

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

CLASS: M.TECH
BRANCH: SER

SEMESTER : I
SESSION : MO/19

SUBJECT: SR501 ELEMENTS OF ROCKET PROPULSION

TIME: 3:00 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 handbook/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) Explain the working principle of a turbojet engine. Also explain why it is not commonly used in all the aircrafts. [4]
- Q.1(b) What are the advantages of nuclear rockets over the chemical rockets? Explain how radioactive decay are utilized in rocket propulsion in getting higher performance compare to other propulsion systems. [4]
- Q.1(c) What are the thrust producing devices in a ramjet engine? [2]
- Q.2(a) Why the study about grain configurations are important? What are the grain configurations practically being used? Explain with the reasons for the same. [4]
- Q.2(b) What are the different shapes of the combustion chamber being used? Explain their advantages and disadvantages relative to the others. [4]
- Q.2(c) What is the use of DBP in the composite solid propellant? [2]
- Q.3(a) Derive the expression of pressure ratio for which flow through a nozzle is considered to be choked. Also calculate the pressure ratio required for these choking conditions, assume $\gamma=1.2$. [5]
- Q.3(b) What do you mean by adoptive nozzle? How it is different from the conventional nozzle? Explain its merits over others. [5]
- Q.4(a) Derive mass flow rate through the nozzle for the choked flow conditions in terms of combustion chamber pressure, characteristic velocity and the nozzle throat area. [5]
- Q.4(b) A solid rocket is designed for the thrust of 2.5 kN. The rocket is operating at a chamber pressure of 40 bar. The specific impulse for the propellant combination is 3000 N-s/kg. Calculate the nozzle throat diameter if the characteristic velocity or C^* for the propellant combination at this chamber pressure is 1650 m/s. [5]
- Q.5(a) What are various test facilities required for conducting rocket testing? Explain how it is different from lab scale to large scale applications. [5]
- Q.5(b) Explain how flight testing is conducted starting from lab scale testing to the practical flight testing. [5]

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