

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology

End Term Examination

B.Tech.[2nd Year]/[3rd Semester]/[2013-14]

Course Name: HEAT TRANSFER OPERATIONS

Course Code: CHE303

Instructions:

Max Marks: 40

Time: 03.00 hr

1. Attempt all sections.

Section A

(10 Marks)

Q.1 ANSWER THE FOLLOWING:

(5 MARKS)

1. Define Radiation, with equation.
2. Define eddy viscosity.
3. Define Radiation shape factors.?
4. Condensation and Boiling are examples of SINGLE-PHASE HOMOGENOUS convective heat transfer. TRUE OR FALSE?
5. State Prandtl number with equation.

Q.2 ANSWER IN BRIEF:

(5 MARKS)

1. Explain THE BLACK BODY.
2. Derive the continuity equation for Laminar Boundary layer on a flat plate.

Section B

(20 Marks)

Q.3 ANSWER ANY FOUR:

1. Write a short- note on Lumped heat capacity systems.
2. Derive the Log Mean Temperature Difference (LMTD) for Heat Exchangers.
3.
 - i. Explain in brief- the two types of condensation.
 - ii. What is the difference between the heat transfer equation in double-pipe heat exchangers and other types?
4. Air at 2 atm and 200°C is heated as it flows through a tube of diameter 1inch, at a velocity of 10 m/s. calculate the heat transfer per unit length of tube if a constant heat flux condition is maintained at the wall and the wall temperature is 20°C above the air temperature, all along the length of the tube. How much would the bulk temperature increase over a 3m length of the tube?
Take $R = 287 \text{ (atm.m}^3\text{)/}^\circ\text{C}$

The properties of air at 200°C are:

$$\text{Pr} = 0.681$$

$$\mu = 2.57 \times 10^{-5} \text{ kg/m.s}$$

$$k = 0.0386 \text{ W/m.}^{\circ}\text{C}$$

$$C_p = 1.025 \text{ kJ/kg.}^{\circ}\text{C}$$

$$\text{Nu}_d = 0.023 \text{ Re}_d^{0.8} \text{Pr}^{0.4}$$

5. 10 tubes of 0.50- in. (1.27 cm) diameter are arranged in a square array and exposed to atmospheric steam. Calculate the mass of steam condensed per unit length of tubes for a tube wall temperature of 98°C.

$$h_{fg} = 2255 \text{ kJ/kg}$$

$$h = 0.725 \left[\frac{\rho_f^2 g h_{fg} k_f^3}{\mu_f n d (T_g - T_w)} \right]^{\frac{1}{4}}$$

Section C

(10 Marks)

1. Water at the rate of 68 kg/min is heated from 35 to 75°C by an oil having a specific heat of 1.9 kJ/kg. °C. the fluids are used in a counterflow double-pipe heat exchanger, and the oil enters the exchanger at 110°C and leaves at 75°C. The overall heat transfer coefficient is 320 W/m². °C. Calculate the heat exchanger area.
2. i. Classify the heat exchangers according to their flow arrangements.
ii. explain Plate type heat exchangers.