

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

**CLASS: M.Tech  
BRANCH: SER**

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

**SUBJECT: SR552 Rocket Combustion Process**

**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) | Describe the various zones in the combustion of a double base propellant with a schematic diagram stating the importance of each zone. What are the reactions rates considered for the single step reaction in the Boys and Corners theory? | [7] | CO1, L4,<br>PO3, PO6       |
| Q.1(b) | Explain the combustion mechanism of the composite solid propellant with the help of BDP model.  | [3] | CO1,L3,<br>PO3,PO4<br>PO6  |
| Q.2(a) | Explain in detail the metal and metal oxide interaction properties in the combustion of metals.   | [5] | CO2,L4,<br>PO1,PO3,<br>PO6 |
| Q.2(b) | Describe the process of combustion of Al metal in a deflagrating propellant. What are the conclusions derived?  | [5] | CO2,L3,<br>PO3, PO6        |
| Q.3(a) | Differentiate between the Marklund and Lake's Method with that of the Nadaud's Method for the determination of erosive function.  | [5] | CO3,L4,<br>PO1,PO3,<br>PO6 |
| Q.3(b) | How does the Razdan and Kuo's Model describe the phenomenon of erosive burning? How is this model different from the previous models of erosive burning?  | [5] | CO3,L3,<br>PO3, PO6        |
| Q.4(a) | Analyze how the combustion of bipropellant droplet combustion is different from that of a monopropellant droplet.   | [6] | CO4, L3,<br>PO1, PO3       |
| Q.4(b) | Explain clearly the different zones which occur in the combustion process of a liquid rocket engine with the help of a schematic diagram. Which zone has a pronounced effect on the combustion process?                                     | [4] | CO4,L4,<br>PO1, PO3        |
| Q.5(a) | Derive a relation of burn rate for the Maxman Gilbert model for the combustion process in a hybrid rocket motor.  | [5] | CO5,L3,<br>PO1, PO3        |
| Q.5(b) | What are the main methods of increasing the combustion efficiency in a hybrid rocket model? Explain the benefits and drawbacks of each methods used.  | [5] | CO5, L3,<br>PO1, PO3       |

:::29/04/2022 E:::