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BAS-015

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B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

June, 2019

BAS-015 : AERODYNAMICS - II

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Answer **any seven** questions.*

*(ii) **All** questions carry **equal** marks.*

(iii) Use of Scientific calculator is permitted.

1. (a) Explain the concept of Prandtl-Meyor expansion around a convex corner and represent it in Hodograph plane. **6**

   (b) A supersonic flow at M1 = 1.58 and P1 = 1 atm expands around a sharp corner. If the pressure down stream of the corner is 0.1306 atm, calculate the deflection angle of the corner. **4**

2. (a) What are the regions of compressible flow ? What is meant by isentropic flow with variable area ? **4**

   (b) A plane travels at a velocity of 1600 kmph at an altitude where the pressure and temperature is 40 kPa and 35°C. Find the Mach angle and Mach number. **6**

3. Sketch the pressure variation along the centre line of a converging diverging nozzle for optimum expansion. What is the influence of back pressure on this variation ? 10

4. What conditions favour detachment of shock waves in Supersonic flows over solid bodies ? Explain why shocks cannot occur in Subsonic flows. 10

5. Answer **any four** of the following questions in brief : 4x2.5=10

   (a) What is boundary layer thickness ?

   (b) Relate vorticity to circulation.

   (c) Define Prandtl lifting line theory.

   (d) Explain Mach Number Spectrum.

   (e) What is expansion hodograph ?

   (f) How is horse shoe vortex formed ?

6. (a) Describe the behaviour of a swept wing of an aircraft placed in a supersonic flow. 5

   (b) Describe the singularity distribution method to predict the flow over a three dimensional body in a supersonic flow. 5

7. (a) Obtain an expression for velocity of sound in terms of specific heats and local temperature in air medium from one dimensional continuity, momentum and energy equations. 6

   (b) What is the maximum possible turning angle when a supersonic stream flows over an expansion corner ? Give appropriate reason. 4

8. Using suitable assumption, derive the linearised velocity potential equation for compressible flows past an airfoil and find out the pressure coefficient. What are the boundary conditions imposed to solve the problem numerically ? 10

9. (a) Draw h-s diagram for the flow through a nozzle. Show how the stagnation properties get affected. 6

(b) A plane travels at a speed of 2400 kmph in an atmosphere of 5°C. Find the Mach angle. 4

10. Analyse the performance characteristics of a convergent-divergent nozzle for different inlet and outlet conditions. 10