Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VIII EXAMINATION – SUMMER 2016**

**Subject Code: 180103 Date: 05/05/2016**

**Subject Name: Space Dynamics**

**Time:10:30 AM to 01:00 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)** | Explain concept of Escape Velocity in detail. | **07** |
| | **(b)** | Define Space? Explain types of space vehicles in detail. | **07** |
| **Q.2** | **(a)** | Write a note on Newton's Law of Gravitation. | **07** |
| | **(b)** | State and Prove Kepler's Laws. | **07** |
| | | **OR** | |
| | **(b)** | With neat sketch explain an elliptic orbit. | **07** |
| **Q.3** | **(a)** | A satellite is launched from a circular equatorial parking orbit at an altitude of 170 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 44,000 km altitude. | **07** |
| | **(b)** | Explain mechanics of Circular orbit. Also list important points for the same. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | From Orbit equation derive eccentricity in terms of difference between kinetic energy and potential energy.. | **07** |
| | **(b)** | Explain the Concept of Entry Corridor. | **07** |
| **Q.4** | **(a)** | Derive Orbit equation. | **07** |
| | **(b)** | Write a short note onHohmann transfer ellipse. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the concept of Deep Space. | **07** |
| | **(b)** | Discuss different types of entry paths. | **07** |
| **Q.5** | **(a)** | 1. Determine the mass of the space dynamics student if the force of attraction between earth and the student is 850 N. | **03** |
| | | 2. Explain Gravitational Potential Energy. | **04** |
| | **(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** |
| | | **OR** | |
| **Q.5** | **(a)** | Derive general equation of motion for a vehicle entering the atmosphere. | **07** |
| | **(b)** | Define Entry heating. Derive an expression for aerodynamic heating rate. | **07** |

---

**Given Data:**

**Radius of earth = 6370 km** **G = 6.67×10^-11 Nm$^2$/kg$^2$**

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

**Radius of Sun = 696500 km**