Unit 9 - Week 7

Assignment 7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-18, 23:59 IST.

1) **True or False:** Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true. *1 point*

If the conducting medium contains no heat sources, the equation for heat transfer with conduction as the dominant mode, reduces to the Fourier field equation and is given as: $\frac{\partial T}{\partial t} = \alpha \nabla^2 T$

The above equation is commonly referred to as Fourier's first law of heat conduction.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

2) **True or False:** Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true. *1 point*

The quantity $\frac{kA}{L}$ is characteristic of a flat wall or a flat plate and is designated the thermal conductance. The reciprocal of the thermal conductance, is the thermal resistance.

The Brinkman number is a dimensionless number related to heat conduction from a wall to a flowing viscous fluid. It is commonly used as a measure of the importance of the viscous dissipation term.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

3) **True or False:** Consider both the statements, and even if one of them is false then mark the entire answer as false, else mark the answer as true. *1 point*

Fourier's law states that the thermal conductivity of a material is independent of the temperature gradient, but not necessarily of temperature itself.

Consider a situation wherein a fluid is entrapped between two rotating concentric cylinders; then the friction between the adjacent layers of the fluid produces heat, i.e., the mechanical energy is converted to thermal energy, and such a transformation is commonly referred to as viscous dissipation.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

4) For an incompressible fluid without energy sources and with constant thermal conductivity, the energy equation reduces to: *1 point*

a. $\frac{DT}{Dt} = k\nabla^2 T$
b. $\rho C_v \frac{\partial T}{\partial t} = k\nabla^2 T$
c. $\rho C_v \frac{DT}{Dt} = k\nabla^2 T$
d. $\rho C_v \frac{DT}{Dt} = \alpha\nabla^2 T$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

5) Critical radius of insulation for a sphere is equal to: *1 point*

a. $\frac{k}{h}$
b. $\frac{k}{2h}$
c. $\frac{2k}{h}$
d. $\frac{2k}{3h}$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

6) Lumped capacitance model in Cartesian coordinate system implies which of the following: (note that here T denotes the temperature) *1 point*

a. $T = f(x,y,z)$
b. $T = f(x,y,z,t)$
c. $T \neq f(x,y,z); T = f(t)$
d. $T = f(x,y,z); T \neq f(t)$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

7) Which of the following conditions are correct, if the boundary condition implies that the surface is isothermal (non-zero temperature)? *1 point*

a. T = constant
b. Q = constant
c. T = 0
d. All of the above

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

8) Consider a fluid with density 750 kg m^{-3}, viscosity 0.03 Pa. s, thermal conductivity 2.1×10^{-2} W m^{-1} K^{-1}, heat capacity 1.35 kJ kg^{-1} K^{-1}, flowing over a horizontal flat plate. Determine the thermal diffusivity of the fluid. Assume that there are no significant variations in the properties of the fluid with temperature. *1 point*

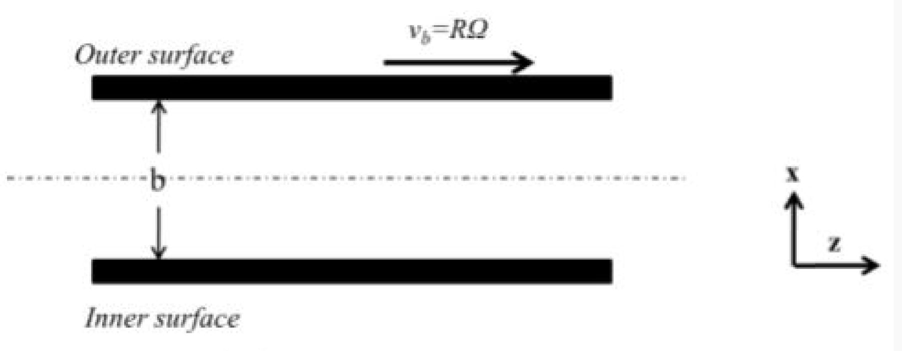
a. 1.05×10^{-6}
b. 2.07×10^{-5}
c. 6.58×10^{-8}
d. 2.07×10^{-8}

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

9) Consider the flow of an incompressible Newtonian fluid between two concentric cylinders having a very small gap, b which is smaller than the radius of the outer cylinder, R. A small section of the concentric-cylinder assembly, wherein the curvature of the bounding surfaces is neglected, is shown in the figure below. It is to be noted that the outer cylinder rotates with an angular velocity of Ω, while the inner cylinder remains stationary. For the system described above, which of the following options is the correct representation of the governing equation? *1 point*

[Hint: Consider a linear velocity distribution for the fluid, and use the following equation: $v_z = v_b \frac{x}{b}$; $v_b = \Omega R$]



a. $-k\frac{d^2T}{dx^2} + \mu\left(\frac{dv_z}{dx}\right) = 0$
b. $-k\frac{dT}{dx} - \mu x\left(\frac{v_b}{b}\right)^2 = C_1$; where C_1 is a constant of integration
c. $k\frac{dT}{dx} - \mu v_z\left(\frac{dv_z}{dx}\right) = 0$
d. $-k\frac{d^2T}{dx^2} = 0$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

10) If the temperature at the walls of the two cylinders are the same (T_0), then what are the boundary conditions for the above problem (question no. 9): *1 point*

a. $x = 0, b; T = T_0$
b. $x = 0; T = T_0$; $x = b; T = 0$
c. $x = 0; T = -T_0$; $x = b; T = T_0$
d. None of the above

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a