Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: CH202
Course Name: PROCESS HEAT TRANSFER (CH)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two questions. Each question carries 15 marks.

1	a)	Derive the expression for temperature distribution in a hollow cylinder without internal energy generation. Also obtain the expression for heat flux. State your assumptions properly.	9
	b)	Explain the significance of Biot and Fourier Numbers.	6
2	a)	An aluminium sphere of weight 2.5 kg is initially kept at a temperature of 350 ^{0}C. It is suddenly immersed into a fluid kept at 20 ^{0} C. The convective heat transfer coefficient is 58 W/m^{2}K. Estimate the time required to cool the sphere to 100 ^{0}C using lumped capacity analysis method. Given density of aluminium = 2700 kg/m^3, specific heat = 900 J/kgK, thermal conductivity = 205 W/mK.	9
	b)	Describe different types of boundary conditions applied to heat conduction problems.	6
3	a)	What is meant by thermal resistance? Explain the electrical analogy for solving heat transfer problems.	5
	b)	Derive the expression for critical thickness of insulation for a cylindrical system. Explain optimum thickness of insulation.	8
	c)	State Fourier's law of heat conduction	2

PART B

Answer any two questions. Each question carries 15 marks

4	a)	Develop the expression for Reynold's analogy between momentum and heat transfer. State the expression for Colburn analogy.	15
5	a)	Describe the basic construction of a shell and tube heat exchanger with a neat diagram.	15
6	a)	Air at a temperature of 300 ^{0}C flows with a velocity of 10 m/s over a flat plate of length 0.5 m. Compute the cooling rate per unit width of the plate needed to maintain it at a surface temperature of 27 ^{0}C. (Given properties of air at 437 K are	7

kinematic viscosity = 5.21 x 10^{-4} m^2/s, thermal conductivity = 0.0364 W/m K, Pr = 0.686, Specific heat = 1.021 kJ/kg K).

b) A grey surface is maintained at a temperature of 827 ^{0}C. If the maximum spectral emissive power at that temperature is 1.37 x 10^{10} W/m^2, determine the emissivity of the body and the wavelength corresponding to the maximum spectral intensity of radiation. 8

PART C

Answer any two questions. Each question carries 20 marks.

7 a) List out the types of evaporators. Briefly describe the construction and operation of the long tube vertical evaporator and the plate type evaporator. 20

8 a) Distinguish between dropwise and film wise condensation. 6

b) Write down the Rohsenow correlation and Zuber correlation for pool boiling. 8

c) Briefly describe the factors affecting condensation. 6

9 a Briefly describe various types of fins. 8

b) Define fin efficiency and effectiveness. 8

c) Write down the Nusselt equation for determination of condensation heat transfer coefficient. 4