Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B. Tech. Summer 2021 - 22 Examination

Semester: 8 **Date: 30/03/2022**

Subject Code: 03101452 **Time: 10:30 am to 01:00 pm**

Subject Name: Space Dynamics **Total Marks: 60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **Objective Type Questions -** (All are compulsory) (Each of one mark) **(15)**

1. Near vacuum outside earth's atmosphere (beyond 100 km) is known as _____.
2. The minimum velocity required to overcome the gravitational force of the earth is _____ km/s.
3. For Hyperbolic trajectory eccentricity e
   a) =0 b) <1 c) =1 d) >1
4. The velocity required for a space vehicle in a circular orbit about the earth is 7.9 km/s. True or False?
5. For a circular trajectory of a satellite around the earth, the centrifugal forces must balance the _____
   a) Propulsive forces b) Gravitational forces
   c) Lift forces d) Drag forces
6. Satellite velocity is maximum at _____ for an elliptical orbit.
   a) Apogee b) Perigee
   c) Focal point d) Infinity
7. Drag losses are absent outside the atmosphere. True or False?
8. Perigee is the closest point to the earth. True or False?
9. If K.E is greater than P.E, the type of trajectory is _____.
10. There is no gravity in space. True or False?
11. To minimize reentry heating, the vehicle must have a blunt nose. True or False?
12. Frictional drag is more in which shape body while reentry. Slender or Blunt?
13. If e=1, the path is _____.
14. Hohmann transfer orbits are interplanetary trajectories which consumes minimum energy. True or False?
15. For circular orbits, KE is less than PE. True or False?

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Explain types of space vehicles with some examples.

B) Derive equation for eccentricity in terms of the difference between K.E and P.E.

C) The period of revolution of the earth about the sun is 365.256 days. The semi major axis of the earth's orbit is 1.49527×10^{11} m. The semi major axis of the orbit of mars is 2.2783×10^{11} m. Calculate the period of mars

D) Write a note on Hohmann Transfer ellipse.

Q.3 A) Write a short note on Different types of Entry Paths. **(07)**

B) Write the Resent advancement in space technology. Also mention merit and demerit of rocket engine propulsion. **(08)**

OR

B) Obtain the following equation of external force acting on rigid body using Newton's law of motion. **(08)**

$$\mathbf{F_e = M \times (d^2 r_c)/(dt^2),}$$

Where, R_c = Position of centre of mass of rigid body.

Q.4 A) Define Entry heating. Derive an expression for aerodynamic heating rate. **(07)**

OR

A) Write a short note on attitude control of Spinning spacecraft. **(07)**

B) Derive orbit equation. **(08)**