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10AE666

Sixth Semester B.E. Degree Examination, June/July 2019
Rockets and Missiles

Time: 3 hrs.

Max. Marks: 100

Note: Answer FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. Explain the nuclear rocket engine with help of a neat diagram and also mention its advantages and disadvantages. (10 Marks)
- b. A rocket projectile has the following characteristics. Initial mass 200kg, Mass after rocket operation 130kg, payload, non propulsive structure etc, 110kg, Rocket operating duration 3.0sec, Average specific impulse of propellant 240Sec. Determine the vehicle's mass ratio propellant mass fraction, propellant flow rate, thrust, thrust - to - weight ratio, acceleration of vehicle, effective exhaust velocity, total impulse and the impulse to weight ratio. (10 Marks)
- 2 a. List and explain the principal losses in nozzles. (10 Marks)
- b. A satellite is launched from a circular equatorial parking orbit at an attitude of 160km into a coplanar circular synchronous orbit by using a Hohmann transfer ellipse. Assume a homogeneous spherical earth with a radius of 6374 km. Determine the velocity increments for entering the transfer ellipse and for achieving the synchronous orbit at 42200km altitude. (10 Marks)
- 3 a. Write a note on aging and useful life of rocket propellants. (04 Marks)
- b. Elaborate the grain configuration of hybrid propellant. (06 Marks)
- c. List the liquid oxidizers and explain any four of them. (10 Marks)
- 4 a. With the help of block diagram, explain the idealized process for selecting propulsion systems. (10 Marks)
- b. Explain the typical criteria in details used in the selection of a particular rocket propulsion system. (10 Marks)

PART - B

- 5 a. Derive an expression for the lift per unit axial distance along the span of a cone cylinder

$$\left(\frac{\bar{y}}{q_0} = 0, \frac{z}{q_e} = 2\alpha_e s(\bar{x}) \right)$$
 (10 Marks)
- b. Derive an expression for $\Delta P = -2(w_\alpha^+ w_t^+ - w_\alpha^- w_t^- + v_\alpha^+ v_t^+ - v_\alpha^- v_t^- + \alpha w_t^+ - \alpha w_t^-)$ (10 Marks)
- 6 How a missile can be controlled? Explain types of controls (conventions) with help of sketches. (20 Marks)
- 7 a. Classify the TVC mechanism and explain each one of them. (10 Marks)
- b. Explain the flight maneuvers with differential throttling with four fixed position thrust chambers. (10 Marks)
- 8 a. Explain different types of Rocket tests. (10 Marks)
- b. Write a note on, test facilities and safe guards. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.