

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: M.TECH
BRANCH: SER**

**SEMESTER : II
SESSION : SP/22**

SUBJECT: SR554 ADVANCED PROPULSION SYSTEM

TIME: 2 HOURS

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--------|---|-----|---|
| Q.1(a) | Explain in detail the concept of Free radical propulsion system with suitable diagram. What are the benefits of this type of propulsion system as compared to electrostatic propulsion? | [6] | CO1, L5,
PO1, PO3, |
| Q.1(b) | Illustrate how does the pulse chemical rocket system mimic the defence mechanism of the bombardier beetle? | [4] | CO1, L4,
PO1, PO3, |
| Q.2(a) | What are the various inlet designs used in a Scramjet engine? (Describe with suitable diagrams). Justify which of them is best suited for practical application. | [6] | CO2, L4,
PO1, PO3,
PO4 |
| Q.2(b) | Differentiate between a Scramjet and Ramjet engine based on the working principle with suitable diagram. | [4] | CO2, L4,
PO1, PO3,
PO4 |
| Q.3(a) | What is radioactive decay? Differentiate between nuclear fission and nuclear fusion based on their process conditions, working principle and energy generation. | [5] | CO3, L4,
PO1, PO2,
PO3, PO4,
PO6 |
| Q.3(b) | Differentiate between the working of a fission-fragment propulsion system and radioisotope nuclear rocket. Explain using required schematic diagrams. | [5] | CO3, L4,
PO1, PO2,
PO3, PO4,
PO6 |
| Q.4(a) | Differentiate between the Arcjet and Resistojet types electro-thermal thrusters on the basis of their working principle. | [5] | CO4, L4,
PO1, PO3,
PO4, PO6 |
| Q.4(b) | What are the major drawbacks of the ion thruster? Justify how Hall effect thruster overcomes these drawbacks. (Include required schematics for explanation) | [5] | CO4, L5,
PO1, PO3,
PO4, PO6 |
| Q.5(a) | Describe the working of pulsed plasma thruster using suitable schematic? Also include the advantages and disadvantages of the system. | [5] | CO5, L4,
PO1, PO2,
PO3, PO4,
PO6 |
| Q.5(b) | What are the design challenges of MEMS-based propulsion concept? What type of propulsion system is best suited for MEMS application and why? | [5] | CO5, L4,
PO1, PO2,
PO3, PO4,
PO6 |

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