Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – WINTER • 2014

Subject Code: 180103 Date: 02-12-2014

Subject Name: Space Dynamics

Time: 02.30 pm - 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.**

Q.1	**(a)**	Write a short note on Escape Velocity.	**07**
	(b)	Explain Newton's Law of Gravitation in detail.	**07**
Q.2	**(a)**	(i) Explain Gravitational Potential Energy. (ii) Determine the mass of the space dynamics student if the force of attraction between earth and the student is 700 N.	**07**
	(b)	Write a short note on Elliptic orbit.	**07**
		OR	
	(b)	Explain india's mars orbital mission in your words.	**07**
Q.3	**(a)**	Explain Hohmann transfer ellipse.	**07**
	(b)	A satellite is launched from a circular equatorial parking orbit at an altitude of 160 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)	At the end of a rocket launch of a space vehicle, the burnout velocity is 9 km/s in a direction due north and 3º above the local horizontal. The altitude above sea level is 805 km. The burnout point is located at 27º degree above the equator. Calculate the trajectory of the space vehicle.	**07**
Q.4	**(a)**	Derive Orbit equation.	**07**
	(b)	Write a short note on Kepler's third law in detail.	**07**
		OR	
Q.4	**(a)**	(i) Find velocities required to obtain a circular orbit and parabolic trajectory for earth.	**04**
		(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.	**03**
Q.4	**(b)**	(i) Classify Space Vehicles.	**04**
		(ii) With neat sketches explain primary phases of space mission.	**03**
Q.5	**(a)**	Derive general equation of motion for a vehicle entering the atmosphere.	**07**
	(b)	Write a short note on Deep Space.	**07**
		OR	
Q.5	**(a)**	Explain Entry heating. Also obtain an equation for aerodynamic heating rate.	**07**
	(b)	Explain different types of entry paths.	**07**

Given Data:

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

Mass of earth = 5.98×10^{24} kg

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