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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, April, 2017

Program Name: B.Tech ASE | **Semester – VIII**
Course Name : Spacecraft Dynamics & Attitude Control | **Max. Marks : 100**
Course Code : ASEG 414 | **Duration : 3 Hrs**
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Section – A (4x5=20 Marks)

1. Calculate the velocity of an artificial satellite orbiting the Earth in a circular orbit at an altitude of 200 km above the Earth's surface.
2. A satellite in Earth orbit passes through its perigee point at an altitude of 200 km above the Earth's surface and at a velocity of 7,850 m/s. Calculate the apogee altitude of the satellite.
3. Calculate the eccentricity of the orbit for the satellite with the following parameters? Given:

   r_1 = 6,628,140 m
   v_1 = 7,900 m/s $\Upsilon = 89^o$

4. Write about Momentum Wheels and propagation of quaternion.

Section – B (4 x 10 = 40 Marks)

5. Explain the following
   a) Attitude Sensor.
   b) Sun Sensor.
   c) Star Sensor.

6. A spacecraft is in a circular parking orbit with an altitude of 200 km. Calculate the velocity change required to perform a Hohmanntransfer to a circular orbit at geosynchronous altitude.

7. Briefly explain about the Vernal Equinox and Van-Allen Belt with suitable diagram.

8. The period of revolution of the earth about the sun is 365.256 days. The semimajor axis of the earth's orbit is $1.49527*10^{11}$ m. The Semimajor axis of the orbit of Mars is $2.2783*10^{11}$ m. Calculate the period of Mars.

   (Or)

9. Draw and Explain the Attitude control for Spinning spacecraft and non-spinning spacecraft.

Section-C (2 x 20 = 40 Marks

10. At the end of a rocket launch of a space vehicle, the burnout velocity is 9km/s is a direction due north and 3^0 above the local horizontal. The altitude above the sea level is 500 mi. The burnout point is located at the 27^{th} parallel above the equator. Calculate and plot the trajectory of the space vehicle.

11. A satellite is in a circular Earth orbit at an altitude of 400 km. The satellite has a cylindrical shape 2 m in diameter by 4 m long and has a mass of 1,000 kg. The satellite is traveling with its long axis perpendicular to the velocity vector and it's drag coefficient is 2.67. Calculate the perturbations due to atmospheric drag and estimate the satellite's lifetime.

(Or)

12. Explain the following:
    a) Ascent through the atmosphere
    b) Mission in space
    c) Entry trajectory on a velocity-Altitude map
    d) Hohmaan Transfer
    d) Types of entry paths and corridor