

B.E DEGREE EXAMINATIONS: NOV /DEC 2024

(Regulation 2018)

Sixth Semester

AERONAUTICAL ENGINEERING

U18AET6104: Rocket Propulsion

COURSE OUTCOMES**CO1:** Illustrate the Basic principles and parameters of rockets.**CO2:** Differentiate and interpret the ignition systems of rocket**CO3:** Analyze the performance of solid-core nuclear thermal rockets, arc jets, and ion thrusters.**CO4:** Analyze the performance of Liquid Propellant Rockets**CO5:** Interpret the advanced propulsion techniques of a rocket**Time: Three Hours****Maximum Marks: 100****Answer all the Questions:-****PART A (10 x 1 = 10 Marks)**

1. Matching type item with multiple choice code

CO1 [K₁]

List I	List II
A. Rocket thrust	i. The velocity of the exhaust gases produced by a rocket engine
B. Exhaust velocity	ii. The force produced by a rocket engine per unit time
C. Specific impulse	iii. The efficiency of a rocket engine in producing thrust
D. Characteristic velocity	iv. The velocity at which a rocket engine produces 1 N of thrust

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	iii	i	ii	iv

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|-----|---|-----|-------------------|
| 20. | Evaluate the feasibility and challenges of implementing anti-matter propulsion systems for interplanetary missions. | CO5 | [K ₄] |
| 21. | List the important hardware components of a solid rocket and their functions. | CO3 | [K ₁] |
| 22. | Discuss about various types of liquid Propellant Injection system. | CO3 | [K ₂] |

Answer any FIVE Questions:-
PART C (5 x 10 = 50 Marks) (Answer not more than 250 words)

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|-----|--|----|-----|-------------------|
| 23. | Explain the operating principle of chemical rockets in detail, including the stages of combustion and thrust generation. | 10 | CO1 | [K ₂] |
| 24. | Describe the various ignition phases involved in solid propellant rocket and igniter design consideration. | 10 | CO2 | [K ₂] |
| 25. | Explain the concept of staging in rockets and its benefits for achieving higher orbital velocities or deeper space exploration. | 10 | CO3 | [K ₂] |
| 26. | Explore the cooling methods used in liquid rocket engines and discuss the advantages and disadvantages of each cooling method. | 10 | CO4 | [K ₂] |
| 27. | With neat sketch, Explain working principles and applications of satellite thrusters and ion propulsion techniques. | 10 | CO5 | [K ₂] |
| 28. | A solid rocket motor has the following characteristics:
Propellant mass = 150 kg
Propellant density = 1800 kg/m ³
Burn rate = 5 mm/s
Grain port area = 0.02 m ²
Nozzle throat area = 0.004 m ²
Calculate:
a) The initial internal surface area of the propellant grain.
b) The initial mass flow rate of the propellant.
c) The initial thrust of the rocket motor.
d) The burn time of the rocket motor. | 10 | CO3 | [K ₄] |
