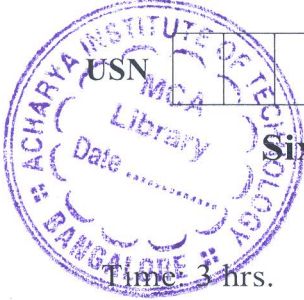USN ☐☐☐☐☐☐☐☐☐☐

15AE61

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
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. Derive continuity equation in Integral and differential form. **(08 Marks)**
    b. Obtain the expression for velocity of sound and write about Mach number regimes. **(08 Marks)**

OR

2. a. Draw De-Laval nozzle and explain how to obtain supersonic flow through the nozzle. **(10 Marks)**
    b. Derive an expression for steady flow energy equation. **(06 Marks)**

Module-2

3. a. Derive Prandtl Relation for normal shockwave and write the expression for shock strength in terms of Mach number. **(08 Marks)**
    b. The state of gas (γ =1.3, R = 469J/Kg K) at the upstream of normal shock wave is given as M_1 = 2.5, P_1 = 2 bar, T_1 = 275K. Calculate the following properties downstream.
    i) Mach number   ii) Pressure   iii) Temperature   iv) Velocity
    Use property ratio formula to find the properties. **(08 Marks)**

OR

4. a. Draw and explain about shock polar and Hodograph plane. **(06 Marks)**
    b. Derive the expression for shock velocity for a moving normal shock wave. **(10 Marks)**

Module-3

5. a. Draw and explain the nature of oblique shock. Obtain the relation for shock angle, wedge angle and Mach number.
    b. Draw and explain the following : **(10 Marks)**
        i) Intersection of shocks of same family
        ii) Reflection of shock from Rigid wall
        iii) Intersection of shocks of opposite family **(06 Marks)**

OR

6. a. Explain about expansion waves and obtain the Prandtl-Meyer function relation in terms of Mach number. **(08 Marks)**
    b. Draw Rayleigh curve and explain about nature of curve in subsonic and supersonic Inlet flow. **(08 Marks)**

Module-4

7   a. Derive the relation for Basic potential equation for compressible flow.   (08 Marks)
    b. Obtain linearized and non-linearized equation using small perturbation theory.   (08 Marks)

OR

8   a. Write the Von-Karman rule for transonic flow relations and use of Karman rule.   (08 Marks)
    b. Obtain pressure co-efficient expression applicable to all flows.   (08 Marks)

Module-5

9   a. With neat sketch, explain the types of supersonic tunnels and their operation.   (10 Marks)
    b. Draw and explain about Schlieren techniques. Also write its advantages and disadvantages.
                                                                                          (06 Marks)

OR

10 a. Explain about pressure measuring instruments used in Wind tunnels.   (10 Marks)
    b. Write about methods for subsonic flow visualization.   (06 Marks)

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