Code No: R09222105 **R09** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Write short notes on the following:
   (a) Orbital velocity and escape velocity.
   (b) Geo-synchronous orbit. [8+7]
2. Write short notes on the following:
   (a) Auroral activity.
   (b) Inner and outer radiation belts about the Earth.
   (c) Solar wind and solar corona.
   (d) Magnetopause and Magnetotail. [15]
3. Write short notes on the following with regard orbital elements:
   (a) Argument of perigee.
   (b) True anomaly.
   (c) Right ascension of the ascending node. [5 + 5 + 5]
4. Explain how jet damping is useful in controlling spinning vehicles. [15]
5. Consider an initial circular, low-earth orbit at a 300km altitude. Find the velocity change that is required to produce an elliptical orbit with a 300km altitude at periapsis and a 3000km altitude at appoapsis. Given μ, the gravitational parameter for Earth = 398600.4 km^3/s^2 and radius of Earth = 6378.14km. [15]
6. Discuss how the weather conditions are going to affect the launching of a space vehicle and the role of flight control team in adverse situations. [15]
7. Describe the two methods to determine the hypersonic drag coefficient for a re-entry space vehicle. [15]
8. (a) How does a liquid motor differ from a solid rocket motor? Explain which of the two will be useful for a sounding rocket of diameter 10cms and length 1.5m.
   (b) A missile carries a war head of 50 kgf. This single stage rocket has lift-off load of 300 kgf, structural load is 250 kgf, and propellant load of 2700kgf. If the specific impulse is 300 sec., calculate the burnout velocity. [7+8]

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Code No: R09222105 **R09** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Write a short note on the following:
   (a) Mean anomaly at the epoch.
   (b) Argument of pericente. [7+8]
2. Explain in detail the potential hazards to a spacecraft due to micro-meteoroids and space junk. [15]
3. Explain how a simple plane change maneuver is different from Hohmann transfer maneuver. Mention the changes that are going to be associated with orbital parameters in a simple plane change of orbits. [15]
4. Consider the motion of a rocket in free space and obtain Tsiolkovskys 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. [15]
5. (a) Define specific impulse of a rocket motor. Describe a solid rocket motor, its propellant and the lasing along with its nozzle.
   (b) Develop the thrust equation for a solid rocket motor for the following conditions:
      i. When it is powering an aerospace vehicle in air medium, and
      ii. When ground tested on a static test bench. [8+7]
6. Describe what goes into the mission operations systems. Justify the statement that mission operations often form the background for a space mission. [15]
7. Describe the re-entry process of a space vehicle. Explain the features of the vehicle which attracts the attention of its designer. Bring out major constraints involved in its design as well. [15]
8. Explain how magnetic desaturation is useful in controlling attitude of a spacecraft. [15]

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Code No: R09222105 **R09** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the effects of heating on the trajectory of a re-entry space vehicle. Indicate the heating rate profiles for launch vehicles having various ballistic coefficient values, in a graphical form.
   (b) Write a short note on 'the three competing re-entry requirements'. [8+7]
2. Distinguish between down link, up link, forward link, return link, and cross link related to communication of information transfer between ground control station and a space craft. [15]
3. Distinguish between circular and elliptical orbital motion of a body in a non rotating reference frame with its origin at another body. [15]
4. Assuming the surface of the earth to be spherical, describe the method to determine the position of the impact point. [15]
5. (a) Explain the changes that could occur in density and pressure of Earth's atmosphere with altitude.
   (b) Why the astronauts are said to be in 'Zero Gravity' environment? Why does a 'free fall' considered to be a better description of the gravity environment? [7+8]
6. Distinguish between spin-stabilization and dual-spin stabilization attitude control mechanisms for spacecrafts. [15]
7. Consider a Hohmann transfer from a circular orbit of radius r_1 to another coplanar circular orbit or radius r_2. Let Δv be the sum of the two velocity increments required for the maneuver. Show that for a fixed gravitational parameter and radius r_1, the maximum required Δv occurs for r_2= 15.58 r_1. [15]
8. Describe the rocket motion in a homogeneous gravitational field for two cases of pitch angles;
   (a) 90^0, and
   (b) other than 90^0. [15]

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Code No: R09222105 **R09** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
INTRODUCTION TO SPACE TECHNOLOGY
Aeronautical Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write a note on the following:
   i. Regenerative cooling.
   ii. Film or boundary layer cooling.
   (b) Discuss different types of grain configuration found in solid motors. [8+7]
2. (a) Describe the re-entry co-ordinate system.
   (b) What are the potential forces that act on a re-entry vehicle? Among these which is the dominant force during re-entry. Explain why? [7+8]
3. Compare Hohmann transfer of orbit with Bielliptic transfer of orbit principles? [15]
4. Discuss the variation of circular velocity and circular orbit time periods with the non-dimensional orbital distance for various planets and the moon. [15]
5. List out and describe in detail various test facilities used for space craft integration and testing. [15]
6. Obtain an expression for the minimum number of stages required in a multi-stage rocket assembly in order to carry maximum payload, for a given ideal velocity and structural efficiency. Further, discuss the method of optimizing the number of stages required. [15]
7. Provide the details of attitude determination during Hohmann transfer of a space vehicle to geosynchronous orbit. [15]
8. Write a detailed note on radiation effects to both manned and unmanned space-crafts. [15]

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