

No. of Printed Pages : 04

Roll No.

E45

B. Tech. EXAMINATION, 2020

(Fifth Semester)

(B Scheme) (Re-appear Only)

(CHE)

CHE309B

HEAT TRANSFER

Time : 2½ Hours]

[Maximum Marks : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

(S)M-E45

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1. Apply Energy Balance over a unit cubic control volume and hence derive Energy Equation in Cartesian Co-ordinates. Write Corresponding expression for the same in cylindrical co-ordinates.

2. (a) Calculate the critical radius of insulation for Asbestos ($k = 0.17 \text{ W/m}^\circ\text{C}$) surrounding a pipe and exposed to room air at 20°C with $h = 3 \text{ W/m}^2\text{C}$. Calculate the heat loss from a 200°C ; 5 cm diameter pipe when covered with the critical radius of insulation and without insulation.
- (b) One face of copper plate 3 cm thick is maintained at 400°C and other face is maintained at 100°C . How much heat is transferred through the plate ? K for copper is $370 \text{ W/m}^\circ\text{C}$.

3. For laminar flow over a flat plate, derive relation between fluid friction and heat transfer and hence derive expression for Reynolds colburn Analogy in which way, this is applicable for turbulent flow in tube.

4. For laminar flow in a tube, derive expression for Nusselt number, for constant heat flux at wall.
5. For Film Condensation on a vertical plate.
Prove :

$$\bar{h} = 0.943 \left[\frac{P(P - P_v) g h_{fg} K_f^3}{\mu L (T_g - T_w)} \right]^{\frac{1}{4}}$$

\bar{h} = Average value of heat transfer co-efficient

μ = Viscosity

h_{fg} = Latent heat of condensation

K_f = Conduction heat transfer co-efficient.

6. What is Effectiveness-NTU method for Heat Exchangers. Derive expression for the same.

7. Write short notes on the following :
- (a) Agitated Film Evaporators
 - (b) Forward feed and Backward feed Evaporators
 - (c) Heat transfer calculation for Evaporators
8. Explain the following :
- (a) Radiation shape factor
 - (b) Gray Body and Black Body
 - (c) Modeling Equations for Radiation heat transfer.