



**B.E DEGREE EXAMINATIONS: APRIL / MAY 2023**

(Regulation 2018)

Sixth Semester

**AERONAUTICAL ENGINEERING**

U18AET6104: Rocket Propulsion

**COURSE OUTCOMES**

- CO1:** Illustrate the Basic Principles and parameters of rockets.  
**CO2:** Differentiate & Interpret the ignition systems of rocket.  
**CO3:** Analyse the Performance of solid-core nuclear thermal rockets, arcjet.  
**CO4:** Analyse the performance of liquid Propellant rockets.  
**CO5:** Interpret the advanced propulsion technique of a rocket.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-  
 PART A (10 x 2 = 20 Marks)  
 (Answer not more than 40 words)**

- |  |     |                   |
|--|-----|-------------------|
| 1. Define specific impulse.                                    | CO1 | [K <sub>1</sub> ] |
| 2. Define characteristic velocity.                             | CO1 | [K <sub>1</sub> ] |
| 3. Difference between Deflagration and Detonation.             | CO2 | [K <sub>2</sub> ] |
| 4. Define hypergolic propellant.                               | CO2 | [K <sub>1</sub> ] |
| 5. What is internal ballistics?                                | CO3 | [K <sub>1</sub> ] |
| 6. Define erosive burning.                                     | CO3 | [K <sub>1</sub> ] |
| 7. What are the types of propellant feed system?               | CO4 | [K <sub>1</sub> ] |
| 8. What are the components of liquid propellant rocket engine? | CO4 | [K <sub>1</sub> ] |
| 9. What are the types of electrical rocket engines?            | CO5 | [K <sub>1</sub> ] |
| 10. What are the advantages of hybrid rocket engine?           | CO5 | [K <sub>1</sub> ] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

- |     |  |     |     |                   |
|-----|--|-----|-----|-------------------|
| 11. | Summarize in detail about the different types of rocket nozzles.   | 16  | CO1 | [K <sub>2</sub> ] |
| 12  | Explain in detail:<br>(i) Pyrotechnic igniters.<br>(ii) pyrogen igniters.  | 8+8 | CO2 | [K <sub>2</sub> ] |
| 13. | a) Explain in detail about the combustion mechanism of solid propellant rocket motors.   | 8   | CO3 | [K <sub>2</sub> ] |
|     | b) Explain the following<br>i) Strand burner<br>ii) T-burner   | 8   | CO3 | [K <sub>2</sub> ] |
| 14. | Explain in detail about the different methods of cooling in liquid propellant rocket engines.  | 16  | CO4 | [K <sub>2</sub> ] |
| 15. | Explain with neat sketch about the working principle of nuclear propulsion and write the advantages and disadvantages of nuclear propulsion.   | 16  | CO5 | [K <sub>2</sub> ] |
| 16. | A rocket projectile has the following characteristics. Initial mass = 200Kg, Mass after rocket operation = 130 Kg rocket payload, Non propulsive structure etc = 110Kg, Rocket operating duration = 3 sec, Average specific impulse = 240 sec. Determine mass ratio, propellant mass fraction, propellant flow rate, thrust, specific propellant consumption, acceleration of vehicle, effective exhaust velocity total impulse, specific power, impulse to ratio. | 16  | CO1 | [K <sub>4</sub> ] |

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