Code No: RR412108 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
SPACE TECHNOLOGY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. Explain various components of a solid rocket motor with a sketch. Discuss the type of nozzle and its requirements in a solid rocket motor. Make use of sketches to illustrate your answer. [12+4]

2. Making use of the momentum equation , develop the equation of thrust developed by a static rocket motor. Explain all that involved by sketches and theory. Define specific impulse and develop the appropriate expression for this case. State any conditions involved. [4+4+4+4]

3. A rocket is in n accelerating flight with its longitudinal axis inclined at angle θ at its mass centre with the vertical. Considering that the mass of the rocket reduces every instance of the burning of the fuel and that this results in instantaneous increment in the fwd. Velocity, develop the rocket equation. Present your results with all possible variables / arguments. [10+6]

4. Consider a sounding rocket of initial mass M_0 in vertical flight under the action of the forces of gravity and thrust. Take the mass flow rate of the burnt out fuel to be a constant. Develop the expressions for burn out velocity V_{bo} , burn out altitude H_{bo} and maximum altitude H_{max} . Make appropriate assumptions if any. [10+4+2]

5. Illustrate the pressure distribution and loading of slender bodies of revolution of circular x-section. Explain the difference between lift distribution for a cone - cylinder combination and that for a parabolic body. Make use of sketches and plots. [8+8]

6. Describe the motion of our planet Earth around the Sun. Show that the path of motion is elliptical. Refer the motion of Earth in polar co ordinates with the origin at the mass center of the Sun. [16]

7. Find the velocity V_0 that is required to place a satellite in orbit around the earth from an altitude of 550 kms above the mean surface of the earth, such that it will reach a maximum altitude of 5500kms. Prove the results used by you. [8+8]

8. The equation of orbit of a space vehicle is recognized as the standard form of a conic section in polar coordinate and is written in its general form as r= $\frac{p}{1+ecos(\theta-C)}$, where p=h^2 / k^2 , e =A(h^2 / k^2) and C is simply a phase angle with it. Work out an expression each for KE and PE associated with a satellite from this equation. Illustrate your observations on the sum total of KE and PE. [16]

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Code No: RR412108 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
SPACE TECHNOLOGY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. Explain main features of a solid rocket motor with a sketch. Provide details of the propellant system and the nozzle. [12+4]

2. By making use of the momentum equation, develop the equation of thrust produced by a static rocket motor. Explain all that involved by sketches and theory. Define specific impulse and develop the appropriate expression for this case. State any conditions involved. [4+4+4+4]

3. Consider the flight of an accelerating rocket with its longitudinal axis inclined at angle θ at its mass centre with the vertical. Considering that the mass of the rocket reduces every instance of the burning of the fuel and that this results in instantaneous increment in the fwd. velocity, develop the rocket equation. Present your results with all possible variables / arguments. [10+6]

4. Consider a sounding rocket in vertical flight under the action of the forces of gravity and thrust. Take the mass flow rate of the burnt out fuel to be a constant. Develop the expressions for burn out velocity V_{bo} , burn out altitude H_{bo} and maximum altitude H_{max} . Make appropriate assumptions if any. [10+4+2]

5. Consider a missile configuration with circular x-section having forward control surface. Explain its aerodynamics, vortex system and longitudinal stability. Define the static margin. [6+6+4]

6. State and prove the First law of planetary motion due to Kepler. (Make use of polar co ordinates) [16]

7. Find the velocity V_0 that is required to place a satellite in orbit around the earth from an altitude of 500 kms above the mean surface of the earth, such that it will reach a maximum altitude of 5000kms. Prove the results used by you. [8+8]

8. Explain with sketches and plots the following terms; target orbit, parking orbit, transfer orbit, circular orbit, elliptic orbit, equatorial orbit,inclined orbit and geo-synchronous orbit . Illustrate all these terms when a satellite is launched from Satish Dhawan Spaceport in India and Corou in French Guyana . Detail out the salient features of these space centres as well. [8+6+2]

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Code No: RR412108 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
SPACE TECHNOLOGY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. Describe with a sketch pressure feed type liquid rocket motor and its functioning. Name one such rocket of WW II fame. What were its strong features? [10+6]

