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

CLASS: MTECH   SEMESTER : II
BRANCH: SER   SESSION : SP/2023

SUBJECT: SR550 LIQUID AND HYBRID ROCKET PROPULSION

TIME: 3 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.

			CO	BL
Q.1(a)	Draw a free-body diagram of the thrust chamber assembly of a liquid propellant rocket and derive thrust equation when Pe=Pa.	[5]	1	3
Q.1(b)	How would you determine the optimal mixture ratio of a liquid propellant rocket engine? Which factors could cause a shift away from the optimal mixture ratio?	[5]	1	4
Q.2(a)	Explain sloshing with the help of spring-mass and pendulum analogies.	[5]	2,3	4
Q.2(b)	Provide a one-equation method to estimate the peak pressure reached after fluid hammer in a propellant feedline.	[5]	2	5
Q.3(a)	Explain the physical meaning of L* obtained for the combustion chamber of a LPRE.	[5]	2	4
Q.3(b)	State the required design data for a Helium based pressurization system.	[5]	2	5
Q.4(a)	Prove that the requirements of insulation for LH_2 are more stringent that LO_2 with the help of simple estimates.	[5]	3	5
Q.4(b)	Draw a generalized phase diagram and show possible steps that could allow production of densified cryogenic propellants.	[5]	3	5
Q.5(a)	Demonstrate the possible methods of interpreting regression rate data in time and space dependent terms.	[5]	4	5
Q.5(b)	Draw the profiles of temperatures and concentrations of solid fuel and gaseous oxidizer for a hybrid rocket motor employing a gasifying fuel.	[5]	4	3

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