

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VI EXAMINATION – WINTER 2025

Subject Code:3160102

Date:02-12-2025

Subject Name:Fundamentals of Jet Propulsion

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Use of gas tables is permissible.

		MARKS
Q.1	(a) Explain the working principle of jet engines. List their different applications.	03
	(b) Define: (i) TSFC (ii) propulsive efficiency (iii) Overall Efficiency (iv) Thermal efficiency	04
	(c) With a neat sketch, derive the expression of jet thrust and pressure thrust developed by a jet engine.	07
Q.2	(a) Why and when thrust augmentation techniques are needed?	03
	(b) Write a short note on ramjet engine.	04
	(c) Draw and explain thermodynamic cycle i.e. h-s diagram for a turbojet engine.	07
OR		
	(c) Explain in detail the factors affecting thrust developed by the turbojet engine.	07
Q.3	(a) Compare the performance of turboprop engine with turbojet engine.	03
	(b) Derive the expression of efficiency of ramjet engine as a function of flight Mach number.	04
	(c) Write and discuss the performance of turbofan engine with neat diagrams.	07
OR		
Q.3	(a) Discuss the need of flame holder in a combustion chamber.	03
	(b) Discuss the factors affecting the performance of a jet engine combustor.	04
	(c) Explain the thrust augmentation techniques in detail.	07
Q.4	(a) Explain the purpose of each zone of combustion chamber.	03
	(b) Derive the Mach area relation and explain its significance.	04
	(c) Air with stagnation pressure 1.013 bar and static temperature 290K is approaching a diffuser with an area ratio of 4. Air inlet Mach number is 2.2. A normal shock occurs just outside the diffuser entry and flow through diffuser is isentropic. Determine Mach number, pressure and temperature at the exit of the diffuser. Also find stagnation pressure loss between the initial and final states of the flow.	07
OR		
Q.4	(a) How the rocket engines differ than jet engines. List applications of rocket engines.	03
	(b) Write a short note on pulse jet engine.	04
	(c) The pressure, velocity and temperature of air at the entry of a nozzle are 2 bar, 145 m/s and 330K, the exit pressure is 1.5 bar. What is the shape of the nozzle? Determine for isentropic flow, the Mach number at entry and exit and stagnation pressure and temperature at nozzle exit.	07

- Q.5** (a) Differentiate between solid propellant rockets and liquid propellant rockets. **03**
- (b) How the Future Fuels and Energy Sources help in Sustainable Aviation. **04**
- (c) The following data apply to a twin spool turbofan engine, with the fan driven by the LP turbine and the compressor by the HP turbine. Separate hot and cold nozzles are used. Overall pressure ratio: 19.0, Fan pressure ratio: 1.65, Bypass ratio: 3.0, Turbine inlet temperature: 1300 K, Air mass flow: 115 kg/s. Find the mass of bypassed air, value of bypass fraction and thrust produced by the fan. The ambient pressure and temperature are 1 bar and 288 K. **07**
- OR**
- Q.5** (a) Derive the expression of thrust developed by the rocket engine. **03**
- (b) Explain the Hybrid Propulsion Concept in aviation. **04**
- (c) Write a short note on over-expanded nozzles. **07**
