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Question Paper Code	11816

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Sixth Semester

Mechanical Engineering

ME8096 – GAS DYNAMICS AND JET PROPULSION

(Regulations 2017)

(Use of approved gas table is permitted)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Define Mach number.	*2,K1,CO1*
2.	Distinguish between nozzle and diffuser.	*2,K2,CO1*
3.	Give assumption made of Rayleigh flow.	*2,K1,CO2*
4.	Define critical condition in Fanno flow.	*2,K1,CO2*
5.	Give the difference between normal and oblique shock wave.	*2,K2,CO3*
6.	Mention the useful applications of shock wave.	*2,K1,CO3*
7.	Give the components of a turbojet engine.	*2,K1,CO4*
8.	Define propulsive efficiency.	*2,K1,CO4*
9.	Classify the rocket engines.	*2,K2,CO5*
10.	State any 4 advantages of rocket engine compared to aircraft engines.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Air (γ = 1.4, R=287.43 J/kgK) enters a straight axis symmetric duct at 300 K, 3.45 bar and 150 m/s and leaves it at 277 K, 2.058 bar and 260 m/s. The area of cross section at entry is 50 cm^2. Assuming adiabatic flow determine: (i) Stagnation temperature (ii) Maximum velocity (iii) Mass flow rate and (iv) Area of cross section at exit.	*13,K2,CO1*
		OR	
	b)	Air flowing in a duct has a velocity of 300 m/s, pressure 100 1 bar, temperature 290K. Taking γ=1.4, R=287 J/kgK. Determine (i) stagnation pressure and temperature (ii) Velocity of sound in the dynamic and stagnation conditions. (iii) Stagnation pressure assuming constant density.	*13,K3,CO1*

12. a) The conditions of a gas in a combustor entry are p_1 = 0.343 bar, T_1 = 310 K, c_1 = 60 m/s. Determine the Mach number, pressure, temperature and velocity at the exit, if the increase in stagnation enthalpy of the gas between entry and exit is 1172.5 kJ/kg. Take C_p = 1.005 kJ/kgK, γ = 1.4. *13,K3,CO2*

OR

b) A Circular duct passes 8.25 kg/s of air at exit mach number of 0.5. The entry pressure and temperature are 345 kPa and 38^0C respectively and the coefficient of friction is 0.005. if the mach number at the entry is 0.15, Determine (i) The diameter of the duct, (ii) The length of the duct, (iii) Pressure and Temperature at exit, (iv) Stagnation Pressure loss. *13,K3,CO2*

13. a) The state of a gas (γ=1.3, R= 0.469 kJ/kg.K) upstream of a normal shock wave is given by the following data: *13,K3,CO3*
M_x = 2.5, p_x = 2 bar, T_x = 275 K
Calculate the Mach number, pressure, temperature and velocity of the gas downstream of the shock; Check the calculated values with those given in the gas tables.

OR

b) A gas (γ=1.3) at p_1 = 345 mbar, T_1 = 350 K and M_1 = 1.5 is to be isentropically expanded to 138 mbar. Determine a) The deflection angle b) Final Mach number and c) The temperature of the gas. *13,K3,CO3*

14. a) Explain the working principle of a ramjet engine with neat sketch. Also state its advantages and disadvantages over turbojet engine. *13,K2,CO4*

OR

b) Describe the working principle of turboprop and turbojet engines with neat sketch. *13,K2,CO4*

15. a) Explain the various types of chemical rocket engines with neat sketch. *13,K2,CO5*

OR

b) What is the function of propellant feed system? Explain the Gas pressure feed system and turbo pump feed system with neat sketch. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Air at p_0 = 10 bar, T_0 = 400 K is supplied to a 50 mm diameter pipe. The friction factor for the pipe surface is 0.002. If the Mach number changes from 3.0 at the entry to 1.0 at the exit determine: (i) The length of the pipe (ii) The mass flow rate. *15,K3,CO3*

OR

b) A jet of air at a Mach number of 2.5 is deflected inwards at the corner of a curved wall. The wave angle at the corner is 60^0. Determine the deflection angle of the wall, pressure and temperature ratios and final Mach number. *15,K3,CO4*