Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII EXAMINATION – WINTER 2015

Subject Code:180103 **Date:04/12/2015**

Subject Name: Space Dynamics

Time: 2:30pm to 5:00pm **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)**	State and Prove Kepler's Laws.	**07**
	(b)	Explain concept of Escape Velocity in detail.	**07**
Q.2	**(a)**	Explain Newton's Law of Gravitation in detail.	**07**
	(b)	(i) Determine the mass of the space dynamics student if the force of attraction between earth and the student is 800 N.	**03**
		(ii) The period of revolution of the earth about the sun is 365.256 days. The semi major axis of earth's orbit is 1.49527×10^{11} m. In turn, the semi major axis of the orbit of Mars is 2.2783×10^{11} m. Calculate the period of Mars.	**04**
		OR	
	(b)	Explain the Concept of Entry Corridor.	**07**
Q.3	**(a)**	Write a short note on the two body problem.	**07**
	(b)	A satellite is launched from a circular equatorial parking orbit at an altitude of 180 km into a coplanar circular synchronous orbit by using a Hohmann transfer ellipse. Assume a homogeneous spherical earth with a radius of 6370 km. Determine the velocity increments for entering the transfer ellipse and for achieving the synchronous orbit at 45,000 km altitude.	**07**
		OR	
Q.3	**(a)**	Explain mechanics of Circular orbit. Also list important points for the same.	**07**
	(b)	With neat sketch explain an elliptic orbit.	**07**
Q.4	**(a)**	Derive Orbit equation.	**07**
	(b)	Write a short note on Hohmann transfer ellipse.	**07**
		OR	
Q.4	**(a)**	(i) Classify Space Vehicles.	**04**
		(ii) Explain Gravitational Potential Energy.	**03**

Q.4	**(b)**	(i) Find velocities required to obtain a circular orbit and parabolic trajectory for earth.	**04**
		(ii) With neat sketches explain primary phases of space mission.	**03**
Q.5	**(a)**	Explain different types of entry paths.	**07**
	(b)	Explain the concept of Deep Space.	**07**
		OR	
Q.5	**(a)**	Explain Entry heating. Also obtain an equation for aerodynamic heating rate.	**07**
	(b)	Derive general equation of motion for a vehicle entering the atmosphere.	**07**

<u>Given Data:</u>

Radius of earth = 6370 km **$G = 6.67\times10^{-11}\ Nm^2/kg^2$**

Mass of earth = 5.98×10^{24} kg **Mass of Sun = 1.99×10^{31} kg**

Radius of earth = 696500 km

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