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

CLASS: MTECH **SEMESTER : II**
BRANCH: AEROSPACE ENGINEERING **SESSION: SP/2025**

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)	Provide expressions for I_{sp} and c* and then suggest their physical interpretations.	[5]	1	3
Q.1(b)	Provide a spring-piston-rack analogy for under-expanded flow.	[5]	1	3
Q.2(a)	With the help of a diagram, derive an expression for the estimation of peak pressure at the time of impact of fluid on a latch valve.	[5]	2	4
Q.2(b)	With the help of equations, identify the essential differences in the designs of pressurized gas feeding systems for short and long duration firings of LREs.	[5]	2	4
Q.3(a)	Describe a design procedure for the combustion chamber of a new LRE.	[5]	3	4
Q.3(b)	Provide a design procedure for orifice injectors.	[5]	3	4
Q.4(a)	Prove that the requirements of insulation for LH_2 are more stringent than LO_2 with the help of simple estimates.	[5]	4	5
Q.4(b)	Draw a generalized phase diagram and show possible steps that could allow production of a dense (or deep) cryogenic propellant.	[5]	4	5
Q.5(a)	Draw profiles of temperature, velocity, fuel mass fraction, oxidizer mass fraction, and product gas mass fraction for a classical hybrid rocket motor (solid fuel-liquid oxidizer).	[5]	5	3
Q.5(b)	Why are pre- and post-combustion chambers required for a classical hybrid rocket motor (solid fuel-liquid oxidizer)?	[5]	5	3

::::::28/04/2025::::::E