Chettinad College of Engineering & Technology
Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai.

Department of Mechanical Engineering

ME 8693 HEAT AND MASS TRANSFER

Unit I - MCQ Bank

UNIT I – CONDUCTION- MCQ Bank

1. The rate of heat transfer for a plane wall of homogenous material with constant thermal conductivity is given by

   A. $Q = kA (t_1-t_2)/\delta$

   B. $Q = 2kAx/ \delta$

   C. $Q = 2kA\delta x$

   D. $Q = 2k/\delta x$

   Answer: (A)

2. The rate of convective heat transfer between a solid boundary and adjacent fluid is given by

   A. $Q = h A (t_s – t_f)$

   B. $Q = h A$

   C. $Q = (t_s – t_f)$

   D. $Q = h (t_s – t_f)$

   Answer: (A)

3. A composite wall generally consists of

   A. One homogenous layer

   B. Multiple heterogeneous layers

   C. One heterogeneous layer

   D. Multiple homogenous layers

   Answer: (B)

4. Logarithmic mean area of the cylindrical tube is given as

   A. $2\pi r_m$

   B. $\pi r_m l$

   C. $2\pi r_m l$

   D. $2r_m l$

   Answer: (D)

5. The heat flow equation through a cylinder of inner radius r_1 and outer radius r_2 is desired to be written in the same form as that for heat flow through a plane wall. For wall thickness (r_2-r_1) the area will be

   A. $A_1 + A_2/2$

   B. $A_1 + A_2$

   C. $A_2 – A_1/ \log_e (A_2/A_1)$

   D. $A_1 + A_2/2 \log_e (A_2/A_1)$

   Answer: (A)

6. A cylinder of radius r and made of material of thermal conductivity k_1 is surrounded by a cylindrical shell of inner radius r and outer radius 2r. This outer shell is made of a material of thermal conductivity k_2. Net conductivity would be

   A. $k_1 + 3 k_2/4$

   B. $k_1 + k_2/4$

   C. $k_1 + 3k_2$

   D. $k_1 + k_2$

   Answer: (A)

7. The temperature distribution associated with radial conduction through a sphere is represented by

   A. Parabola

   B. Hyperbola

   C. Linear

   D. Ellipse

   Answer: (B)

8. The thermal resistance for heat conduction through a spherical wall is

   A. $(r_2-r_1)/2\pi kr_1r_2$

   B. $(r_2-r_1)/3\pi kr_1r_2$

   C. $(r_2-r_1)/\pi kr_1r_2$

   D. $(r_2-r_1)/4\pi kr_1r_2$

   Answer: (D

9. The rate of conduction heat flow in case of a composite sphere is given by

   A. $Q = t_1 – t_2/ (r_2 – r_1)/4\pi k_1r_1r_2 + (r_3 – r_2)/4\pi k_2r_2r_3$

   B. $Q = t_1 – t_2/ (r_2 – r_1)/4\pi k_1r_1r_2 + (r_3 – r_2)/4\pi k_2r_2r_3$

   C. $Q = t_1 – t_2/ (r_2 – r_1)/4\pi k_1r_1r_2 + (r_3 – r_2)/4\pi k_2r_2r_3$

   D. $Q = t_1 – t_2/ (r_2 – r_1)/4\pi k_1r_1r_2 + (r_3 – r_2)/4\pi k_2r_2r_3$

   Answer: (C)

10. The thermal resistance for heat conduction through a hollow sphere of inner radius r_1 and outer radius r_2 is

    A. $r_2 – r_1/4\pi k r_1r_2$

    B. $r_2/4\pi k r_1r_2$

    C. $r_1/4\pi k r_1r_2$

    D. $4\pi k r_1r_2$

    Answer: (A)

11. The quantity d t/Q for conduction of heat through a body i.e. spherical in shape is

    A. $\ln (r_2/r_1)/2\pi Lk$

    B. $\ln (r_2/r_1)/\pi Lk$

    C. $\ln (r_2/r_1)/2Lk$

    D. $\ln (r_2/r_1)/2\pi k$

    Answer: (A)

12. If we increase the thickness of insulation of a circular rod, heat loss to surrounding due to

    A. Convection and conduction increases

    B. Convection and conduction decreases

    C. Convection decreases while that due to conduction increases

    D. Convection increases while that due to conduction decreases

    Answer: (C)

13. Shape factor for cylinder is

A. $6 \pi l/\log_e (r_2/r_1)$

B. $4 \pi l/\log_e (r_2/r_1)$

C. $\pi l/\log_e (r_2/r_1)$

D. $2 \pi l/\log_e (r_2/r_1)$

Answer: (D)

14. Which is true regarding a complete rectangular furnace?

A. 6 walls, 12 edges and 6 corners

B. 0 walls, 2 edges and 4 corners

C. 6 walls, 12 edges and 8 corners

D. 2 walls, 6 edges and 8 corners

Answer: (C)

15. With variable thermal conductivity, Fourier law of heat conduction through a plane wall can be expressed as

A. $Q = -k_0 (1 + \beta t) A \, dt/dx$

B. $Q = k_0 (1 + \beta t) A \, dt/dx$

C. $Q = -(1 + \beta t) A \, dt/dx$

D. $Q = (1 + \beta t) A \, dt/dx$

Answer: (A)

16. The mean thermal conductivity evaluated at the arithmetic mean temperature is represented by

A. $k_m = k_0 [1 + \beta (t_1 - t_2)/2]$.

B. $k_m = k_0 [1 + (t_1 + t_2)/2]$.

C. $k_m = k_0 [1 + \beta (t_1 + t_2)/3]$.

D. $k_m = k_0 [1 + \beta (t_1 + t_2)/2]$

Answer: (D)

17. With respect to the equation $k = k_0 (1 + \beta t)$ which is true if we put $\beta = 0$?

A. Slope of temperature curve is constant

B. Slope of temperature curve does not change

C. Slope of temperature curve increases

D. Slope of temperature curve is decreases

Answer: (A)

18. If β is greater than zero, then choose the correct statement with respect to given relation $k = k_0 (1 + \beta t)$

A. k doesn't depend on temperature

B. k depends on temperature

C. k is directly proportional to t

D. Data is insufficient

Answer: (C)

19. The unit of thermal conductivity doesn't contain which parameter?

A. Watt

B. Pascal

C. Meter

D. Kelvin

Answer: (B)

20. 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)

21. For an object i.e. spherical the value of critical radius would be

A. 2k/3h

B. 3k/h

C. 2k/h

D. k/h

Answer: (C)

22. Maximum value of critical radius is

A. 0.01 m

B. 0.04 m

C. 0.06 m

D. 0.0001 m

Answer: (A)

23. . The value of critical radius in case of a cylindrical hollow object is

A. 2k/h

B. 2h/k

C. k/h

D. h/k

Answer: (C)

24. A pipe of outside diameter 20 mm is to be insulated with asbestos which has a mean thermal conductivity of 0.1 W/m degree. The local coefficient of convective heat to the surroundings is 5 W/square meter degree. Find the critical radius of insulation for optimum heat transfer from a pipe?

A. 10 mm

B. 20 mm

C. 30 mm

D. 40 mm

Answer: (B)

25. The temperature drop in a plane wall with uniformly distributed heat generation can be decreased by reducing

A. Wall thickness

B. Heat generation rate

C. Thermal conductivity

D. Surface area

Answer: (A)

26. The rate of heat conduction through a cylindrical tube is usually expressed as

A. Per unit length

B. Per unit area

C. Only length

D. Only area

Answer: (A)