Code No: RR322106 **Set No.1**

III B.Tech. II Semester Regular Examinations, April/May -2005
ROCKETS AND MISSILES
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe the ignition system in liquid propellant rockets.
   (b) Explain the term ignition delay, What is the effect of change in the ignition delay on the performance of the rocket.
2. (a) Sketch the various types of burning of the grains of solid propellant.
   (b) Explain using control and canard control of a missile.
3. (a) Describe the missile with wing control and tail control and compare them by drawing sketches
   (b) What do you mean by Surface to surface missile and air to air missile discuss them in respect of design characteristics and performance.
4. (a) Derive the expression for the stability derivatives of a missile with rear controls.
   (b) Discuss the role of wing, body and tail to the directional stability and control of a missile.
5. Derive the expression for altitude at the end of powered flight for a rocket with vertical flight in frictional air. Also show the maximum distance covered by the rocket in the vertical direction.
6. What do you mean by thrust vector control? Explain various methods of thrust vector control in the liquid propellant rockets?
7. Prove that for an N stage rocket with identical stages with same structural factor $\in$ and payload ratio of λ.
   Speed ratio $v = -nIn\left(\varepsilon\left(i-\lambda\right)+\lambda\right)$
8. What do you mean by thermal protection system? Which types of thermal protection system are used in rockets and missiles? Describe a thermal protection system based on heat absorption.

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Code No: RR322106 **Set No.2**

III B.Tech. II Semester Regular Examinations, April/May -2005
ROCKETS AND MISSILES
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe the ignition system in liquid propellant rockets.
   (b) Explain the term ignition delay, What is the effect of change in the ignition delay on the performance of the rocket.
2. (a) Explain the different types of control surfaces in missiles.
   (b) How does a missile differ from a rocket
   (c) What are the characteristics of bodies of revolution
3. (a) What are the main classes of missiles, discuss each type with its characteristics.
   (b) Write the characteristics of bodies of revolutions.
4. Explain why
   (a) Roll stabilization is difficult in missiles having canard control.
   (b) Homing missiles need not be roll stabilized.
   (c) Usually ramjet powered missiles prefer wing control
   (d) Large static margin are detrimental to maneuverability of missile.
5. Find the equations of motion for the flight of a rocket with constant pitch angle in homogeneous gravitational field & Derive the expressions of velocities and altitudes.
6. Explain the terms burnout velocity, burnout altitude and Culmination altitude for rocket motion in homogeneous gravitational field and show, by curves, how they depend upon thrust-to weight-ratio.
7. An optimal 2-stagerocket is to operate in a drag and gravitational force free environment. It is to provide $\Delta\nu$ of 500 m/s to a payload of 1000kg.
   Given C_1=3000m/s, C_2=4000m/s, δ_1=0.1, δ_2=0.15
   Find m_0, λ_1 and λ_2
   Find the same things for $C_1 = C_2 = 3000m/s$ $\delta_1 = \delta_2 = 0.1$
8. Which alloys are good for making structures exposed to cryogenic temperatures? Discuss the properties of the material used in the missiles and rockets at cryogenic temperatures.

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Code No: RR322106 **Set No.3**

III B.Tech. II Semester Regular Examinations, April/May -2005
ROCKETS AND MISSILES
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the function of valves in rocket engines; explain the various types of the valves used in the propellant supply.
   (b) Show the position of valves by a neat sketch.
2. Show the different airframe components of a rocket; explain the different types of fore-bodies.
3. (a) What are the considerations on which the size of the wing of a missile depend, discuss
   (b) Discuss the aerodynamic characteristics of various forebodes of the missiles.
4. (a) What is the effect of body up wash on the aerodynamic characteristics of a missile with rear control?
   (b) Derive an expression for the static stability margin for the wing control missile.
5. Define the terms culmination point, culmination velocity and culmination altitude. Derive the expressions for the coordinates of culmination point for rocket motion with constant pitch angle in homogeneous gravitational field.
6. What is the use of employing auxiliary thrust chamber in the liquid propellant rockets? Apart from the roll control, what is the use of such thrusters? Discuss the merits and demerits of jet vane controlled thrust vector of liquid propellant rocket.
7. For a vertical ascent of a 2 stage rocket, find expression for culmination altitude and show that it decreases with the increase in the coast time between burn out of stage one and ignition of stage 2.Derive the expression for maximum culmination height.
8. What are the factors responsible for selection of material for rockets? Discus each factor in respect of its area of application.

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Code No: RR322106 **Set No.4**

III B.Tech. II Semester Regular Examinations, April/May -2005
ROCKETS AND MISSILES
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. How the rockets are ignited, explain the different types of ignition systems used in the rocket engines.

2. What is propellant slosh, how does it occur, what effect does it have on the performance of the rocket engine. Discuss the means of rectifying it.

3. (a) Draw a typical complete missile model normal force and pitching moment curve for a missile with rear (tail) control and explain the various points of the curves.
   (b) What are the effects of increasing aspect ratio?

4. What are the damping parameters of an airframe for dynamic stability analysis? Derive the expressions and explain the results.

5. (a) What are various rocket parameters affecting the motion of the rocket in free space.
   (b) Define the terms, payload ratio and propellant ratio, how does the propellant ratio depend upon the ideal velocity of the rocket.

6. (a) What is ballistic factor? How it affects the free flight dispersion?
   (b) Show that the burnout velocity of a single stage rocket motor moving vertically is given by:
   $V_b = g.I_{sp}.In\left[m_0/\left(m_0 - m_f\right)\right]$
   Where m_o is initial mass of missile, m_f is mass of fuel and I_{sp} is the specific impulse. State any assumptions, if made.

7. For a critical space mission with an incremental velocity requirement of 25000 m/s and specific power of 0.2 kW/kg, determine the optimum values of v and t for maximum payload.

8. Which materials are used for the nozzles of rockets and missiles? Explain the refractory materials in details with their characteristics

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