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**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)

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.