

**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  $1.49527 \times 10^{11}$  m. In turn, the semi major axis of the orbit of Mars is  $2.2783 \times 10^{11}$  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**

**Given Data:**

**Radius of earth = 6370 km**

**$G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$**

**Mass of earth =  $5.98 \times 10^{24}$  kg**

**Mass of Sun =  $1.99 \times 10^{31}$  kg**

**Radius of earth = 696500 km**

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