

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

**CLASS: M.TECH
BRANCH: SER**

**SEMESTER : II
SESSION : SP/19**

SUBJECT: SR550 LIQUID AND HYBRID 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 hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
-

- Q.1(a) Develop an analogy between spring-piston system and a static liquid rocket motor. [5]
Q.1(b) Analyze the nature of penalty incurred due to incorrect nozzle length. [5]
- Q.2(a) Derive an expression for the weight of pressurant when it is hotter than the liquid propellant. [5]
Q.2(b) Generalize the above equation when multiple powered and coasting phases are to be considered. [5]
- Q.3(a) Define asymmetric sloshing and provide two analogies to model the sloshing in propellant tanks. [5]
Q.3(b) Derive the boundary conditions at the interface and walls of the tank subject to lateral sloshing. [5]
- Q.4(a) Derive a system of equations for the analysis of fluid hammer in a liquid propellant feed line. [5]
Q.4(b) Provide a simple one-equation analysis for the same problem of fluid hammer. [5]
- Q.5(a) Develop an equation for the interface between a solid fuel and oxidizer with reference to a classical hybrid rocket motor. [5]
Q.5(b) With reference to above equation, sketch the temperature and concentration profiles, clearly denoting the values of end states of the variables on the profiles. [5]

:::::01/05/2019:::::M