

Unit 6 - Week 4: Elliptic Equations

Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Introduction to Computational Fluid Dynamics

Week 2: Classification of PDEs

Week 3: Finite Difference Method

Week 4: Elliptic Equations

● Lec 1: Finite difference formulations of Elliptic Equations with boundary condition treatment

● Lec 2: Iterative Methods

○ Lec 3: Applications

● Lec 4: Linear Solvers

○ Quiz : Assignment 4

○ Solution: Assignment 4

● Feedback form for week 4

Week 5: Parabolic Equations

Week 6: Hyperbolic Equations

Week 7: Stability Analysis

Week 8: Vorticity-Stream Function Formulation

Week 9: MAC Algorithm

Week 10: Finite Volume Method - I

Week 11: Finite volume method - II

Week 12: SIMPLE Algorithm

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Assignment 4

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

Due on 2020-02-26, 23:59 IST.

1) The five point formula for discretizing $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ using a uniform step size is

1 point

- $\phi_{i+1,j} + \phi_{i-1,j} - 2\phi_{i,j} + \phi_{i,j+1} + \phi_{i,j-1} = 0$
- $\phi_{i+1,j} + \phi_{i-1,j} - 3\phi_{i,j} + \phi_{i,j+1} + \phi_{i,j-1} = 0$
- $\phi_{i+1,j} + \phi_{i-1,j} - 4\phi_{i,j} + \phi_{i,j+1} + \phi_{i,j-1} = 0$
- $\phi_{i+1,j} + \phi_{i-1,j} - 5\phi_{i,j} + \phi_{i,j+1} + \phi_{i,j-1} = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\phi_{i+1,j} + \phi_{i-1,j} - 4\phi_{i,j} + \phi_{i,j+1} + \phi_{i,j-1} = 0$

2) The discretized equation for $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{q'''}{k} = 0$ with $\Gamma = \left(\frac{\Delta y}{\Delta x}\right)^2$ is

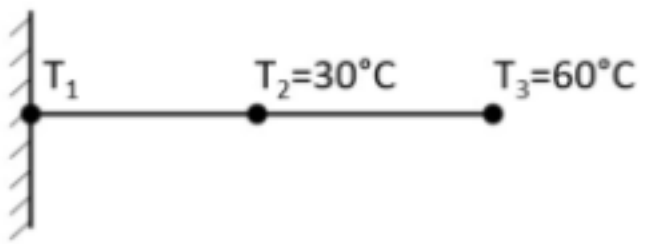
1 point

- $\Gamma T_{i+1,j} + \Gamma T_{i-1,j} + T_{i,j+1} + T_{i,j-1} + \Delta x^2 \frac{q'''}{k} = 2(\Gamma + 1) T_{i,j}$
- $T_{i+1,j} + T_{i-1,j} + \Gamma T_{i,j+1} + \Gamma T_{i,j-1} + \Delta x^2 \frac{q'''}{k} = 2(\Gamma + 1) T_{i,j}$
- $T_{i+1,j} + T_{i-1,j} + \Gamma T_{i,j+1} + \Gamma T_{i,j-1} + \Delta y^2 \frac{q'''}{k} = 2(\Gamma + 1) T_{i,j}$
- $\Gamma T_{i+1,j} + \Gamma T_{i-1,j} + T_{i,j+1} + T_{i,j-1} + \Delta y^2 \frac{q'''}{k} = 2(\Gamma + 1) T_{i,j}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $\Gamma T_{i+1,j} + \Gamma T_{i-1,j} + T_{i,j+1} + T_{i,j-1} + \Delta y^2 \frac{q'''}{k} = 2(\Gamma + 1) T_{i,j}$

3) The value of T_1 , with left boundary as adiabatic and grid size of 0.10, using the values of T_2 and T_3 is _____ °C.

