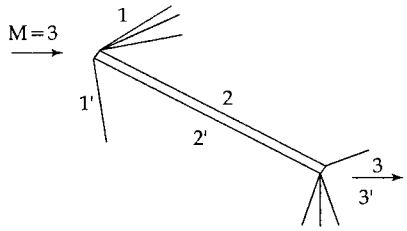
5. Explain shock polar for oblique shock wave with suitable sketch. **10**

6. Consider a wedge with 15° half angle in a Mach 5 flow which is given below. Calculate the drag coefficient for the wedge. **10**



7. (a) Explain with neat sketch : shock wave interaction 8 reflection. **5**

(b) For the flat plate which is given below, calculate the flow Mach No. across all waves, assuming slip stream deflection to be negligible. **5**



8. Explain the phenomena of flow separation over the flate surface and also justify why golf balls are manufactured with dimpled surface. **10**

9. The velocity distribution in the boundary layer of a flat plate is prescribed by the relation. **2.5x4=10**

$$\frac{u}{U_0} = \left(\frac{y}{\delta}\right)^{\frac{1}{7}}$$

Find the following :

(a) Displacement thickness

(b) Momentum thickness

(c) Energy thickness

(d) Shape factor