

Code No: 07A72111

R07

Set No. 2

IV B.Tech I Semester Examinations, December 2011
ROCKETS AND MISSILES
Aeronautical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. What are the various methods of thrust - vector controls used in the liquid propellant rockets? [16]
2. Derive equations for the burn out range (distance covered by the time of burn out) of a rocket in uniform gravitational field. [16]
3. (a) What are the effects of different solid propellants on the burning rate?
(b) Why thrust termination is necessary in solid propellant rockets? [8+8]
4. (a) Differentiate between feed system and expulsion system used in liquid propellant engines.
(b) Which factor affects the volume of air - tank in the gas pressure propellant feed system. [8+8]
5. With neat sketches explain the forces and moments acting during the separation stage of multi - stage rocket system. [16]
6. (a) Sketch and explain the effects of drag and derive equations for estimating drag.
(b) Explain about lateral aerodynamic moment of a rocket. [8+8]
7. What are the various components of the rockets and missiles made by MMC (Metal matrix Composites) and FRP (Fiber Reinforced Plastics), and mention their relative merits? [16]
8. Derive an equation for the culmination altitude of a two stage rocket. Mention all the assumptions made. [16]

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Set No. 4

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Time: 3 hours

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Answer any FIVE Questions
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1. (a) Derive equations of velocity and altitudes for the case of constant thrust.
(b) Find equations of velocity in terms of time after burnout time in the two dimensional motion of a rocket. [8+8]
2. Differentiate between the sequence of operations involved and dynamics in the separation of tandem and parallel stages. [16]
3. Rockets and missiles, when moving at high speed will be exposed to high temperatures. What insulating materials are used so that heat will not be transferred to inner parts? [16]
4. (a) Explain with a neat sketch various mountings used for igniters.
(b) Which one of the mountings is best in the design and gives better performance? [8+8]
5. What are the design considerations to be made for the lateral control in cruciform type of missile? [16]
6. Describe the principle and working of side injection thrust vector control. How will this affect the performance of the rocket control? [16]
7. (a) Derive the equations for the burnout range in terms of mass ratio in free space.
(b) Describe the behavior of burnout and culmination altitude for vertical ascent in a homogeneous gravitational field and in vacuum. [8+8]
8. (a) Explain about squib primer and various types of primers used in the rockets.
(b) What is the influence of motor free volume on igniter change? [8+8]

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Set No. 1

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Aeronautical Engineering

Time: 3 hours

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1. (a) Derive the TSIOLKOFKY'S equation for the velocity of a rocket.
(b) What is induced drag and how does it depend on aspect ratio? [8+8]
2. (a) Explain with a neat sketch the working principle of a solid propellant rocket motor.
(b) How the "combustion instability" affects the burning rate of solid propellant rocket motor? [8+8]
3. (a) Describe the airframe components of a rocket and the forces acting on the rocket while moving through atmosphere.
(b) Sketch and explain all the forces and moments contributing to the lateral movement of a rocket. [8+8]
4. What is the need of multi - stage rocket system and derive equations to find the velocity at the end of burn out of the rocket and maximum altitude obtained? [16]
5. How thrust termination method of control is used in solid and liquid propellant rockets. What are the problems associated with these methods? [16]
6. Explain with a neat sketch the construction and working of combustion chamber and indicate various elements of the chamber used in liquid propellant rocket. [16]
7. (a) What are the various thermal protection system (TPS) used in rockets and missiles?
(b) What are the places of rockets exposed to high temperatures and what materials are used for thermal protection? [8+8]
8. Explain the following.
(a) Advantages of multi - staging
(b) Forces acting on a rocket in vertical ascent. [8+8]

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Set No. 3

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Aeronautical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What are the atmospheric effects on the performance of a rocket?
(b) Discuss the structural and aerodynamic effects of wind on the rocket. [8+8]
2. What materials are used to the forebody of rockets and missiles and mention the fabrication methods used for it? [16]
3. Derive an expression for the burn out velocity of multi stage rocket system. [16]
4. (a) What is expulsion efficiency and which device gives maximum expulsion efficiency?
(b) Explain about basic types of expulsion devices with a neat sketch. [8+8]
5. Differentiate between attitude control with thrust vector control mentioning their relative advantages and limitations. [16]
6. For a two dimensional motion of a rocket in homogeneous gravitational field derive expressions for burnout velocity, burnout altitude, Culmination altitude. [16]
7. (a) How the burning rate of solid propellant can be increased?
(b) Derive equations involving burning rate and gas velocity. [8+8]
8. (a) Explain about homogeneous gravitational field in atmosphere and in vacuum.
(b) Derive an equation for the culmination altitude of a two - stage rocket in vertical flight in a homogeneous gravitation field and in vacuum. [8+8]
