1+3

JAYA GROUP INSTITUTIONS-THIRUNINRAVUR
8TH SEMESTER – B.E / B.Tech
INTERNAL ASSESSMENT-I (MODEL EXAMINATION-I)

Sub.Name: ROCKETS & MISSILES
Sub.Code: AE 2033
Duration: 180 Minutes

Date: 9.2.15
Branch: AERONAUTICAL ENGG
Max.Marks: 100

PART-A

1.Define payload of a rocket?

2.Define mass ratio and structural efficiency of rocket?

3.Distinguish between the rocket motion under constant thrust and constant specific thrust cases?

4.Define normal plane of motion and the roll angle with reference to two dimensional result motion?

5. What is gravity turn trajectory?What is its importance in trajectory selection?

6.What are the techniques that are used for stage separation of a space launch vehicle in the atmosphere?

7.What are the techniques that are used for stage separation of a space launch vehicle in the space?

8.What is coasting phase of a space launch vehicle?

9.What are the important variables in controlling main stream axial thrust in secondary injection thrust vector control system?

10.How is thrust control achieved by jetavators control for rockets?

PART-B

11.a.i) Derive two dimensional equation of motion of a rocket under the influence of aerodynamic, gravitational and thrust forces?

ii)Derive an expression for Tsiolkovsky equation?

(or)

b.Derive the expression for burnout range for the following condition i)constant thrust, ii)constant specific thrust.

12.a.Derive an expression for culmination altitude reached by a sounding rocket. Neglect aerodynamic and gravitational forces. Assume constant thrust.

(or)

b .i)Show that at the time of culmination,the vertical component of velocity of a rocket tracing an inclined trajectory with constant pitch angle in zero. Assume that the rocket motion is in free space.

ii)Derive a relation between velocity, high path angle and specific thrust for a rocket undergoing a gravity turn trajectory.

13.a.i)What in kick angle? Derive an expression for kick angle.

ii)Calculate the culmination range and culmination altitude reached by a rocket after the burnout with the following data, specific impulse of the rocket is 278s, thrust to weight ratio 1.48, mass ratio 5.2 and pitch angle 41.2° .assume that the rocket is tracing an inclined trajectory with constant pitch angle. Aerodynamic forces may be neglected and thrust can be assumed constant.

(or)

b. A rocket unit is launched from a launcher which is inclined at angle of 32deg to the horizontal. Assuming that the rocket axis makes of launch during its initial flight. Estimate the following

i) Horizontal component of velocity at the time of 32 sec from the time of launch.

ii) Vertical component of velocity at a time of 44 sec from the time of launch.

iii) Burn out velocity

iv) . The flight path angle at a time of 22 sec from the time of launch. Neglect aerodynamic forces and assume the following data. Specific impulse = 264 sec, initial launch mass=1002 kg, mass flow rate=8.4 kg/s (constant) thrust to weight ratio,=1.33

14.a. Derive an expression for separation velocity imparted by a helical compression spring during stage separation of a multistage space launch vehicle in space.

(or)

b. What is thrust vector control? What are the methods of thrust vector control methods? Explain in detail.

15.a. Derive an expression for vehicle optimization.

(or)

b .i) Explain multistaging of rockets.

ii) Explain in detail about secondary injection thrust vector control.