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

CLASS: BE **SEMESTER: VI/ADD**
BRANCH: MECHANICAL **SESSION : SP/2020**

SUBJECT: ME6003 HEAT AND MASS TRANSFER

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.
6. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q1 An aluminium alloy plate of 400 mm x 400 mm x 4 mm size at 200°C is suddenly quenched into liquid oxygen at -183°C. Determine the time required for the plate to reach a temperature of -70°C. Assume h = 20000 kJ/m^2-h-°C, C_p = 0.8 kJ/kg°C, and ρ = 3000 kg/m^3. [5]

Q2 Explain the following: [5]
(i) physical significance of Thermal conductivity and Thermal Diffusivity
(ii) concept of Contact Thermal Resistance

Q3 A turbine blade made of stainless steel (k = 29 W/m°C) is 60 mm long, 500 mm^2 cross-sectional area and 120 mm perimeter. The temperature of the root of blade is 480°C and it is exposed to products of combustion passing through the turbine at 820°C. If the film coefficient between the blade and the combustion gases is 320 W/m^2 °C, determine: the temperature at the middle of the blade and the rate of heat flow from the blade. [5]

Q4 Stating the boundary conditions followed by the determining the temperature distribution equation, analyze the heat dissipation equation from a rectangular fin of length L with insulated end. [5]

Q5 Show that "the emissive power of a radiating surface is π times the radiation intensity". [5]

Q6 Analyze the reciprocity equation considering two black surfaces of areas A_1 and A_2 arranged at inclinations θ_1 and θ_2 respectively, with their normal that are at temperatures T_1 and T_2 respectively and separated by a non-absorbing medium. [5]

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