Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: FT205

Course Name: FUNDAMENTALS OF HEAT AND MASS TRANSFER

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks. Marks

1 a) Derive the expression for rate of heat transfer and temperature distribution in a hollow cylinder. Also obtain its thermal resistance. (6)

b) Discuss the boundary conditions in heat transfer. (4)

2 a) Derive the equation for steady-state heat transfer through a hollow cylindrical wall of length l, the inside and outside surface are maintained at $T_1$and T_2 respectively. (5)

b) An aluminium sphere weighs 7 Kg and initially at a temperature of 260^0C is suddenly immersed in a fluid at 10^0C. The heat transfer coefficient between fluid and aluminium sphere is 50 W/m^2K. Compute the time required to cool the sphere to 90^0C. The property values are density of sphere is 2707 kg/m^3, specific heat capacity is 900 J/kg^{0}C, thermal conductivity is 204 W/m^{0}C. (5)

3 a) What is convection? Derive the basic Mass transfer equation during for steady state and incompressible the fluid flow (5)

b) Explain velocity boundary layer formation when fluid flows past over a solid. (5)

4 a) Explain the different regimes of pool boiling process. (7)

b) Differentiate dropwise condensation and film condensation. (3)

PART B

Answer any three full questions, each carries 10 marks.

5 a) With a neat sketch explain the construction and working of a shell and tube heat exchanger. (8)

b) State Weins displacement law of radiation. (2)

6 a) Discuss effectiveness NTU method of Heat Exchanger design. (5)

b) A refrigerator is designed to cool 250 kg/hr of liquid having specific heat capacity 3350 J/KgK at 120^0C using a parallel flow arrangement. 1000 kg/hr of cooling water is available for cooling purposes at a temperature of 10^0C. If the overall heat transfer coefficient is 1160 W/m^2K and the surface area of heat exchanger is 0.25 m^2, calculate the outlet temperature of the cooled liquid and (5)

water. Also calculate the effectiveness of the heat exchanger.

7 a) Discuss the mass transfer theories in turbulent flow. (10)

8 a) Derive the expression for Fick's first law of diffusion with respect to stationary co-ordinate axis. (7)

b) What is diffusion coefficient? Give its units. (3)

PART C

Answer any four full questions, each carries 10 marks.

9 a) Discuss the criteria for selecting solvent for absorption. (7)

b) What is tray efficiency? Differentiate Point efficiency and Murphree efficiency. (3)

10 a) What is HETP? Give its physical significance. (5)

b) Explain absorption with chemical reaction. (5)

11 Write a note on industrial absorbers with neat sketches. (10)

12 a) Explain V-L equilibria during a distillation process. (5)

b) What is q-line? Explain its importance. (5)

13 a) With a neat schematic diagram explain differential distillation. (6)

b) Define reflux ratio and mention its importance. (4)

14 State the assumptions of Mc-cabe Thiele method. With neat schematic give the procedure for obtaining theoretical number of trays. (10)

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