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10AE666

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Rockets and Missiles

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. What are the different classifications of Rocket propulsion? (08 Marks)
- b. The following data are given for a certain rocket. Unit thrust = 8896 N, Propellant consumption = 3.876 kg/s, Velocity of vehicle = 400 m/s, Energy content of propellant = 6.911 MJ/kg. Assume 100% combustion efficiency and determine (i) effective exhaust velocity (ii) Kinetic jet energy rate per unit flow of propellant (iii) Internal efficiency (iv) Propulsive efficiency (v) Overall efficiency (vi) Specific impulse (vii) Specific propellant combustion. (12 Marks)
- 2 a. For a vehicle in gravitational-less space determine the mass ratio required to boost the vehicle velocity by (i) 1600 m/s (ii) 3400 m/s. The effective exhaust velocity is 2000 m/s. If the initial total vehicle mass is 4000 kg. What are the corresponding propellant mass? (10 Marks)
- b. For an ideal rocket with a characteristic velocity of 1200 m/s, a mass flow rate of 73 kg/s, the thrust coefficient of 1.50, and the nozzle throat area of 0.0248 m², compute effective exhaust velocity, thrust, chamber pressure and specific impulse. (10 Marks)
- 3 a. Describe the desirable physical properties of liquid propellants. (08 Marks)
- b. Explain in detail about the grain and configuration of solid propellants with neat sketches. (12 Marks)
- 4 a. Discuss about merits and demerits of solid propellant rocket propulsion system. (10 Marks)
- b. Explain the advantages and disadvantages of liquid propellant rocket engines. (10 Marks)

PART – B

- 5 a. Derive an expression for lift and moment of a slender body revolution with usual notation. (12 Marks)
- b. With the help of a neat sketch, discuss about the wing body interference. (08 Marks)
- 6 a. List and explain the different types of missile aerodynamic controls. (10 Marks)
- b. Derive an equation of motion for missile with pitch control with usual notations. (10 Marks)
- 7 a. What are the importance of thrust vector control? (05 Marks)
- b. Explain the four categories of thrust vector control mechanisms and its types. (10 Marks)
- c. How do you control the rocket and missiles by thrust vector control with multiple thrust chamber or nozzle? Explain. (05 Marks)
- 8 a. Explain in detail about the test facility of chemical rocket propulsion system with neat sketch. (12 Marks)
- b. What are the physical quantities to be measured during rocket propulsion testing? (08 Marks)

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