

# CBCS SCHEME

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18AS61

## Sixth Semester B.E. Degree Examination, July/August 2022 Missiles and Launch Vehicles

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Describe the layout of a Military missile and explain the different components of it. (08 Marks)
- b. Rocket projectile has following characteristics:
- Initial mass 200kg.
  - Mass after rocket operation 130kg.
  - Payload, non-propulsive structure 110kg.
  - Rocket operation duration 3.0sec.
  - Average specific impulse of propellant 240sec.
- Determine:
- Vehicle Mass ratio
  - Propellant mass fraction
  - Propellant flow rate
  - Thrust to weight ratio
  - Acceleration of vehicle
  - Effective exhaust velocity. (12 Marks)

OR

- 2 a. Define the following:
- Specific impulse
  - Total impulse
  - Specific propellant consumption
  - Mass Ratio. (08 Marks)
- b. With a neat sketch, explain mission profile of a launch vehicle. (12 Marks)

### Module-2

- 3 a. Define propellant grain and explain the desirable properties of propellant grain. (08 Marks)
- b. With necessary sketch, explain the types of nozzles used in a solid rocket motor. (12 Marks)

OR

- 4 a. Describe regarding the pressure feed system and turbo pump feed system of liquid rocket propulsion. (12 Marks)
- b. With necessary sketch describe the different types of injection system used in liquid rocket propulsion. (08 Marks)

### Module-3

- 5 a. Identify the forces and moment acting on a missile while passing through atmosphere and explain it with help of a neat sketch. (10 Marks)
- b. Define rocket dispersion and its types. Explain regarding the factors which influence dispersion. (10 Marks)

OR

- 6 a. Derive the equations for longitudinal and lateral moments acting on a missile with necessary sketch. (10 Marks)
- b. With a neat sketch, explain the design consideration of a re-entry vehicle. (10 Marks)

**Module-4**

- 7 a. Derive the equation for finding range during absence of gravity under a constant thrust case. (08 Marks)
- b. With neat sketch, explain different TVC mechanisms. (12 Marks)

OR

- 8 a. A 4 stage rocket is used to put up a satellite of 40kg mass in a Low Earth Orbit (LEO). The approximate values of mass of propellant, mass of structure and jet velocity for each stage is are given below.

Stage	I	II	III	IV
Mass of propellant (kg)	9000	3500	1700	260
Structural mass (kg)	1500	550	250	40
Jet velocity (M/S)	2200	2400	2500	2750

Determine:

- i) The payload mass fraction of total rocket.
- ii) The structural mass fraction of each stage.
- iii) The ideal  $\Delta V$  provided by each stage and total  $\Delta V$ .
- iv) If first stage fires for period of 50 seconds and mass flow rate is constant, what will be acceleration of rocket at take off? (12 Marks)
- b. Explain briefly:
- i) Stage separation within atmosphere.
- ii) Stage separation out of atmosphere. (08 Marks)

**Module-5**

- 9 a. Describe regarding criteria for selection of materials for a rocket and missile. (10 Marks)
- b. How does ablative material handle the high temperature generated in rockets and missiles? Explain the application of ablative materials in parts of rockets and missiles. (10 Marks)

OR

- 10 a. Explain vertical static test stand for a large liquid propellant thruster with necessary sketch. (12 Marks)
- b. Describe regarding post accidental procedure and steps to respond in emergency during rocket testing. (08 Marks)

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