CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   15AE61

Sixth Semester B.E. Degree Examination, Feb./Mar. 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 Derive an expression for area ratio as a function of Mach number with usual notation.

(16 Marks)

OR

2 Air (C_p = 1.05 kJ/kg-k, γ = 1.38) at $P_1 = 3 \times 10^5 N/m^2$ and T_1 = 500K flows with a velocity of 200m/s in a 30cm diameter duct. Calculate :
   i)   Mall flow rate
   ii) Stagnation temperature
   iii) Mach number
   iv) Stagnation pressure value assuming the compressible and incompressible.   (16 Marks)

Module-2

3 Derive the following relations for flow through a normal shock wave.

   i) $M_y^2 = \dfrac{\frac{2}{\gamma-1} + M_x^2}{\frac{2\gamma}{\gamma-1}M_x^2 - 1}$

   ii) $\dfrac{T_y}{T_x} = \dfrac{\left(1+\frac{\gamma-1}{2}M_x^2\right)\left(\frac{2\gamma}{\gamma-1}M_x^2 - 1\right)}{\frac{1}{2}\dfrac{(\gamma+1)^2}{(\gamma-1)}}$.   (16 Marks)

OR

4 A normal shock wave with pressure ratio of 4.5 impinges on a plane wall. Determine the static pressure ratio for the reflected normal shock wave. The air temperature in front of the incident wave is 280k.   (16 Marks)

Module-3

5 Derive the Pradtl – Meyor function (ν) in terms of the mach number using oblique shock wave.   (16 Marks)

OR

6   Air flow at Mach 4.0 and pressure $10^5 N/m^2$ is turned abruptly by a wall into the flow with a turning angle of 20° as shown is the Fig.Q6. If the shock is reflected by another wall, determent the flow properties 'M' and 'ρ' downstream of the reflected shock.
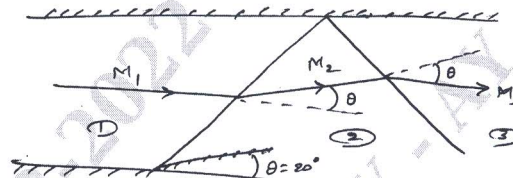

Fig.Q6   (16 Marks)

Module-4

7   Derive the Linerarized pressure coefficient for small perturbations.   (16 Marks)

OR

8   Obtain the differential equations of motion for steady compressible flows.   (16 Marks)

Module-5

9   Show the calculation of percentage energy loss in the various parts of wind tunnel.
                                                                              (16 Marks)

OR

10 Discuss the advantages and disadvantages of the following high speed wind tunnels :
    a. Blow down – type wind tunnel
    b. Induction – type wind tunnel
    c. Continuous supersonic wind tunnel.   (16 Marks)

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