A   **Reg. No. :**

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In transonic flow Mach number is   CO1- U

   (a) $0.8 < M < 1.2$ (b) $0.8 > M < 1.2$ (c) $0.8 < M < 1.5$ (d) $0.9 < M < 1.2$

2. For a Incompressible flow   CO1- U

   (a) $M < 0.3$ (b) $M > 0.3$ (c) $M = 0.3$ (d) $M = 0$

3. Flow in a constant area duct with heat transfer is known as   CO1- U

   (a) Fanno flow   (b) Isothermal   (c) Rayleigh flow   (d) Isentropic flow

4. In Rayleigh flow entropy increases due to heat   CO1- U

   (a) Addition   (b) Deletion   (c) None of these   (d) All the above

5. The shock wave right angle to the flow is called   CO1- U

   (a) Normal   (b) Oblique   (c) Expansion   (d) Compression

6. Which of the following is weak shock wave?   CO1- U

   (a) Normal   (b) Expansion   (c) Compression   (d) both b and c

7. Pulse Jet Engine is also called as   CO1- U

   (a) Turbo Jet   (b) Flying Bomb   (c) Turbo Fan   (d) none of these

8. Air Breathing Engines is also called as   CO1- U

   (a) Rocket Engine   (b) Jet Engine   (c) Petrol Engine   (d) Diesel Engine

9. Liquid fuel consists of   CO1- U

   (a) Refine petrol   (b) liquid hydrogen   (c) Hydrazine   (d) None of these

10. Notation for hydrogen peroxide   CO1- U

   (a) H_2O (b)O_2H (c)H_2O_2 (d) All the above

PART – B (5 x 2= 10 Marks)

11. List the use of Mach number?   CO1- U

12. List the assumptions made in Rayleigh flow   CO1- U

13. Define shock wave   CO1- U

14. List the main parts of ramjet engine   CO1- U

15. Classify the rocket engines based on source of energy employed.   CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) Determine (i) Velocity of sound at the stagnation conditions CO3- App (16)
       (ii) Maximum velocity of the jet (iii) Stagnation Enthalpy (iv)
       Crocco number An air jet (R=287 J/kg K) at 400K has sonic
       velocity, γ=1.3.

                                   Or

    (b) Air expands isentropically through the convergent nozzle from CO3- App (16)
       constant inlet conditions P_O = 4 bar, To= 550K, Exit area of
       nozzle is 1000cm$^{2.}$ Determine the exit velocity and the mass
       flow rate for the following two cases at exit, M =1, M = 0.85.

17. (a) The condition of a gas in a combustion chamber at entry are T1 CO4- App (16)
       = 375 K, P1 = 0.50 bar, C1 = 70 m/s. The air fuel ratio is 29
       and the calorific value of the fuel is 42 MJ/kg. Calculate 1)
       Initial & final Mach number 2) Final pressure, temperature &
       velocity of the gas 3) % of stagnation pressure loss 4)
       Maximum stagnation temperature. Take γ=1.4, Gas constant =
       0.287 KJ/kg K

                                   Or

    (b) The friction factor for a 50mm diameter steel pipe is 0.005. At CO4-App (16)
       inlet to the pipe the velocity is 70 m/s, temperature is 800C and
       the pressure is 10 bar. Find the temperature, pressure and Mach
       number at exit if the pipe is 25m long also determine the
       maximum possible length.

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18. (a) The upstream Mach number, pressure and temperature of normal shock wave are 2.4 bar, 2 bar and 270 K respectively. Calculate the Mach number, pressure, temperature and velocity of the gas for downstream of the shock. Check the calculated values with those given in the gas tables. Take $\gamma=1.3$, R=460J/KgK   CO3- App   (16)

<div align="center">Or</div>

(b) An oblique shock wave occurs at the leading edge of a symmetrical wedge. Air has a Mach number of 2.1 and deflection angle (δ) of 15°. Determine the following for strong and weak waves. 1. Wave angle 2. Pressure ratio 3. Density ratio 4. Temperature ratio 5. Downstream Mach number.   CO3- App   (16)

19. (a) Explain the working of ramjet engine with neat sketch   CO1- U   (16)

<div align="center">Or</div>

(b) Explain the working of pulse jet with neat sketch   CO1- U   (16)

20. (a) Explain the construction, working principle and operation of liquid propellant rocket engine with neat sketch and also state its advantages.   CO1- U   (16)

<div align="center">Or</div>

(b) Explain the construction, working principle and operation of solid propellant rocket engine with neat sketch and also state its advantages.   CO1- U   (16)

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