**Heat Transfer**

**Department of Mechanical Engineering**

1. Heat transfer takes place according to which of the following law?

a) Newton’s second law of motion

b) First law of thermodynamics

c) Newton’s law of cooling

d) Second law of thermodynamics

Answer: d

1. Which of the following is an example of steady-state heat transfer?

a) Electric bulb cools down by the surrounding atmosphere

b) Chilling effect of cold wind on a warm body

c) Boilers and turbines

d) Cooling of I.C engine

Answer: a

1. A person prefers to sit by a fire during the cold winter months. Which of the following heat transfer types gives him with the most heat?

a) Convection and radiation together

b) Radiation will provide quick warmth

c) If it is near the fire, convection sounds good

d) Conduction from the fire

Answer: b

1. Why fins are provided on a heat transfer surface?

a) Pressure drop of the fluid should be minimized

b) Increase turbulence in flow for enhancing heat transfer

c) Surface area is maximum to promote the rate of heat transfer

d) Increase temperature gradient so as to enhance heat transfer

Answer: c

1. Radiation heat transfer is characterized by

a) Movement of discrete packets of energy as electromagnetic waves

b) Due to bulk fluid motion, there is a transport of energy

c) There is the circulation of fluid by buoyancy effects

d) Thermal energy transfer as vibrational energy in the lattice structure of the material

Answer: a

1. The convective heat transfer coefficient in the laminar flow over a flat plate \_\_\_\_\_\_\_\_\_\_

a) Decreases with increase in free stream velocity

b) Increases if a denser fluid is used

c) Increases with distance

d) Increases if a higher viscosity fluid is used

Answer: b

1. A cross-flow type air heater has an area of 50 cm2. The overall heat transfer coefficient is 100 W/m2 K and the heat capacity of both hot and cold streams is 1000 W/m K. The value of NTU is

a) 0.2

b) 6

c) 1000

d) 5

Answer: d

1. Negative sign in Fourier heat conduction equation indicates

a) Heat always flow is in the direction of positive temperature gradient

b) Heat always flow in the direction of negative temperature gradient

c) No heat flow is there

d) Data is insufficient

Answer: b

1. Thermal conductivity is maximum for which substance

a) Silver

b) Ice

c) Aluminum

d) Diamond

Answer: d

1. Which of the following is an example of forced convection?

a) Chilling effect of cold wind on a warm body

b) Flow of water in condenser tubes

c) Cooling of billets in the atmosphere

d) Heat exchange on cold and warm pipes

Answer: b

1. For a fin of finite length with an insulated end, the fin efficiency is given as

a) tan h (ml)

b) tan (ml)/ml

c) tan h (m)/ml

d) tan h (ml)/ml

Answer: d

1. For an infinitely long fin, the effectiveness of fin is given as

a) (P k/h AC)

b) (P k/h AC)3/2

c) (P k/h AC)1/2

d) (P k/h AC)2

Answer: c

1. Three fins of equal length and diameter but made of aluminum, brass and cast iron is heated to 200 degree Celsius at one end. If the fins dissipate heat to the surrounding air at 25 degree Celsius, the temperature at the free end will be least in

a) Brass fin

b) Cast iron fin

c) Aluminum fin

d) Each fin will have the same temperature

Answer: c

1. The interchange factor is also known as

a) Equivalent emissivity

b) Irradiation

c) Radiosity

d) Shape factor

Answer: a

1. Two long parallel surfaces, each of emissivity 0.7 are at different temperatures and accordingly have radiation exchange between them. It is desired to reduce 75% of this radiant heat transfer by inserting thin parallel shields of equal emissivity 0.7 on both sides. What should be the number of shields?

a) 2

b) 4

c) 1

d) 3

Answer: d

1. Which type of boiling occurs in steam boilers employing natural convection?

a) Forced convection

b) Pool

c) Local

d) Saturated

Answer: b

1. The phenomenon of stable film boiling is referred to as

a) Nucleate effect

b) Boiling regimes

c) Leiden frost effect

d) Von karma effect

Answer: c

1. Drop wise condensation usually occurs on

a) Oily surface

b) Glazed surface

c) Smooth surface

d) Coated surface

Answer: a

1. For film wise condensation on a vertical plane, the film thickness δ and heat transfer coefficient h vary with distance x from the leading edge as

a) δ decreases, h increases

b) Both δ and h increases

c) δ increases, h decreases

d) Both δ and h decreases

Answer: c

1. The zone or thin layer wherein the temperature field exists is called the

a) Single boundary layer

b) Multi boundary layer

c) Hydrodynamic boundary layer

d) Thermal boundary layer

Answer: d

1. The velocity profile of the hydrodynamic boundary layer is dependent upon

a) Time

b) Viscosity

c) Temperature

d) Mass

Answer: b

1. The relationship between the thermal and hydrodynamic boundary layer thickness is governed by the

a) Peclet number

b) Prandtl number

c) Stanton number

d) Fourier number

Answer: b

1. Ambient air at 20 degree Celsius flows past a flat plate with a sharp leading edge at 3 m/s. The plate is heated uniformly throughout its entire length and is maintained at a surface temperature of 40 degree Celsius. Calculate the thickness of the hydrodynamic boundary layer. Assume that transition occurs at a critical Reynolds number of 500000

a) 16.5 mm

b) 17.5 mm

c) 18.5 mm

d) 19.5 mm

Answer: b

1. With increase in excess temperature, the heat flux in boiling

a) Increases continuously

b) Decreases and then increases

c) Decreases, then increases and again decreases

d) Increases, then decreases and again increases

Answer: d

1. Heat flux increases with temperature excess beyond the Leiden-frost point due to

a) Radiation effect becomes predominant

b) Occurrence of subcooled boiling

c) Vapor space become large

d) Promotion of nucleate boiling

Answer: a

1. Air at 20 degree Celsius flows over a flat surface maintained at 80 degree Celsius. Estimate the value of local heat transfer coefficient if the local heat flow at a point was measured as 1250 W/m2. Take thermal conductivity of air as 0.028 W/m K

a) 23.83 W/m2K

b) 22.83 W/m2K

c) 21.83 W/m2K

d) 20.83 W/m2K

Answer: d

1. For a given value of Nusselt number, the convective surface coefficient h is directly proportional to

a) Length

b) Mass

c) Thermal conductivity

d) Density

Answer: c

1. In a food processing plant, a brine solution is heated from 12 degree Celsius to 65 degree Celsius in a double pipe parallel flow heat exchanger by water entering at 35 degree Celsius and leaving at 20.5 degree Celsius. Let the rate of flow is 9 kg/min. Estimate the area of heat exchanger for an overall heat transfer coefficient of 860 W/m2K. For water c P = 4.186×103 J/kg K

a) 1. 293 m2

b) 0.293 m2

c) 7. 293 m2

d) 8. 293 m2

Answer: b

1. The Nusselt number is related to Reynolds number in laminar and turbulent flows respectively as

a) Re-1/2 and Re0.8

b) Re1/2 and Re0.8

c) Re-1/2 and Re-0.8

d) Re1/2 and Re-0.8

Answer: b

1. Chose the correct one with respect to the critical radius of insulation

a) There is more heat loss i.e. conductive

b) There occurs a decrease in heat flux

c) Heat loss increases with addition of insulation

d) Heat loss decreases with addition of insulation

Answer: c