G 1326 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2016

Seventh Semester

Branch : Mechanical Engineering

ME 010 703—GAS DYNAMICS AND JET PROPULSION (ME)

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. State Karman's law.
2. State the significance of area ratio.
3. How will you account for variation in flow properties during a frictional flow ?
4. Where does 'normal shock' occur in a nozzle ?
5. Write the properties of propellants.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Distinguish between compressible and incompressible flow.
7. Write the assumptions in deriving Euler's equation.
8. Write all the Rayleigh flow equations. Explain.
9. Explain the importance of stagnation state and stagnation properties.
10. Explain the practical mechanisms involving propeller thrust.

(5 × 5 = 25 marks)

Part C

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

11. Prove that sonic velocity of an ideal gas depends on the temperature and nature of the gas.

Or

12. Show that the discharge through a nozzle is maximum when there is a sonic condition at its throat.

13. A supersonic wind tunnel nozzle is to be designed for M = 2, with a throat section, 0.11 m.^{2} in area. The supply pressure and temperature at the nozzle inlet, where the velocity is negligible, are 70 kPa and 37° C. respectively. Compute the mass flow rate, the exit area and the fluid properties at the throat and the exit. Take r = 1.4.

Or

14. Explain the significance of the critical pressure ratio. Derive an expression for it. Deduce its values for different gases.

15. Explain all the aspects of :

(i) Diabatic flow without friction and (ii) Adiabatic flow with friction. Give examples for each.

Or

16. Explain the pressure variations and choking in a nozzle, with relevant plots.

17. Explain the phenomena of normal shock in an ideal gas.

Or

18. A gas is flowing through a nozzle. The nozzle is encountered with a shock. The Mach number upstream of the shock is 1.6, and the static temperature downstream of the shock is 470 K. Calculate the change in velocity across the shock.

19. Explain the transformations in energy through a gas turbine engine. Discuss how will you classify gas turbine engines.

Or

20. With neat sketches, explain any *four* practical applications of rocket propulsion theory.

(5 × 12 = 60 marks)