Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3170104 **Date: 20/05/2026**

Subject Name: Rocket and Missile Technology

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.**

Q.1	**(a)**	Explain significance of thrust equation in rocket propulsion.	**03**
	(b)	List and explain key performance parameters of a rocket engine.	**04**
	(c)	A rocket engine produces a thrust of **2500 N** by expelling combustion gases at a velocity of **2000 m/s**. If the **mass flow rate** of the exhaust gases is **1.2 kg/s**, **calculate the specific impulse (Isp)** of the engine in seconds. Also, explain the significance of specific impulse in rocket engine design.	**07**
Q.2	**(a)**	Define propellant loading tolerances and inventory.	**03**
	(b)	Differentiate between volume loading and mass loading in rocket propulsion systems.	**04**
	(c)	Explain the concept of outage control in rocket propulsion systems.	**07**
		OR	
Q.2	**(c)**	How does the injector design affect combustion efficiency and stability?	**07**
Q.3	**(a)**	Differentiate between pressure-fed and pump-fed propellant feed systems used in liquid rocket engines.	**03**
	(b)	Explain the importance of thrust control and cooling in liquid propellant rocket engines.	**04**
	(c)	Evaluate the factors involved in selecting liquid propellants for rocket engines.	**07**
		OR	
Q.3	**(a)**	Explain the design considerations for the outlet of a propellant tank in a liquid rocket engine.	**03**
	(b)	Compare standard and reverse hybrid propulsion systems.	**04**
	(c)	Explain the general aerodynamics of an airfoil used in missile technology. Discuss the significance of aspect ratio and wing planform in the design of missile wings.	**07**
Q.4	**(a)**	Define jet controls in rocket propulsion systems. How do jet controls influence the stability and maneuverability of a rocket during flight? a	**03**
	(b)	Evaluate the role of a boattail design in missile aerodynamics. Provide examples of missile types that benefit from boattail designs.	**04**
	(c)	Analyze the working principle of hybrid rocket propulsion. Discuss its key components, operational advantages, and limitations compared to solid and liquid propulsion systems.	**07**
		OR	

Q.4	**(a)**	Explain the phenomenon of erosive burning in solid propellant rockets.	**03**
	(b)	Compare and contrast the aerodynamic properties of conical, ogival, and hemispherical forebody shapes in missile design.	**04**
	(c)	Discuss the salient features of solid propellant rockets. Explain the advantages and disadvantages of using solid propellants compared to liquid propellants in rocket propulsion systems.	**07**
Q.5	**(a)**	Discuss how aerospike engines help reduce induced drag in missile and rocket systems.	**03**
	(b)	Analyze the impact of induced drag and interference drag on the aerodynamic performance of a missile during flight.	**04**
	(c)	Classify missiles based on their propulsion systems and flight characteristics.	**07**

OR

Q.5	**(a)**	Explain how friction drag, pressure drag, and induced drag affect the overall performance of a rocket in flight.	**03**
	(b)	**Evaluate** the effectiveness of a **boost-glide trajectory** in reducing aerodynamic drag and improving missile performance.	**04**
	(c)	Discuss the differences and performance advantages of the following missile trajectories: Boost-Sustain Trajectory, Long-Range Cruise Trajectory, and Long-Range Ballistic Trajectory.	**07**

*****