CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ 15AE61

Sixth Semester B.E. Degree Examination, July/August 2022
Aerodynamics – II

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Gas Tables is permitted.

Module-1

1   a. Derive continuity equation in differential and Integral form using control volume approach. **(08 Marks)**
     b. Derive an expression for velocity of sound in terms of temperature. **(08 Marks)**

OR

2   a. Explain how to obtain a supersonic flow in a De-Laval nozzle with the help of maintaining back pressure with relevant graph. **(10 Marks)**
     b. Air is flowing with a velocity of 200 m/s in a 30 cm diameter duct. Pressure and temperature are maintained as 3 bar and 500 K respectively. Determine (i) Mass flow rate   (ii) Mach number (iii) Stagnation temperature. Take $C_P = 1.05$ KJ/kg-K, $\gamma = 1.38$. **(06 Marks)**

Module-2

3   a. Derive Pranatl relation for normal shock wave and write the property ratios expression before and after the shock for P_2/P_1, T_2/T_1, P_2/P_1 and $S_2 - S_1$. **(12 Marks)**
     b. Write the equations of motion for Normal shock wave. **(04 Marks)**

OR

4   a. Derive Hugonoit equation and explain Hugonoit curve. **(08 Marks)**
     b. The gas flowing over a normal shock having upstream properties as $M_1 = 2.5$, $P_1 = 2$ bar and $T_1 = 275$ K. Calculate the Mach number, pressure, Temperature and velocity of gas downstream of the shock. Take $\gamma = 1.3$, $R = 469$ J/kg-K. **(08 Marks)**

Module-3

5   a. For a flow through an oblique shock, obtain expression for relation of Mach number, shock angle and deflection angle. **(08 Marks)**
     b. Discuss about shock polar and Hodograph plane. **(08 Marks)**

OR

6   a. An oblique shock in air causes an entropy increases of 11.5 J/kg-K. If the shock angle is 25°, determine the Mach number a head of shock and the flow deflection angle if $M_2 = 2.7$. **(08 Marks)**
     b. Discuss about Fanno flow with h-s diagram and obtain fundamental equation of Fanno flow. **(08 Marks)**

Module-4

7   a. Derive the relation for Basic potential equation for compressible flow. **(08 Marks)**
     b. Using small perturbation theory obtain linearized potential flow equation. **(08 Marks)**

OR

8 a. Discuss about Von-Karman Transonic flow rule and write its equation. **(08 Marks)**
b. Derive the expression for pressure co-efficient which is applicable for subsonic and supersonic flow. **(08 Marks)**

Module-5

9 a. Explain about types of Wind Tunnel with neat sketch. **(10 Marks)**
b. Write about Flow Visualization Techniques for subsonic flows. **(06 Marks)**

OR

10 Draw and explain the following:
a. Mach-Zhender Interferometer.
b. Shock tube.
c. Schlieren system.
d. Hot wire Anemometer. **(16 Marks)**

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