Code No: R05322106 **R05** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Assume that the Earth station near the equator and the Earth station at a high latitude region are both observing distance variation of the same geo stationary satellite. How would these variations differ between these two Earth stations.
   (b) When walking on a circus tight rope, balance is achieved by stretching both the arms all way out by holding a long bar. Show that the stretched out arms or the bar correspond to a reaction wheel used in a zero momentum three axis stabilized satellite. [8+8]

2. (a) Write the important features of a satellite in geostationary orbit.
   (b) The Virginia Tech earth station is located at 80.438^0 longitude and 37.229^0 N latitude. Calculate the look angles (azimuth and elevation angles) to a geosynchronous satellite whose sub-satellite point is located at 121^0 W longitude.
   (c) Why do signal losses occur in the earth's atmosphere for satellite communication? Write a note on ionospheric effects. [6+6+4]

3. Consider the motion of a rocket in free space and obtain Tsiolkovsky's equation to predict the velocity increment in the vehicle. Further, obtain expression for the velocity increment at its burnout condition. Discuss the ideal velocity variation for different mass ratios. [16]

4. Write short notes on the following:
   (a) Particle motion in a uniform gravity field
   (b) Solar constant
   (c) Parking orbit
   (d) Geostationary orbit. [4+4+4+4]

5. (a) 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.
   (b) Calculate the period of revolution for the satellite in the above problem. [8+8]

6. (a) What are the forces that act on a re-entry vehicle? Among these which is the dominant force during re-entry? Elucidate.

(b) A vehicle attempting to aero-brake into orbit around Mars needs to achieve an equivalent ΔV_{retro} of 2 km s^{-1}. If the entire aero-braking maneuver lasts for 10 minutes, estimate the drag force acting on the vehicle in the process, in terms of g's.

[8+8]

7. (a) A satellite is launched into a low Earth orbit an altitude of 400 km, velocity of 8,000 m/s with Φ equal to 12^0. Calculate the satellite's altitudes at perigee and apogee.(Φ is the flight path angle, the angle between the local horizontal and the velocity vector)

   (b) Calculate the eccentricity of the orbit of the satellite in the above problem.

[10+6]

8. Describe the rocket motion in a homogeneous gravitational field for two cases of pitch angles; (a) 90^0, and (b) less than 90^0. [16]

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Code No: R05322106 **R05** **Set No. 4**

III B.Tech II Semester Examinations,December 2010
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the forces that act on a re-entry vehicle? Among these which is the dominant force during re-entry? Elucidate.
   (b) A vehicle attempting to aero-brake into orbit around Mars needs to achieve an equivalent ΔV_{retro} of 2 km s^{-1}. If the entire aero-braking maneuver lasts for 10 minutes, estimate the drag force acting on the vehicle in the process, in terms of g's. [8+8]

2. (a) Assume that the Earth station near the equator and the Earth station at a high latitude region are both observing distance variation of the same geo stationary satellite. How would these variations differ between these two Earth stations.
   (b) When walking on a circus tight rope, balance is achieved by stretching both the arms all way out by holding a long bar. Show that the stretched out arms or the bar correspond to a reaction wheel used in a zero momentum three axis stabilized satellite. [8+8]

3. (a) A satellite is launched into a low Earth orbit an altitude of 400 km, velocity of 8,000 m/s with Φ equal to 12^0. Calculate the satellite's altitudes at perigee and apogee.(Φ is the flight path angle, the angle between the local horizontal and the velocity vector)
   (b) Calculate the eccentricity of the orbit of the satellite in the above problem. [10+6]

4. Describe the rocket motion in a homogeneous gravitational field for two cases of pitch angles; (a) 90^0, and (b) less than 90^0. [16]

5. Write short notes on the following:
   (a) Particle motion in a uniform gravity field
   (b) Solar constant
   (c) Parking orbit
   (d) Geostationary orbit. [4+4+4+4]

6. (a) Write the important features of a satellite in geostationary orbit.
   (b) The Virginia Tech earth station is located at 80.438^0 longitude and 37.229^0 N latitude. Calculate the look angles (azimuth and elevation angles) to a geosynchronous satellite whose sub-satellite point is located at 121^0 W longitude.

(c) Why do signal losses occur in the earth's atmosphere for satellite communication? Write a note on ionospheric effects.

[6+6+4]

7. (a) 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.

