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Sixth Semester B.E. Degree Examination, Dec.2018/Jan.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. Classify the different types of rocket systems based on the type of propellants. (05 Marks)
 - b. With a neat diagram, explain the working of arc heating electric rocket. (05 Marks)
 - c. A rocket projectile has the following characteristics :

Initial mass	: 250 kg
Mass after rocket operation	: 160 kg
Payload, non propulsive structure	: 130 kg
Rocket operating duration	: 5 sec
Average specific impulse of propellant	: 270 sec.

 Determine mass ratio of vehicle ; Mass ratio of rocket system ; propellant mass fraction ; propellant flow rate; thrust; thrust to weight ratio of the vehicle; acceleration of the vehicle, effective exhaust velocity; total impulse; impulse to weight ratio of propulsion system. (10 Marks)
- 2
 - a. Design a nozzle for an ideal rocket that has to operate at 20km altitude and give 5000N thrust at a chamber pressure of 5.475 MPa and a chamber temperature of 2490k. Assuming that $k = 1.30$ and $R = 355.4\text{J/kg-k}$. Atmospheric pressure at 20 km is 0.005475 MPa. Determine total pressure ratio; exit temperature; throat velocity; throat area; exit area. (10 Marks)
 - b. Discuss the different principal loss in a ideal nozzle. (10 Marks)
- 3
 - a. Explain the decomposition of hydrazine with suitable chemical equations which is used as a monopropellant. (05 Marks)
 - b. What are the different classifications of solid propellants? (05 Marks)
 - c. With a neat sketch explain the working of hybrid rocket propulsion list the advantages, disadvantages and applications. (10 Marks)
- 4
 - a. Explain the idealized process for selecting propulsion system. (08 Marks)
 - b. What are the advantages and disadvantages of solid and liquid propellants? (12 Marks)

PART – B

- 5
 - a. Calculate the centre of pressure for a tangent ogive as a function of its caliber, the length of the ogive in diameters of the base. (08 Marks)
 - b. Discuss the generalized nature of aerodynamic and stability derivatives. (12 Marks)
- 6
 - a. With a neat diagram, explain different types of missile controls. (10 Marks)
 - b. Discuss altitude effects and the change in missile altitude due to impulsive pitch control. (10 Marks)

- 7 a. With a neat sketch, explain TVC mechanisms with a single nozzle with hinge scheme and jet vanes. (08 Marks)
- b. List the advantages and disadvantages of different types of thrust vector control mechanisms. (12 Marks)
- 8 a. What are the different types of rocket tests? List the programs for which these tests are performed. (08 Marks)
- b. What are the typical personal and plant security or safety provisions in a modern test facility. (08 Marks)
- c. Briefly explain the usage of computers in test facility. (04 Marks)

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