F 3424 **(Pages : 2)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

GAS DYNAMICS AND JET PROPULSION (M)

(Old Scheme—Prior to 2010 admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Use of approved Gas tables and charts are permitted.

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Give the characteristic equation for a gas.
2. Explain Mach cone and Mach angle.
3. Define the terms : nozzle efficiency and nozzle discharge coefficient.
4. Distinguish between under-expanded and over-expanded nozzle.
5. Derive an equation describing Rayleigh line.
6. Discuss Prandtl's velocity relationship.
7. Discuss the effect of friction on flow parameters in Fanno flow.
8. Explain how flow velocity is determined in supersonic flow.
9. Explain what is meant by thrust Augmentation. What is its effect ?
10. Define thrust power ; propulsive power and propulsive efficiency.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Derive the continuity equation in integral form for a control volume.

Or

Turn over

12. An aircraft flies at 800 km/hr at an attitude of 10,000 m (T = 223.15 K, P = 0.2646 bar). The air is reversibly compressed in an inlet diffuser. If the Mach number at the exit of the diffuser is 0.36, determine :

    (i) Entry Mach number.

    (ii) Velocity, pressure and temperature of air at the diffuser exit.

13. Discuss the operation of a converging-diverging nozzle under vary back pressure.

Or

14. Air is discharged from a reservoir at P_0 = 6.91 bar and T_0 = 325°C through a nozzle to an exit pressure of 0.98 bar. If the flow rate is 3600 kg/hr, determine for isentropic flow, throat at area, pressure, velocity, exit area and maximum velocity.

15. Show that the upper and lower branches of a Fanno line represents the subsonic and supersonic flow. Also show that the maximum entropy condition is sonic.

Or

16. The pressure, temperature and Mach number at the entry of a flow passage are 2.45 bar, 26.6°C and 1.4 respectively. If the exit Mach number is 2.5, determine for adiabatic flow of a perfect gas (r = 1.4), stagnation temperature, temperature and velocity of gas at exit, and the flow rate per square meter of the inlet cross-section.

17. Derive the following relation for flow through a normal shock :

$$P_y / P_x = \frac{2r}{r+1} \mu x^2 - \frac{r-1}{r+1}.$$

Discuss the impossibility of a shock wave in subsonic flow.

Or

18. An aircraft flies at a Mach number of 1.2 at an attitude of 16,000 m (P = 103 M bar, T = 216.65 K). The compression in its engine is partly achieved by a normal shock wave standing at the entry of its diffuser. Determine immediately down stream of the shock :

    (i) Mach number. (ii) Temperature of the air.

    (iii) Pressure of the air. (iv) Stagnation pressure loss across the shock.

19. With the help of neat sketches explain the working of Ramjet engine. Discuss its merits and demerits.

Or

20. Explain about turbo pump feed system for liquid propellant with neat sketch.

(5 × 12 = 60 marks)