GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

SM19002034

Registration No: | | | | | | | | | | |

Total Number of Pages : 2 **M.TECH**

M.TECH 2ND SEMESTER (AR 17) SUPPLEMENTARY EXAMINATIONS, APRIL/MAY 2019

ADVANCED HEAT TRANSFER II

Branch: TE, Subject Code:MTEPC2020

Time: 3 Hours **Max Marks : 70**

PART-A **(10 X 2=20 MARKS)**

1. Answer the following questions.

a) What are the generally accepted values of critical Reynolds number for (a)flow over a flat plate(b)flow in a tube?

b) Can we have Nusselt number less than one? Justify.

c) What is Fick's Law and give analogy with Fourier's Law?

d) Under what condition, the effectiveness NTU method is preferred over LMTD method as a method of analysis of heat exchanger

e) What is critical heat flux in boiling? What is its importance?

f) Draw the laminar and turbulent velocity boundary layer for natural convection on a vertical plate.

g) What is mass diffusivity? What is its dimension?

h) Write down the N-S equations for incompressible viscous liquids and explain the terms in it.

i) In a fully developed region of flow in a circular tube, will the velocity profile change in the flow direction? How about the temperature profile?

j) How does a cross flow heat exchanger differ from a counter flow one?

PART-B **(5 X 10=50 MARKS)**

Answer any five questions from the following.

2. a) What do you mean by Von Karman's integral method? How is it used in deriving heat transfer coefficient for flow over a flat plate? [5]

   b) Explain the principle of dimensional homogeneity. How is it utilized in deriving dimensional groups? [5]

3. a) Classify and explain different methods of boiling. [5]

   b) Find the location and magnitude of maximum velocity in the boundary layer formed on a heated or cooled vertical plate **.** [5]

4. a) What is limitation of the LMTD method? How ε-NTU method is is superior to correction factor-LMTD method? [5]

   b) The condenser of a large steam power plant is a heat exchanger in which steam is condensed to liquid water. Assume the condenser to be a shell-and-tube heat exchanger consisting of a single shell and 30,000 tubes, each executing two passes. The tubes are of thin wall construction with D=25 mm, and steam condenses on their outer surface with an associated convection coefficient of h_0=11000 W/m^2.K. the heat transfer rate that must be effected by the exchanger is q=2×10^9 W , and this is accomplished by passing cooling water through the tubes at a rate of 3×10^4 kg/sec. the water enters at 20^0C while the steam condenses at 50^0C. What is the temperature of the cooling water emerging from the condenser? What is the required tube length (L) per pass? [5]

5. a) Differentiate between Reynolds Analogy and Colburn Analogy. [5]

b) In a refrigeration system brine solution having viscosity 16.5 N-s/m^2 and the thermal conductivity 0.85 W/m-K is flowing through a long pipe 2.5 cm inner diameter at a velocity of 6.1 m/s. under these conditions the heat transfer coefficient was found to be 1135 W/m^2-K for a brine temperature of -1^oC and pipe temperature of 18.3^oC. Find the temperature rise of brine per meter length of pipe if the velocity is doubled and same heat transfer takes place. Assume Specific heat of brine is 3768J/kg-K and the density is 1000 kg/m^3. Assume fully developed flow . [5]

6. a) **S**tate physical interpretation of Eckert number, Grashoff number, Schmidt number and Lewis number [5]

b) Explain Fick's law of diffusion. What is mass diffusivity? What is its dimension? [5]

7. a) Show that for a parallel flow heat exchanger $\in = \frac{1-exp[-NTU(1+R)]}{(1+R)}$ [5]

b) Find the location and magnitude of maximum velocity in the boundary layer formed on a heated or cooled vertical plate. [5]

8.Write short notes on : [5]

a) Regimes of boiling

b) Evaporative cooling [5]

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