

**2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**IV B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS  
**SPACE MECHANICS**  
(AERONAUTICAL ENGINEERING)

JULY- 2005

TIME: 3 HOURS

MAX MARKS: 80

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**Answer any FIVE Questions**  
**All Questions carry equal marks**  
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1. (a) A satellite is in an elliptical orbit, which brings it to an altitude of 200 km at perigee and out to an altitude of 1500 km at apogee. Calculate the velocity of the satellite at both perigee and apogee.
- (b) Derive the equation by using two-point method on an ellipse for finding velocity of an object at periapsis and apoapsis.
2. (a) Explain in detail the various elements of earth atmosphere.
- (b) If the condition of the standard atmosphere at the mean sea level is given by  $P_0 = 1.013$  bar,  $T_0 = 288.2$  K and  $\rho_0 = 1.225$  Kg/m<sup>3</sup>. Determine pressure, temperature, density and viscosity at altitudes of 10 and 15 km.
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.
4. Discuss in detail about
  - (a) Longitude station-keeping and
  - (b) Latitude station-keeping
5. Explain in detail different types of perturbations.
6. (a) In case of patched conic approximation made in interplanetary trajectory analysis, discuss various steps involved.
- (b) Discuss in detail about the orbit constants involved with two co-rotating point masses on the basis classical mechanics.
7. A ballistic missile has the following burn out conditions:  $V = 7168$  ms<sup>-1</sup>;  $h = 276$  km; and  $\dot{\theta} = 250$ . Find the range using algebraic development and geometric development.
8. (a) On what basis a material can be selected for space application?
- (b) Write a brief note on advanced materials, which are used in space application.