

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.
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- Q.1(a) Sketch the profiles of important variables along the longitudinal axis of a typical liquid rocket engine. [5]
(BT Level: 3, CO: 1)
- Q.1(b) Analyze the nature of penalty incurred due to incorrect nozzle length. [5]
(BT Level: 4, CO: 1)
- Q.2(a) Derive an expression for the weight of a pressurant when it is hotter than the liquid propellant. [5]
(BT Level: 4, CO: 2)
- Q.2(b) Provide a simple one-equation analysis of fluid hammer effect in propellant lines. [5]
(BT Level: 5, CO: 2)
- Q.3(a) Summarize a design procedure for the combustion chamber of a typical liquid rocket engine. [5]
(BT Level: 4, CO: 3)
- Q.3(b) Construct a procedure for designing a doublet impinging jet injector used for a pair of liquid fuel and liquid oxidizer. [5]
(BT Level: 4, CO: 3)
- Q.4(a) Prove that the requirements of insulation for LH₂ are far more stringent than LO₂ with the help of approximate estimates. [5]
(BT Level: 5, CO: 4)
- Q.4(b) Describe a potential cryocooler system intended for space-storable cryogenes. [5]
(BT Level: 3, CO: 4)
- Q.5(a) Based on the experiments conducted in laboratory, demonstrate the possible methods of interpreting the experimentally obtained data of port diameter during a typical burn test for a classical hybrid combustion chamber employing gasifying fuel. [5]
(BT Level: 5, CO: 5)
- Q.5(b) Identify the bulk-phase heat transfer and mass transfer modes for classical hybrid combustion and show the profiles of temperature and concentration across the propellant surface. [5]
(BT Level: 4, CO: 5)