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

00142

B.TECH. IN AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2011

BAS-015 : Aerodynamics - II

Time : 3 hours *Maximum Marks : 70*

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

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1. (a) Derive an expression Connecting Area and Velocity Variations with Mach number for a one-dimensional compressible flow. 5

   (b) An airplane is flying at 2.5 Mach at an altitude where the pressure and temperature are respectively, 0.2 atm and - 50°C. Calculate the pressure and temperature at the leading edge of the wing. 5

2. (a) Derive a general expression for the speed of sound in a compressible gas. 4

   (b) Air at 30°C and 1 atm is drawn through a C-D nozzle which discharges in to a large vaccum tank. Determine the Conditions upstream and down stream of a normal shock which is located at the nozzle exit. The nozzle throat and exit areas are 0.025 m^2 and 0.0724 m^2, respectively. 6

3. (a) Explain the term chocking in a CD nozzle and the flow conditions responsible for it. 2

(b) Air flows at a mass flow rate of 9.0 kg/s isothermally at 300 K through a straight rough duct of constant Cross-Sectional area 1.5×10^{-3} m^2. At one end A the pressure is 6.5 bar and at the other end B the pressure is 8.5 bar. Determine (i) velocities U_A and U_B, (ii) the force acting on the duct wall. 8

4. (a) Derive a relation Connecting flow turning angle, shock angle and free stream Mach number for Oblique Shock Waves. 4

(b) An incident shock wave with wave angle=35 degree implinges on a straight wall. If the upstream flow properties are M_1=3, P_1=1 atm, T_1=300 K, Calculate the reflected shock wave angle with respect to the wall. 6

5. (a) What is an expansion Hodograph ? What is it's use in supersonic aerodynamics ? 4

(b) A Supersonic stream of air at M=2.5, T=300 K and P=1.5 atm passes through a sudden convex and then a sudden concave corner of turning angle 15° each. Determine Mach number and pressure of flow downstream of the Concave Corner. 6

6. Explain the procedure to be followed for the design of a supersonic nozzle using method of characteristics. **10**

7. (a) Write a short note on Laminar Flow air foils. **4**

   (b) Explain the swinging of a cricket ball with the help of a neat sketch. **6**

8. (a) Explain in brief the boundary layer Separation. How it is different for laminar and turbulent flows ? **3**

   (b) A thin plate of length 0.5 m and width 1m is moving in air along it's length at a speed of 100 m/s. Calculate the total skin friction drag on the plate assuming sea level conditions. **7**

9. (a) State Biot-Savart law. **2**

   (b) Determine the expression for the Vortex drag for elliptical loading and find the condition for the maximum vortex drag. **8**

10. (a) Explain in brief the superiorities of 'Lifting Surface theory' for predicting lift distribution on a wing with an arbitary planform. Make use of sketches and other representation in this regard. **8**

    (b) Write short note on down wash ? **2**
