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18AE/AS52

**Fifth Semester B.E. Degree Examination, July/August 2022**  
**Aerodynamics - II**

Time: 3 hrs.

Max. Marks: 100

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

**Module-1**

- 1 a. Derive an expression for Area ratio as a function of Mach number with usual notation. (10 Marks)  
b. Calculate the dynamic pressure of the flow if  $V_\infty = 175 \text{ m/s}$ ,  $P_\infty = 1 \text{ atm}$  and  $T_\infty = 298\text{K}$ .  
What will be the percentage error if the flow is treated as incompressible? (10 Marks)

**OR**

- 2 Draw a neat diagram showing the variation of pressure along the convergent nozzles and convergent – divergent duct for various back pressure and explain. (20 Marks)

**Module-2**

- 3 a. Derive the Prandtl – Meyer equation for Normal shock wave in perfect gas. (10 Marks)  
b. Derive the expression for Rankine – Hugonist equation of a normal shock wave. (10 Marks)

**OR**

- 4 a. Derive the expression for Static Pressure Ratio across the shock in terms of upstream Mach Number. (10 Marks)  
b. Derive the expression for temperature ratio across the shock in terms of upstream Mach Number. (10 Marks)

**Module-3**

- 5 a. Write the Density ratio and Pressure ratio across the oblique shock wave (Rankine – Hugonist Equation). (10 Marks)  
b. Discuss the Relations for a Moving Normal shock wave. (10 Marks)

**OR**

- 6 With a neat sketch, explain the shock polar diagram and characteristics of Flow through oblique shocks. (20 Marks)

**Module-4**

- 7 a. Derive the expression for Pressure Co-efficient for Linearized flow. (10 Marks)  
b. Derive Small Perturbation theory using Linearized Velocity Potential equation. Also write the conclusion. (10 Marks)

**OR**

- 8 a. Derive the expression for Pressure Co-efficient for Linearized Supersonic flow (Ackert's Supersonic Airfoil theory). (10 Marks)  
b. Derive the Prandtl – Glauert rule using Linearized Subsonic flow. (10 Marks)

**Module-5**

- 9 With a neat sketch, explain Blow down wind tunnel (Open circuit) and Blow down wind tunnel (Closed circuit). Discuss the advantages and disadvantages. (20 Marks)

**OR**

- 10 Explain the Flow Visualization Technique used in Wind tunnels. With a neat sketch, explain the following :  
a. Shadow Technique    b. Interferometer Technique    c. Schlieren Technique. (20 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.