Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEMESTER IV EXAMINATION – SUMMER 2015

Subject code: 140503 Date: 03/06/2015

Subject Name: PROCESS HEAT TRANSFER

Time: 10.30am-01.00pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Do as directed **07**

(1) Define thermal diffusivity

(2) When warm and cold fluid is mixed, the heat transfer is mainly by
(a) conduction (b) convection (c) radiation (d) both (a) & (c)

(3) What is convective conductance?

(4) An insulation should have
a. low thermal conductivity b. high thermal conductivity
c. less resistance to heat transfer d. a porous structure

(5) Sieder and Tate equation for determination of H.T.C is valid
(a) for fluid in laminar flow (b) for fluid in turbulent flow
(c) when Grashoff number is very important
(d) for liquid metal

(6) Maximum heat transfer rate is obtained in
a. laminar flow b. turbulent flow c. creeping flow d. transition region

(7) Tube pitch is the ____ of tube diameters and the clearances
(a) sum (b) difference (c) ratio (d) none of these

(b) Derive an expression for heat flow through a cylinder. State all the necessary assumption **07**

Q.2 **(a)** Derive an expression for radial heat conduction through tubes **07**

(b) Derive an expression for the composite cylinder. Write all the necessary assumption **07**

OR

(b) Discuss critical insulation thickness **07**

Q.3 **(a)** 1000 kg/hr of cheese 15 ^{0}C is pumped through a tube 7.5 cm in diameter. After passing through an unheated length of about 50 diameters, it passes through 1.2 m length of tube maintained at 90^{0}C. Calculate the heat transfer coefficient and the mean temperature of cheese leaving the heated section. For cheese following properties values may be used. **07**
k=0.43 W/m ^{0}C, ς = 1100 kg/m^3 Cp= 2.85 kJ/kg ^{0}C,
μ=86400 kg/hr.m

(b) Describe Wien's displacement law and Stefan Boltzmann law **07**

OR

Q:3 **(a)** Define following terms **07**
Black body, reflectivity, space density of radiation, monochromatic emissive power, emissivity, white body

(b) Explain with sketch, the various method of feeding in multiple-effect evaporator. **07**

Q.4 **(a)** Listing the assumption derive the equation for logarithmic mean temperature difference (LMTD) for parallel flow heat transfer **07**

(b) What is Boiling ? Explain regime of pool boiling with neat sketch. Specify critical heat flux. **07**

OR

Q.4 **(a)** Explain film wise and drop wise condensation in detail **07**

(b) Water at 60^0C enters a tube 2.5 cm dia and 3.0 m long at a mean flow velocity of 2 cm/s. Calculate the exit water temperature Tb_2, if the wall temperature is constant at 80 ^{0}C . **07**

Properties of water at	60^0C	66^0C
ς	985 kg/m^3	982 kg/m^3
Cp	4.18 kJ/kg ^{0}C	4.185 kJ/kg ^{0}C
k	0.651 W/m^{o}C	0.656 W/m^{o}C
P_r	3.02	2.78
μ	4.71*10^{-4}kg/m.s	4.36*10^{-4}kg/m.s

Q.5 **(a)** Write the classification of heat exchanger and with neat sketch explain shell and tube heat exchanger **07**

(b) Write the physical significance of various dimensionless groups involved in heat transfer study (Any Five) **07**

OR

Q.5 **(a)** Discuss absorption of radiation for opaque solids. **07**

(b) Explain Vapor recompression and mechanical recompression for evaporators. **07**

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