

**IV B.Tech II Semester Supplementary Examinations, Apr/May 2006**  
**SPACE MECHANICS**  
**(Aeronautical Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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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. [8+8]
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  $96.58^\circ$ . 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 [16]

8. (a) Discuss about the effects of trapped particles on spacecraft systems.
- (b) Write about primary cosmic radiation with regard to spacecraft systems. [8+8]

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