

2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS,
SPACE MECHANICS
(AERONAUTICAL ENGINEERING)

APRIL/MAY 2006

TIME - 3 HOUR
MARK - 80**Answer any FIVE Questions**
All Questions carry equal marks

1. Halley's comet last passed perihelion in 1986. It has a semi-major axis (a) = 17.9564 AU and eccentricity (e) = 0.967298. [One astronomical unit (AU) is the distance between the earth and the sun]. Calculate the period of Halley's comet and predict the year of next return. Solve Kepler's equation and calculate E , v , and scalar radius vector r for the current data. [16]

2. Write short notes on the following:

- (a) Circular orbit
- (b) Medium earth orbit
- (c) Conic orbit
- (d) Hyperbolic trajectory.

[16]

3. (a) Define

- i. Lagrange and Jacobi Identities and
- ii. Liberation points. Discuss them in detail.

(b) On August 24, 1989, Voyager 2 flew past the north pole of Neptune. The elements of the voyager 2 encounter hyperbola were: $a = 20$ km, $e = 2.45$. During departure, Voyager 2 passed Triton, one of the moons of Neptune, at a radius of 354,600 km. What was the time since periapsis for the encounter with Triton.

[10+6]

4. (a) How does atmospheric drag affect the spacecrafts orbiting the earth in low earth orbit?

(b) Define and discuss the Regression of the line of nodes and Precession of the lines of apsides. [8+8]

5. A satellite is in a circular orbit with a period of 90 minutes and an inclination of 96.580 . Calculate the altitude of the orbit and the change in the line of nodes due to the J_2 gravity perturbation.

[16]

6. What are the main points to be considered during launching of an interplanetary spacecraft and discuss.

[16]

7. Write a detailed notes on

- (a) Optimal flight considerations and
- (b) Boost phase and Re-entry phase

8. (a) Discuss about the effects of trapped particles on spacecraft systems.

(b) Write about primary cosmic radiation with regard to spacecraft systems