

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIth SEMESTER-EXAMINATION – MAY- 2012****Subject code: 160102****Date: 11/05/2012****Subject Name: Fundamentals of Jet Propulsion****Time: 10:30 am – 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Classify the liquid propellant system and factor to be considered in selecting a liquid propellant? **07**

(b) Derive and explain thrust equation with figure? When the rocket motor operates in a vacuum, what should be the condition? **07**

Q.2 (a) Define thrust augmentation? Explain the methods in brief for augmenting the thrust of turbojet engine? **07**

(b) A jet plane having 2 jets works on turbo-jet system. It flies at a speed of 800 km/h at an altitude where the specific mass of air is 0.15 kg/m^3 . The propulsive efficiency is 55%. The drag on the plane is 6500 kW. Calculate (1) absolute velocity of jet, (2) quantity of air compressor and (3) diameter of jet. **07**

OR

(b) List design variable for turbofan engine and derive equation of optimum bypass ratio for ideal turbofan. **07**

Q.3 (a) Compare ramjet and turbo jet engine? Explain critical, Super critical and subcritical operation of ramjet engine? **07**

(b) Draw thermodynamic cycle for ramjet on T-S diagram? Derive expression for following (a) Condition at diffuser exit section (b) Over-all efficiency. **07**

OR

Q.3 (a) Explain in brief types of burner and main burner air flow distribution. **07**

(b) List the cooling techniques? Explain linear cooling techniques? **07**

Q.4 (a) Derive equation for Area ratio of nozzle with respect to M? **07**

(b) Determine the exit velocity and mass flow rate for isentropic flow of the air through a nozzle from inlet stagnation condition of 7 bar and 320°C to an exit pressure of 1.05 bar if the exit area is 6.26 sq.cm. Assume a constant specific heat ratio of 1.4. and $C_p = 1.005 \text{ kJ/Kg K}$. **07**

OR

Q.4 (a) Classify different types of nozzle with figure? Explain “choking of nozzle” in brief? **07**

(b) Find the throat diameter of a nozzle which discharges 4.5 kg per minute, if the steam is supplied at 7 bar and 250°C . What should be the exit diameter of nozzle if the nozzle discharges at 1 bar with a nozzle efficiency of 85%. Use Mollier diagram. **07**

- Q.5 (a)** Illustrate the different forms of diffuser? Explain performance of diffuser in brief? **07**
- (b)** An air diffuser expands from 0.02 m^2 to 0.08 m^2 . The approach velocity is 40 m/s and the discharge velocity is 10 m/s . The inlet pressure and the ambient pressure are 1.01325 bar and there is a static pressure rise in the diffuser of 76 mm of water. If the air temperature is 21°C , find the net reaction on the diffuser? **07**

OR

- Q.5 (a)** Classify supersonic inlet and explain each in brief? **07**
- (b)** Draw subsonic inlet with nomenclature? Explain inlet sizing, inlet flow distortion, nacelle and interference drag in brief. **07**
