Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1105086

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024

Fifth Semester

Aerospace Engineering

U20AS501 – COMPRESSIBLE FLOW

(Regulation 2020)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define compressibility of a gas.

2. What causes Mach cones?

3. What are the properties of a gas flow after passing through a normal shock, what characteristics does a gas flow have?

4. Differentiate normal shock wave and oblique wave.

5. What is a shock polar?

6. What is meant by detached shock?

7. Define the term Fanno flow.

8. What occurs when heated air passes through a nozzle?

9. What is drag divergence Mach number?

10. Mention the uses of swept wing in a high speed airplane.

PART – B (5 x 16 = 80 Marks)

11. (a) Derive the expression for chocked mass flow rate through a CD nozzle. (16)

(OR)

(b) Starting from the fundamentals derive the area-mach number-velocity relation and explain it for different passages. (16)

12. (a) Derive the θ-β-M relation for an oblique shock wave and discuss about the strong and weak solutions of shock wave. (16)

(OR)

(b) Derive the Prandtl's relation for a normal shock wave. (16)

13. (a) A uniform supersonic stream with M=3, P=1atm and T=288 K encounters a compression corner which deflects the stream by an angle $\theta = 20^{o}$. Calculate the shock angle and flow properties behind the shock wave. (16)

(OR)

(b) Explain Shock polar and enumerate importance of shock polar with sketches. (16)

14. (a) With neat sketch compare Under expanded, Correctly expanded and Over expanded nozzle. (16)

(OR)

(b) Derive an expression for C_L and C_D of a symmetric diamond profile in supersonic flow kept at small angle of attack. (16)

15. (a) Briefly explain the need and characteristic features of Transonic area rule. (16)

(OR)

(b) Explain with neat sketch about the shock induced separation. (16)

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