(b) Calculate the period of revolution for the satellite in the above problem. [8+8]

8. Consider the motion of a rocket in free space and obtain Tsiolkovsky's equation to predict the velocity increment in the vehicle. Further, obtain expression for the velocity increment at its burnout condition. Discuss the ideal velocity variation for different mass ratios. [16]

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Code No: R05322106 **R05** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Consider the motion of a rocket in free space and obtain Tsiolkovsky's equation to predict the velocity increment in the vehicle. Further, obtain expression for the velocity increment at its burnout condition. Discuss the ideal velocity variation for different mass ratios. [16]

2. Describe the rocket motion in a homogeneous gravitational field for two cases of pitch angles; (a) 90^0, and (b) less than 90^0. [16]

3. (a) What are the forces that act on a re-entry vehicle? Among these which is the dominant force during re-entry? Elucidate.
   (b) A vehicle attempting to aero-brake into orbit around Mars needs to achieve an equivalent ΔV_{retro} of 2 km s^{-1}. If the entire aero-braking maneuver lasts for 10 minutes, estimate the drag force acting on the vehicle in the process, in terms of g's.
   [8+8]

4. (a) A satellite is launched into a low Earth orbit an altitude of 400 km, velocity of 8,000 m/s with Φ equal to 12^0. Calculate the satellite's altitudes at perigee and apogee.(Φ is the flight path angle, the angle between the local horizontal and the velocity vector)
   (b) Calculate the eccentricity of the orbit of the satellite in the above problem.
   [10+6]

5. (a) Write the important features of a satellite in geostationary orbit.
   (b) The Virginia Tech earth station is located at 80.438^0 longitude and 37.229^0 N latitude. Calculate the look angles (azimuth and elevation angles) to a geosynchronous satellite whose sub-satellite point is located at 121^0 W longitude.
   (c) Why do signal losses occur in the earth's atmosphere for satellite communication? Write a note on ionospheric effects.
   [6+6+4]

6. Write short notes on the following:
   (a) Particle motion in a uniform gravity field
   (b) Solar constant
   (c) Parking orbit
   (d) Geostationary orbit. [4+4+4+4]

7. (a) 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.

   (b) Calculate the period of revolution for the satellite in the above problem. [8+8]

8. (a) Assume that the Earth station near the equator and the Earth station at a high latitude region are both observing distance variation of the same geo stationary satellite. How would these variations differ between these two Earth stations.

   (b) When walking on a circus tight rope, balance is achieved by stretching both the arms all way out by holding a long bar. Show that the stretched out arms or the bar correspond to a reaction wheel used in a zero momentum three axis stabilized satellite. [8+8]

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Code No: R05322106 **R05** **Set No. 3**

III B.Tech II Semester Examinations,December 2010
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Consider the motion of a rocket in free space and obtain Tsiolkovsky's equation to predict the velocity increment in the vehicle. Further, obtain expression for the velocity increment at its burnout condition. Discuss the ideal velocity variation for different mass ratios. [16]

2. (a) Assume that the Earth station near the equator and the Earth station at a high latitude region are both observing distance variation of the same geo stationary satellite. How would these variations differ between these two Earth stations.

   (b) When walking on a circus tight rope, balance is achieved by stretching both the arms all way out by holding a long bar. Show that the stretched out arms or the bar correspond to a reaction wheel used in a zero momentum three axis stabilized satellite. [8+8]

3. (a) 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.

   (b) Calculate the period of revolution for the satellite in the above problem. [8+8]

4. (a) What are the forces that act on a re-entry vehicle? Among these which is the dominant force during re-entry? Elucidate.

   (b) A vehicle attempting to aero-brake into orbit around Mars needs to achieve an equivalent ΔV_{retro} of 2 km s^{-1}. If the entire aero-braking maneuver lasts for 10 minutes, estimate the drag force acting on the vehicle in the process, in terms of g's.

   [8+8]

5. (a) Write the important features of a satellite in geostationary orbit.

   (b) The Virginia Tech earth station is located at 80.438^0 longitude and 37.229^0 N latitude. Calculate the look angles (azimuth and elevation angles) to a geosynchronous satellite whose sub-satellite point is located at 121^0 W longitude.

   (c) Why do signal losses occur in the earth's atmosphere for satellite communication? Write a note on ionospheric effects.

   [6+6+4]

6. (a) A satellite is launched into a low Earth orbit an altitude of 400 km, velocity of 8,000 m/s with Φ equal to 12^0. Calculate the satellite's altitudes at perigee and apogee.(Φ is the flight path angle, the angle between the local horizontal and the velocity vector)

(b) Calculate the eccentricity of the orbit of the satellite in the above problem. [10+6]

7. Describe the rocket motion in a homogeneous gravitational field for two cases of pitch angles; (a) 90^0, and (b) less than 90^0. [16]

8. Write short notes on the following:

   (a) Particle motion in a uniform gravity field

   (b) Solar constant

   (c) Parking orbit

   (d) Geostationary orbit. [4+4+4+4]

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