

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

CLASS: MTECH
BRANCH: SER

SEMESTER: II
SESSION: SP/19

SUBJECT: SR555 HEAT TRANSFER IN SPACE APPLICATIONS

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.
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- Q.1(a) Write equations expressing the heat fluxes associated with conduction, convection, and thermal radiation. Demonstrate their applicability with the help of typical diagrams. [5]
- Q.1(b) Write energy balance for the interface of a solid with fluid and indicate its special features. [5]
- Q.2(a) Provide a guideline diagram to assess the relevance of the planets as sources of thermal loads for a spacecraft intended for mission in LEO. [5]
- Q.2(b) Clearly demonstrate the differences among design temperature range, acceptance temperature range, and qualification temperature range. On this basis, formulate a statement of testing for the detectors used in a spacecraft. [5]
- Q.3(a) How can the optimal MLI blanket design be achieved? Support your arguments with suitable diagrams. [5]
- Q.3(b) Derive the view factor formulae for a sphere within another sphere. [5]
- Q.4(a) Suggest a procedure for analyzing aerodynamic heating of fuselage of a missile. [5]
- Q.4(b) Derive an equation for tracking the skin temperature of a missile subjected to intense aerodynamic heating during re-entry. [5]
- Q.5(a) Analyze the cold and hot case scenarios of a cubesat. [5]
- Q.5(b) For a manned REV shaped like a capsule, analyze the aerodynamic and re-entry heating issues in brief with the help of suitable equations and qualitative diagrams. [5]

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