GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

RM19002046

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

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

M.TECH 2ND SEMESTER (AR 18) REGULAR 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) State the five methods which are available for evaluation of convection heat transfer coefficient.

b) What do you mean by thermal boundary layer? How is this different from hydrodynamic boundary layer?

c) State Reynolds analogy and explain its application in convective heat transfer.

d) Write down two-dimensional momentum and energy equation in cylindrical coordinate system.

e) What is the importance of critical heat flux?

f) Write Fick's law of diffusion.

g) What is the magnitude of Nusselt number for laminar flow in a tube considering constant heat flux case? What is the value of constant wall temperature plate?

h) What do you mean by fouling factor?

i) What are the heat transfer modes are involved in heat exchanger for heat transfer augmentation?

j) State Buckingham π theorem. What are its merit and demerits?

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

Answer any five questions from the following.

Q.2.

a) Derive the Nusselt number expression for constant heat flux case for laminar flow in tube. [5]

b) With the help of Buckingham π-theorem show that for forced convection heat transfer. [5]

Q.3.

a) Writing mass, momentum and energy equations, derive the Grashoff number for natural convection heat transfer using dimensionless parameters. [5]

b) Air at 20°C and moving at 15 m/s is warmed by an isothermal steam heated plate at 110°C, 0.5m length and 0.5m width. Find the average heat transfer coefficient and the total heat transferred. What are heat convection coefficient, thermal boundary layer thickness and hydraulic boundary layer thickness? [5]

Q.4.

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

b) What would be the effectiveness of counter flow heat exchanger if $C_{min}/C_{max}=0$ and $C_{min}/C_{max}=1$ [5]

Q.5.

Air at 27°C and 1 bar pressure flows over a flat plate with a velocity of 2m/s. Estimate(i)the boundary layer thickness at a distances of 20cm and 40 cm from the leading edge of the plate (ii) the mass flow that flows between x=20 cm and x=40 cm. Take μ of air at 27°C as 1.85×10-5 kg/ms. Assume unit depth in z-directions. If the plate is heated over its entire plate (iv) compute the drag force exerted on the first 40 cm of the plate. Properties of air at 316.5K are ν=17.36×10-6 m2/s, k=0.02749 W/mK, Pr=0.7,cp=1006 J/kgK. [10]

Q.6.

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

b) In the heat transfer relation Q=UAΔTlm for a heat exchanger, what is ΔT lm called? Derive the expression for parallel flow heat exchanger. [5]

Q.7.

a) How is the mass transfer coefficient evaluated by dimensionless analysis. [5]

b) Air at 1 atm, 25°C, containing small quantities of iodine flows with a velocity of 5.18 m/s inside a 3.048 cm diameter tube. Determine the mass transfer coefficient for iodine transfer from the gas stream to the wall surface. If C_m is the mean concentrate of iodine in kg mol/m^3. In the air stream, determine the rate of deposition of iodine on the tube surface where the iodine concentration is zero. Take kinematic viscosity of air is 1.58x10^{-5} m^2/s and D for air-iodine system at 1 atm, 298K is 0.826x10^{-5} m^2/s. [5]

Q.8. Write short notes on:

a) Equimolar counter diffusion [5]

b) Fick's law of diffusion [5]

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