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**Question Paper Code : 40057**

B. E. /B. Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Aeronautical Engineering

AE8503 – AERODYNAMICS–II

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is flow process?
2. What are the properties of flow medium that determine the velocity of sound wave in the medium?
3. Define shock wave.
4. What are the applications of Rankine- Hugonit relation?
5. What are the applications of method of characteristics?
6. Define Rayleigh flow.
7. What is perturbation potential?
8. What is a Mach wave?
9. What is drag divergence Mach Number?
10. Define camber of the airfoil.

PART B — (5 × 13 = 65 marks)

11. (a) Design a convergent divergent nozzle for the design Mach of 2.0 and obtain the range of overexpansion and underexpansion if the nozzle delivers air to the atmosphere. (13)

Or

- (b) Obtain an expression for velocity of sound in terms of ratio of specific heats and local temperature in air medium from the one dimensional continuity, momentum, and energy equations. (13)
12. (a) What are the applications of Rayleigh correction formula for pitot tubes in supersonic flows? Derive the formula. (13)

Or

- (b) Derive the Prandtl's relation for flow across a normal shock and explain its significance. (13)
13. (a) Explain in detail the Philosophy of the method of characteristics. (13)

Or

- (b) Bring out the essential differences between Rayleigh flow and Fanno flow with neat illustrations. Give practical examples. (13)
14. (a) Based on the small perturbation theory, derive the linearized velocity potential equation for compressible flows. (13)

Or

- (b) Explain the linearized supersonic flow theory? How is the lift coefficient of a flat plate making an angle of attack to a supersonic flow calculated using the theory? (13)
15. (a) (i) With a neat sketch explain the area rule for drag reduction. (5)
- (ii) Illustrate any three important aerodynamic characteristics of swept Wings (5)
- (iii) Write a brief note on supercritical airfoil. (3)

Or

- (b) (i) Explain the concept of critical Mach number. Distinguish between lower and upper critical Mach numbers. (5)
- (ii) With neat sketch, explain shock induced separation in supersonic flows. Give any one practical example. (5)
- (iii) Write a brief note about aspect ratio of wings. (3)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain in detail – subsonic, Transonic, supersonic and Hypersonic flows. (9)
- (ii) Discuss a detailed comparative study between subsonic and supersonic aerodynamics. (6)

Or

- (b) Derive the Area —Mach number —Velocity relation. Based on the above relationship explain the concepts of nozzle and Diffuser. Explain why a 'Convergent —Divergent nozzle' is needed for generating the supersonic flows. (15)
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