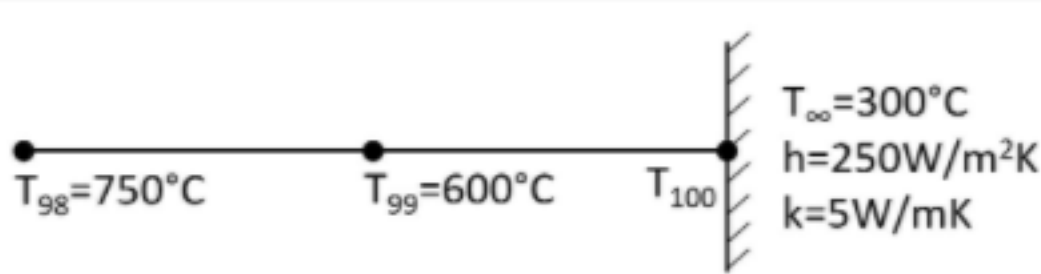


No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 20

1 point

4) For a constant grid size of 0.12, the value of T_{100} using the values of T_{98} and T_{99} for the given mixed boundary condition, is _____ °C.



No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 350

1 point

5) The optimum value of relaxation factor $\omega_{opt} = \frac{2-\sqrt{1-a}}{a}$ is valid for any domain.

1 point

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

6) TDMA gives result in less iterations as compared to Gauss-Seidel.

1 point

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

7) If heat flux is specified at a boundary, it is a Dirichlet boundary condition.

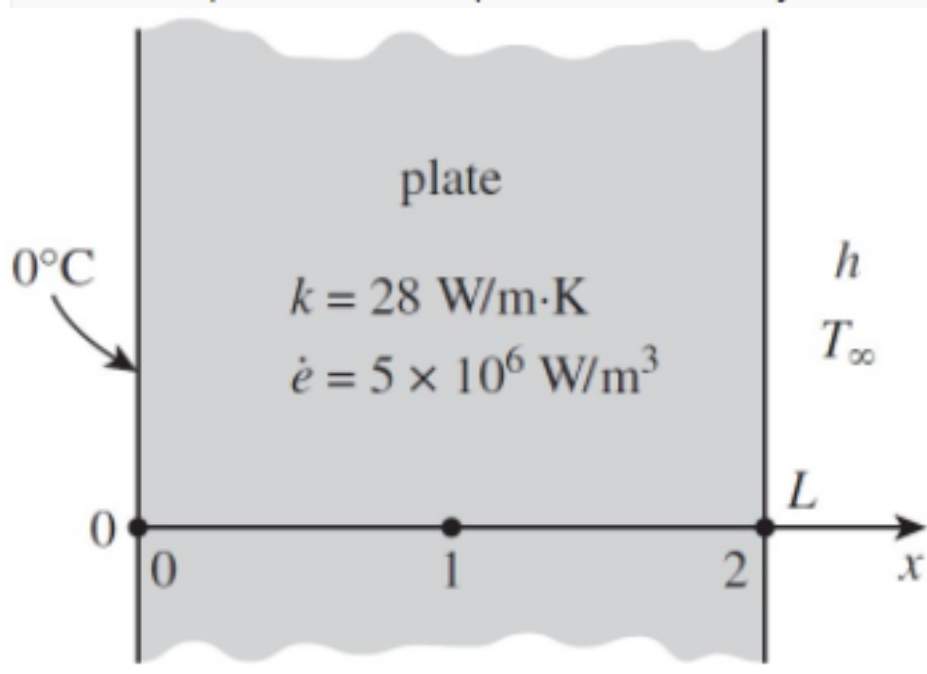
1 point

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

8) Consider a large plate of thickness $L = 4$ cm in which heat is generated uniformly at a constant rate, \dot{e} . One side of the plate is maintained at 0°C by iced water while the other side is subjected to convection to an environment at $T_\infty = 30^\circ\text{C}$ with a heat transfer coefficient of $h = 45 \text{ W/m}^2\text{K}$. Considering a total of three equally spaced nodes in the medium, two at the boundaries and one at the middle, the exposed surface temperature of the plate under steady conditions is _____ °C.



No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 130,145

1 point