(Pages : 3) **M – 6694**

Reg. No. : ....

Name : ....

Seventh Semester B.Tech. Degree Examination, December 2021

08.703 GAS DYNAMICS (M)

(2008 Scheme)

Time : 3 Hours Max. Marks : 100

Instruction: (1) Answer all question from Part A

(2) Answer one full question from each module of Part B

(3) Use of Gas Table is permitted

PART A

1. What do you mean by continuum flow? Define Knudsen number.

2. Explain adiabatic steady flow ellipse.

3. Discuss the effects of Mach number on compressibility.

4. Show that M=1 at the point of maximum entropy for Rayleigh flow.

5. Explain Choking in Fanno flow.

6. Explain Rayleigh flow clearly stating assumptions. Give examples.

7. Explain why shock is not possible in a subsonic flow.

8. Write a note on supersonic flow over a compression and expansion corner.

9. What is wedge probe? Explain the working of wedge probe with a sketch.

10. How does a Prandtl-pitot tube simultaneously measure the static and stagnation pressure? **(10 × 4 = 40 Marks)**

P.T.O.

PART – B

Module – I

11. (a) Derive the energy equation for a control volume. State the assumptions. **10**

(b) A conical diffuser has an inlet diameter of 40 cm and exit diameter of 80 cm. Air enters the diffuser with a static pressure of 200 kPa and a static temperature of 37°C. The average velocity of flow at inlet to the diffuser is 265 m/s. Calculate.

(i) the mass flow rate,

(ii) properties at the section. **10**

OR

12. (a) Derive the relation between Mach number M and dimensionless Mach number M*. **10**

(b) The pressure, temperature and Mach number at the entry of a flow Passage are 2.45 bar, 26.5 C and 1.4 respectively. If the exit Mach number is 2.5 determine for adiabatic flow of a perfect gas γ=1.3, R=0.469kJ/kg.K)

(i) stagnation temperature,

(ii) temperature and velocity of gas at exit, and

(iii) the flow rate per square metre of the inlet cross-section. **10**

Module – II

13. (a) Show that the upper and lower branches of a Fanno curve represent subsonic and supersonic flows respectively. Prove that at the maximum entropy point, the Mach number is unity and all processes tend to approach this point. **10**

(b) Air flows through a constant area duct. Pressure and temperature of the air at inlet to the duct are 100 kPa and 10°C respectively and the inlet Mach number is 2.8. Heat is transferred to the air as it flows through the duct and as a result the Mach number at the exit is 1.3. Find the temperature and pressure of air at the exit. Find the maximum amount of heat that can be transferred to the air per unit mass of air. Also find the exit pressure and temperature that would exit with this maximum heat transfer. The effect of wall friction is neglected. **10**

OR

14. (a) Derive the following relation for a Rayleigh flow. **10**

$$\frac{Q_{max}}{C_p T_1} = \frac{(1-M^2)^2}{2(1+\gamma)M^2}$$

(b) A convergent divergent nozzle having a throat diameter of 7.5 supplies air to an insulated duct of diameter 15 mm. The stagnation properties of air at entry of the nozzle are 7.5 bar and 300k. The flow through the nozzle is isentropic. The mean friction for the duct is 0.005. Calculate the maximum length of the duct that can be provided without discontinuity in the nozzle or duct. Find the conditions of air at the duct exit. **10**

Module – III

15. (a) With a neat sketch explain the working of an interferometer. **10**

(b) Derive Rankine-Hugonit relation. **10**

OR

16. (a) With a neat sketch explain the working of a constant temperature type not-wire anemometer. **10**

(b) The exit to entry area of a divergent duct is 1.4:1. The Mach number at inlet and exit are 1.7 and 0.5 respectively. A normal shock occurs in the duct. Assuming isentropic flow of air before and after the shock, determine.

(i) location of the normal shock in the duct,

(ii) percentage loss in stagnation pressure, and

(iii) change in entropy. **10**

(3 × 20 = 60 Marks)