

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

CLASS:M.Tech/PhD
BRANCH: SER

SEMESTER : II/All
SESSION : SP/22

SUBJECT: SR551 Solid Rocket Propulsion

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 the combustion mechanism for double base propellant with suitable sketches. Also write the main products formed at each zone. [4] CO1, L3
- Q.1(b) Derive the equation for the equilibrium pressure of the solid rocket motor. Also show that $n < 1$ gives stable combustion. [6] CO1, L4
- Q.2(a) Derive the exit velocity through the nozzle using the exact thermodynamic relations. [5] CO2, L4
- Q.2(b) Explain the procedure for getting the expansion conditions mainly the exit temperature for the equilibrium conditions. [5] CO2, L4
- Q.3(a) Show that pressure ratio should be greater than 1.7 for the nozzle to be choked. Write the assumptions used in deriving this relations. [6] CO3, L4
- Q.3(b) What are different types of nozzles used in the solid rocket motor? Explain any one of them. [4] CO3, L3
- Q.4(a) What do you mean by thrust vectoring? Explain how gimbaling of either thrust chamber or nozzle is used for this purposes. Write the challenges associated with this mechanism from the practical point of view. [6] CO4, L4
- Q.4(b) What do you mean pyrogen igniters? Explain clearly its working principles with suitable sketches. [4] CO4, L3
- Q.5(a) What are do you mean by vortex instabilities? How it is different from other types of instabilities? [4] CO5, L3
- Q.5(b) What are the main triggering sources of instabilities in solid rocket motor? Write the various methods adopted to overcome these instabilities. [6] CO5, L3

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