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BAS-015

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00156

June, 2015

BAS-015 : AERODYNAMICS – II

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. Use of scientific calculator is permitted.*

1. (a) Derive a relation connecting flow turning angle, shock angle and free stream Mach number for oblique shock waves. *5*

(b) An incident shock wave with wave angle 35° impinges 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. *5*

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

3. State Biot-Savart law. Determine the expression for the vortex drag for elliptical loading and find the condition for the maximum vortex drag. *10*

4. (a) Write a short note on laminar flow airfoils. 5

(b) Explain the swinging of a cricket ball with the help of a neat sketch. 5

5. (a) With a neat sketch, explain the concept of Prandtl-Meyer expansion waves. How do flow properties like total pressure and Mach number change across the expansion waves ? 5

(b) Sketch the Shock polar for M = 2·0 and explain the method of finding the Mach numbers and Shock angles for a turning angle of 5°. 5

6. (a) Explain the terms Bound vortex, Starting vortex and Horse shoe vortex. 3

(b) Show that for an elliptical wing loading, the induced drag is minimum. 7

7. (a) A thin plate of length 2 m and width 1 m is moving in air along its length at a speed of 10 m/s. Calculate the total skin friction drag on the plate assuming sea-level conditions. 7

(b) Write a short note on Boundary layer separation. 3

8. Consider a double wedge airfoil having chord C = 2 m and half angle 10° kept at an angle of attack of 5° in supersonic stream of Mach number 2·5 as shown in Figure 1. Evaluate lift and drag of this airfoil considering sea-level conditions. *10*

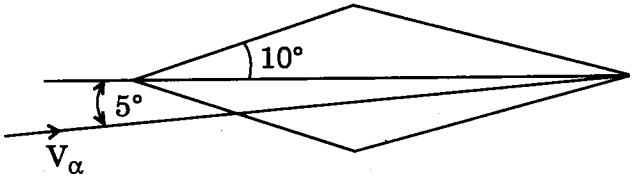

Figure 1

9. Explain the phenomenon of flow separation over the flat surface and also justify why golf balls are manufactured with dimpled surface. *10*