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B.Tech. IN AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2013

BAS-025 : SPACE DYNAMICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any seven** questions. Use of scientific calculator is permitted. Assume data suitably.*

1. (a) Write a short note on transfer orbit's and hence define Hohmann transfer ellipse. Briefly explain the maneuver's carried while launching a spacecraft to moon. 6

   (b) Explain shell theorem, superposition principle and limitations of Newton's law of motion. 4

2. (a) Derive the equation to obtain escape velocity of an object. 4

   (b) Explain briefly ' Gravitational Potential Energy'. 4

   (c) Write down Kepler's third law for Elliptical orbits. 2

3. (a) A launch vehicle with mass of 10000kg moving radially outwards from earth has a speed of 4km/s when its engine shuts off 400km above Earth's surface. Assuming negligible air drag, find the vehicle velocity when it is 500km above earth's surface. What maximum height above earth's surface is reached by the rocket ? **5**

(b) Calculate the Escape Velocity for sun on its surface. **3**

(c) How does acceleration due to gravity vary over the surface of the earth? **2**

4. (a) Explain the reference frame where sun is taken as origin and compare it with the reference frames usually considered for satellite orbits. **4**

(b) Write short notes on the following:

(i) Time of flight **2**

(ii) Re-entry phase **2**

(iii) Trajectory geometry **2**

5. A satellite is launched from a circular equatorial parking orbit at an altitude of 200km into a coplanar circular synchronous orbit by using a Hohmann transfer ellipse. Determine the velocity increments for entering the transfer ellipse and for achieving the circular synchronous orbit of radius 35800km. **10**

6. (a) Write and explain the factors behind perturbation of satellite orbit and its positions. 5

(b) A space craft with mass 5000kg and a satellite with mass 400kg are revolving around the earth in same circular orbit of radius 7250km from earth's centre. What will be the ratio of their orbital velocities and ratio of their respective orbital time periods? 5

7. Explain the stability of motion near the liberation point. Make use of sketches and examples. 10

8. What do you understand by fast interplanetary trajectory? Derive the expression for $\frac{V\pi}{Ve}$ for a ' fast ' interplanetary trajectory of a spacecraft which is moving from earth to planet mars. 10

9. Describe Cowell's method and Encke's method in detail. 10