Code No: NR422108 **Set No.1**

IV B.Tech. II Semester Supplementary Examinations, July -2005
SPACE MECHANICS
(Aeronautical Engineering)

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

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) List out various elements and bring out the significance of parabolic and hyperbolic orbits.
   (b) Discuss about the following:
      i. The many body problem
      ii. Circular restricted 3-body problem
3. (a) Discuss in detail the circular restricted three body problem and state all the assumptions.
   (b) Write down different types of satellite orbits usually used by ISRO.
4. How can we classify the perturbation/variation in the orbital elements based on their affect on Keplarian elements? Discuss in detail each variation and its effects.
5. Explain in detail different types of perturbations.
6. Give a detailed account of ephemeris calculations.
7. Desired range 10120 km(ψ= 90.90^0) to a target takes a long way round to the target ψ= 269.08^0.
   (a) Findϕ_{60}, and
   (b) compare the long and short trajectory characteristics.
8. Discuss in detail about fibre reinforced and metal matrix composite materials.

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Code No: NR422108 **Set No.2**

IV B.Tech. II Semester Supplementary Examinations, July -2005
SPACE MECHANICS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain in detail regarding
   i. co-ordinate systems in space and
   ii. Classification of planets.
   (b) Explain how celestial sphere concept is used in studying motion of an object in the sky.

2. Show that the speed of a satellite in a circular orbit is $v_c = [(\mu/r)]^{0.5}$. Compare this to escape velocity at the same radius. Calculate $v_c and v_{esc}$ at r = 6578 km (200 km altitude) and at r = 385,000 km (the distance to the moon).

3. (a) Explain in detail the terms
   i. Gravity assist maneuvers and
   ii. Time of flight
   (b) The elements of the Magellan mapping orbit about Venus are as follows: a = 10,400 km and e = 0.4. The mapping pass is started at a true anomaly of 280^0. Find out the altitude, flight path velocity, velocity and time since periapsis at this point.

4. Discuss in detail about
   (a) Longitude station-keeping and
   (b) Latitude station-keeping

5. A satellite is in a circular orbit with a period of 90 minutes and an inclination of 96.58^0. Calculate the altitude of the orbit and the change in the line of nodes due to theJ_2 gravity perturbation.

6. (a) Write a short note on
   i. Hyperbolic excess velocity and c_3,
   ii. V∞attheplanet.
   (b) Classify the planetary trajectories based on the length of the transfer ellipse.

7. Write short notes on
   (a) boost phase,
   (b) free fall phase, and
   (c) re-entry phase.

8. Discuss in detail about fibre reinforced and metal matrix composite materials.

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Code No: NR422108 **Set No.3**

IV B.Tech. II Semester Supplementary Examinations, July -2005
SPACE MECHANICS
(Aeronautical Engineering)

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

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, $T_o = 288.2$ K and$\mu_o = 1.8 \times 10^{-5}$ Kg/m-s. 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 $ms^{-}1$; h = 276 km; and $\phi = 25^0$. 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.

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Code No: NR422108 **Set No.4**

IV B.Tech. II Semester Supplementary Examinations, July -2005
SPACE MECHANICS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain in detail regarding
   i. co-ordinate systems in space and
   ii. Classification of planets.
   (b) Explain how celestial sphere concept is used in studying motion of an object in the sky.
2. (a) List out various elements and bring out the significance of parabolic and hyperbolic orbits.
   (b) Discuss about the following:
   i. The many body problem
   ii. Circular restricted 3-body problem
3. Present a detailed report on various types of earth orbits in spacecraft analysis.
4. Write a note on
   (a) solar radiation perturbation,
   (b) earth triaxiality perturbation and
   (c) Luni-solar perturbation.
5. (a) Write a detailed note on six classical orbital elements which are necessary to specify a particular orbit on the basis of a two-body problem.
   (b) Describe in detail Cowell's and Encke's methods as applicable to orbital perturbations?
6. Write in detail about different perturbations, which affect spacecraft trajectory.
7. Desired range 10120 km(ψ= 90.90^0) to a target takes a long way round to the target ψ= 269.08^0.
   (a) Findϕ_{60}, and
   (b) compare the long and short trajectory characteristics.
8. (a) Discuss about solar electron and solar proton events.
   (b) Write about meteoroids and micrometeoroids.

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