GATE Mechanical Engineering

ASSIGNMENT- Heat Transfer – 1

1 Mark – Question 1 to Question 10

1. In descending order of magnitude, the thermal conductivity of
   (a) Pure iron,
   (b) Liquid water,
   (c) Saturated water vapor and
   (d) Aluminum can be arranged as

   (A) a b c d (B) b c a d (C) d a b c (D) d c b a

   (Gate-2001, ISRO-2003)

2. A composite wall having three layers of thickness 0.3 m, 0.2 m and 0.1 m and of thermal conductivities 0.6, 0.4 and 0.1 W/mK, respectively, is having surface area 1 m2. If the inner and outer temperatures of the composite wall are 1840 K and 340 K, respectively, what is the rate of heat transfer?
   (a) 150 W (b) 1500 W (c) 75 W (d) 750 W (IES-2007)

3. In a Radiative Heat Transfer, grey surface is one
   (a) Which has emissivity independent of temperature
   (b) Whose emissivity is independent of wavelength
   (c) Which has reflectivity equal to zero
   (d) Which appears equally bright from all directions (ISRO-2013)

4. In a condenser of a power plant, the steam condenses at a temperature of 60°C. The cooling water enters at 30°C and leaves at 45°C. The logarithmic mean temperature difference (LMTD) of the condenser is
   (a) 16.2 °C
   (b) 21.6 °C
   (c) 30 °C
   (d) 37.5 °C

5. For flow of fluid over a heated plate, the following fluid properties are known
   Velocity of flow = 5 m/s;
   Temperature of plate = 100°C;
   Temperature of free stream = 30°C;
   Viscosity = 0.001Pa-s;
   Density = 1.2 kg/m^3;
   Specific heat at constant pressure = 1 kJ/kgK;
   Thermal conductivity = 1W/m− K

The hydrodynamic boundary layer thickness at a specified location on the plate is 1 mm. The thermal boundary layer thickness at the same location is

(A) 0.001 mm (B) 0.01 mm

(C) 1 mm (D) 1000 mm

6. The meaning of **m** and Value **C_1** in Wien's Displacement Law, $\lambda_m \times T = C_1$, are

m	**C_1**
(a) Maximum Wavelength in Black Body	28.98 μm
(b) Minimum Wavelength in Black Body	14.49 μm
(c) Wavelength of Minimum Emission	1449 μm
(d) Wavelength of Maximum Emission	2898 μm

7. The ratio Internal conduction resistance to the Surface convection resistance is known as
   (a) Grashoff Number
   (b) Biot Number
   (c) Stanton Number
   (d) Prandtl Number

8. The insulated tip temperature of a rectangular longitudinal fin having an excess (over ambient) root temperature of θ_o is:
   (a) $\theta_o \tanh(mL)$
   (b) $\theta_o / \sinh(mL)$
   (c) $\theta_o \tanh(mL) / (mL)$
   (d) $\theta_o / \cosh(mL)$

9. Extended surfaces are used to increase the rate of heat transfer. When the convective heat transfer coefficient h = mk, the addition of extended surface will:
   (a) Increase the rate of heat transfer
   (b) Decrease the rate of heat transfer
   (c) Not increase the rate of heat transfer
   (d) Increase the rate of heat transfer when the length of the fin is very large (IES-2010)

10. F or a heat exchanger, ΔT_{max} is the maximum temperature difference and ΔT_{min} is the minimum temperature difference between the two fluids. *LMTD* is the log mean temperature difference. C_{min} and C_{max} are the minimum and the maximum heat capacity rates. The maximum possible heat transfer (Q_{max}) between the two fluids is
    (A) C_{min} LMTD (B) $C_{min}\,\Delta T_{max}$ (C) $C_{max}\,\Delta T_{max}$ (D) $C_{max}\,\Delta T_{min}$ (Gate-2016)

2 Mark - Question 11 to Question 25