Assignment 7

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

PROBLEM STATEMENT FOR QUESTIONS 1-7:
Consider a solid slab (as shown in figure) occupying the space from \( y = -b \) to \( y = +b \) to an initial temperature of \( T_0 \). At time \( t = 0 \), the surfaces at \( y = \pm b \) are suddenly raised in temperature \( T_1 \) and maintained at that temperature for \( t > 0 \).

![Diagram of the slab](image.png)

1) The assumption(s) for writing the energy equation as

\[
\rho C_p \left( \frac{\partial T}{\partial t} + v_x \frac{\partial T}{\partial x} + v_y \frac{\partial T}{\partial y} + v_z \frac{\partial T}{\partial z} \right) = k \left( \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \right)
\]

is/are

- a) Thermal conductivity is a constant
- b) Specific heat is a constant
- c) Density is a constant
- d) Spatial distribution of temperature is linear

No, the answer is incorrect.
Score: 0

Accepted Answers:
- a
- b
- c
- d
The assumption(s) for simplifying the energy equation as
\[ \frac{\partial T}{\partial t} = \frac{k}{\rho C_p} \left( \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \right) \]
is/are
a) The problem is steady state
b) Diffusive heat transfer is absent
c) Convective heat transfer is absent
d) The material of construction is non-homogeneous

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

3) The following equation may be written if which of the options are assumed
\[ \frac{\partial T}{\partial t} = \frac{k}{\rho C_p} \frac{\partial^2 T}{\partial y^2} \]
a) Steady state
b) Thermal gradient only in one direction
c) Temperature is function of only time
d) Temperature is function of only space

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

4) If the non-dimensionally temperature is defined as \( \theta = \frac{T-T_0}{T_1-T_0} \), coordinate or length as \( \eta = \frac{y}{L} \)
time as \( \tau = \frac{at}{D} \) the non-dimensional form of the energy equation is
a) \( \frac{\partial \eta}{\partial \tau} = \frac{\partial^2 \theta}{\partial \eta^2} \)
b) \( \frac{\partial \theta}{\partial \tau} = \frac{\partial^2 \theta}{\partial \eta^2} \)
c) \( \frac{\partial \theta}{\partial \eta} = \frac{\partial^2 \theta}{\partial \tau^2} \)
d) \( \frac{\partial \theta}{\partial \tau} = \frac{k}{\rho C_p} \frac{\partial^2 \theta}{\partial \eta^2} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
b
5) If the non-dimensional temperature is defined as $\theta = \frac{r - r_0}{R_{1} - r_0}$ coordinate or length as $\eta = \frac{y}{b}$ time as $\tau = \frac{at}{b^2}$ the initial condition for the problem is

a) $\theta = 1$ at $\tau = \infty \forall \eta$

b) $\theta = 1$ at $\tau = 1 \forall \eta$

c) $\theta = 0$ at $\tau = 0 \forall \eta$

d) $\theta = 1$ at $\tau = 0 \forall \eta$

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

6) If the non-dimensional temperature is defined as $\theta = \frac{r - r_0}{R_{1} - r_0}$ coordinate or length as $\eta = \frac{y}{b}$ time as $\tau = \frac{at}{b^2}$ the initial condition for the problem is

a) $\theta = 1$ at $\tau = \infty \forall \eta$

b) $\theta = 1$ at $\tau = 1 \forall \eta$

c) $\theta = 0$ at $\tau = 0 \forall \eta$

d) $\theta = 1$ at $\tau = 0 \forall \eta$

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

7) Looking at the system, it is expected that the temperature profile will be symmetric about centre line (that is, about $y = 0$). So in such cases, a symmetric boundary condition is applied on the centre line ($at \eta = 0$) as $\partial T / \partial y = 0$, and the model equation is solved for one-half of the problem along the $y$ direction (that is, between $y = 0$ and $y = +b$ or $-b$). For such a situation, if non-dimensional temperature is defined as $\theta = \frac{r - r_0}{R_{1} - r_0}$ coordinate or length as $\eta = \frac{y}{b}$ and time $\tau = \frac{at}{b^2}$ the boundary conditions for the problem are

a) $\partial \theta / \partial \eta = \text{constant} \forall \eta \tau > 0$ and $\theta = 1$ at $\eta = -1 \forall \tau > 0$

b) $\partial \theta / \partial \eta = 0$ at $\eta = 0 \forall \tau > 0$ and $\theta = 0$ at $\eta = +1 \forall \tau > 0$

c) $\partial \theta / \partial \eta = 0$ at $\eta = 0 \forall \tau > 0$ and $\theta = 0$ at $\eta = -1 \forall \tau > 0$

No, the answer is incorrect.
8) What is the bandwidth of the following matrix?
\[
\begin{bmatrix}
9 & 7 & 8 \\
2 & 1 & 2 \\
7 & 2 & 1
\end{bmatrix}
\]

a) 1  

b) 3  

c) 0  

d) 5  

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

9) Which of the following method(s) may be used to solve a tri-diagonal matrix system?

a) Modified Gauss elimination  

b) Modified LU-decomposition  

c) Gauss-Seidel Method  

d) Newton Raphson Method  

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

10) Which of the following statement(s) is/are correct regarding Gauss-Elimination Method to solve a set of linear algebraic equations?

a) It reduces a given set of \(N\) equations to an equivalent triangular set, so that one of the equations has only one unknown  

b) It is an iterative method  

c) It is a non-iterative method  

d) It is an indirect method  

No, the answer is incorrect.
Score: 0
Accepted Answers:
11) Which of the following statement(s) is/are false regarding Gauss-Jordan Method?

a) It is an extension of Gauss elimination method  
b) It is often used to determine inverse of a matrix  
c) It is an iterative method to solve a set of linear algebraic equations  
d) It is a non-iterative method to solve a set of linear algebraic equations  

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

12) Which of the following is/are non-iterative method(s) to solve a set of linear algebraic equation?

a) Gauss-Jordan Method  
b) Jacobi Method  
c) Gauss-Seidel Method  
d) Gauss-Elimination Method  

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

13) Cholesky decomposition may be used to solve:

a) Identity matrix  
b) Upper triangular matrix  
c) Lower triangular matrix  
d) Symmetric matrix  

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

14)
For a cylindrical coordinate system \((r, \theta, z)\), which of the following condition(s) denote(s) axisymmetric process?

\[ \begin{align*}
\text{a)} & \quad \frac{\partial}{\partial r} = 0 \\
\text{b)} & \quad \frac{\partial}{\partial \theta} = 0 \\
\text{c)} & \quad \frac{\partial}{\partial z} = 0 \\
\text{d)} & \quad r \frac{\partial}{\partial r} = 0
\end{align*} \]

- a
- b
- c
- d

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

15)
Which of the following assumption(s) has/have been applied to write the following energy balance equation?

\[ \frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial y^2} \]

- a) Thermal gradient in only one direction
- b) Constant thermal conductivity
- c) No net heat generation or consumption
- d) Substantial derivative of thermal field is zero

- a
- b
- c
- d

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