2. Make use of the momentum equation to develop the equation of thrust developed by a static rocket motor. Explain all that involved by sketches and theory. Define specific impulse and develop the appropriate expression for this case. State any conditions involved. [4+4+4+4]

3. Consider the flight of a rocket of mass m accelerating with its longitudinal axis inclined at angle θ at its mass centre with the vertical. Considering that the mass of the rocket reduces every instance of the burning of the fuel and that this results in instantaneous increment in the fwd. velocity, develop the rocket equation. Present your results with all possible variables / arguments. [10+6]

4. Consider a sounding rocket in vertical flight under the forces of gravity and thrust. Take the mass flow rate of the burnt out fuel to be a constant. Develop the expressions for burn out velocity V_{bo} , burn out altitude H_{bo} and maximum altitude H_{max} . Make appropriate assumptions if any. [10+4+2]

5. Consider a missile configuration with circular x-section having rear control surface. Explain its aerodynamics, vortex system and longitudinal stability. Define the static margin. [4+4+4+4]

6. State the three laws of planetary motion uncovered by Kepler.Adopting the polar co ordinates, prove the first law. Do you note any inter relationship between these three laws? [3+10+3]

7. Find the velocity V_0 that is required to place a satellite in orbit around the earth from an altitude of 450 kms above the mean surface of the earth, such that it will reach a maximum altitude of 3500kms. Prove the results used by you. [8+8]

8. The equation of orbit of a space vehicle is put in the standard form of a conic section in polar coordinate and is written in its general form as r = $\frac{p}{1+ecos(theta-C)}$, where p=h^2 / k^2 , e =A(h^2 / k^2) and C is simply a phase angle with it. Work out an expression each for KE and PE associated with a satellite from this equation. Illustrate your observations on the sum total of KE and PE. [16]

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Code No: RR412108

Set No.4

IV B.Tech. I Semester Regular Examinations, November -2005
SPACE TECHNOLOGY
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain with sketches the details and functioning of a gravity feed type liquid rocket motor. What are the special requirements in this type of rocket motors? [10+6]

2. Derive the equation of thrust developed by a static rocket motor from the application of momentum equation. Develop an expression for the Specific Impulse of the rocket. Make use of sketches for the purpose of illustrations. [6+6+4]

3. Consider a sleek rocket of mass m accelerating with its longitudinal axis inclined at angle θ at its mass centre with the vertical. Considering that the mass of the rocket reduces every instance of the burning of the fuel and that this results in instantaneous increment in the fwd. velocity, develop the rocket equation. Present your results with all possible variables / arguments. [10+6]

4. Consider a sounding rocketof initial mass M_0 in vertical flight experiencing the forces of gravity and thrust. Take the mass flow rate of the burnt out fuel to be a constant.Develop the expressions for burn out velocity V_{bo} , burn out altitude H_{bo} and maximum altitude H_{max} . Make appropriate assumptions if any. [10+4+2]

5. Explain the aerodynamics of a missile with fwd. controls. Elaborate the action and interaction of flow from the control surfaces on the body of the missile and the main lifting surface. Describe the load factor capability of such a missile.Comment on the static margin in this case. [6+4+4+2]

6. It is known that the period of revolution of the Earth around the Sun is 365.3 days and that the semi-major axis of the Earth's orbit is $1.495{*}10^{11}$ m. Corresponding period of the Saturn is 29.458 earth years. What is the semi-major axis of the planet Saturn. Prove the relationship used in your calculations. [8+8]

7. Find the velocity V_0 that is required to place a satellite in orbit around the earth from an altitude of 400 kms above the mean surface of the earth, such that it will reach a maximum altitude of 3000kms. Prove the results used by you. [8+8]

8. Define with sketches and plots the following terms; target orbit, parking orbit, transfer orbit, circular orbit, elliptic orbit, equatorial orbit,inclined orbit and geo-synchronous orbit . Illustrate all these terms when a satellite is launched from Satish Dhawan Spaceport in India and Corou in French Guyana . Detail out the salient features of these space centres as well. [8+6+2]

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