CBCS SCHEME

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15AE61

Sixth Semester B.E. Degree Examination, June/July 2019
Aerodynamics – II

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Describe the performance under various back pressure considering convergent divergent nozzle, with a relevant sketch. **(10 Marks)**

b. Consider a point over an F-15 airplane, where the pressure, temperature and mach number are 1890 lb/ft^2, 450 R and 1.5 respectively. At this point, calculate T_0, P_0, T*, P* and the flow velocity.
[note : at M = 1.5, P_0/P = 3.671 and T_0/T = 1.45, at M = 1, P_0/P^* = 1.893, T_0/T^* = 1.2 and R = 1716 ft. lb/(slug °R). **(06 Marks)**

OR

2 a. Derive the equation for speed of sound in a perfect gas. **(08 Marks)**

b. Derive the energy equation for steady one-dimensional flow. **(08 Marks)**

Module-2

3 a. Derive the mach number equation across a normal shock wave in terms of upstream mach number. **(08 Marks)**

b. Describe in detail about moving normal shock waves with a neat sketch and appropriate equations. **(08 Marks)**

OR

4 a. The velocity of a normal shock wave moving into stagnant air (P = 1.0 bar, t = 17°C) is 500 m/s. IF the area of cross-section of duct is constant determine: i) Pressure ii) Temperature iii) Velocity of air iv) Stagnation temperature and v) The Mach number imported upstream of the wave-front.
Note: At $M_x = 1.465$, $M_y = 0.715$
$P_y/P_x = 2.335$, $T_y/T_x = 1.297$ **(08 Marks)**

b. Derive Rankine-Hugnoit equation for normal shock waves and compare the same for isentropic flow. **(08 Marks)**

Module-3

5 a. Derive Prandtl-Equation for the oblique shocks. **(08 Marks)**

b. Explain in detail about the shock polar with a neat graphs. **(08 Marks)**

OR

6 a. Derive an expressions for Rankine Hugonoit equation for oblique shocks. **(10 Marks)**

b. With a neat graphs, explain the pressure turning angle in detail. **(06 Marks)**

Module-4

7 a. Derive the equation of linearized velocity potential equations. **(08 Marks)**

b. Derive the linearized pressure coefficient, valid for small perturbation. **(08 Marks)**

OR

8 a. The theoretical lift, coefficient for an thin symmetric airfoils 2π2, where angle of attack is 4°. Using the Prandtl-Glanert rule, calculate the lift coefficient for $M_\infty = 0.7$ **(04 Marks)**

b. Derive the basic potential equations for compressible flow. **(12 Marks)**

Module-5

9 a. Explain in detail about flow visualization methods. **(06 Marks)**

b. Describe the operations of various types of Hypersonic wind tunnel with relevant sketches. **(10 Marks)**

OR

10 a. Write a short note on: Shock tubes and shock tunnels with a neat diagram. **(08 Marks)**

b. Explain the operation of transonic wind tunnel with a neat diagram. **(08 Marks)**

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