Unit 11 - Week 8

Course outline

Assignment 8

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

Due on 2019-09-25, 23:59 IST.

1) The centred two point finite difference formula for approximating the first derivative of a function $f(z)$ at a point z_0 is given by: *1 point*

- $(f(z_0 + \Delta z/2) - f(z_0 - \Delta z/2))/(\Delta z)^2$
- $(f(z_0) - f(z_0 - \Delta z/2))/\Delta z$
- $(f(z_0) - f(z_0 - \Delta z/2))/(\Delta z)^2$
- $(f(z_0 + \Delta z/2) - f(z_0 - \Delta z/2))/\Delta z$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$(f(z_0 + \Delta z/2) - f(z_0 - \Delta z/2))/\Delta z$

2) The value of magnetic field at the centre of a Yee cell $H_z(i + 0.5, j + 0.5)$ for 2D TE polarization can be calculated as (where $\dot{E}$ is the time derivative of electric field) *1 point*

- $H_z(i - 0.5, j + 0.5) + \epsilon_0\, \Delta y\, \dot{E}_x(i + 0.5, j + 0.5)$
- $H_z(i - 0.5, j - 0.5) + \epsilon_0\, \Delta y\, \dot{E}_x(i + 0.5, j - 0.5)$
- $H_z(i + 0.5, j - 0.5) + \epsilon_0\, \Delta y\, \dot{E}_x(i + 0.5, j)$
- $H_z(i - 0.5, j - 0.5) + \epsilon_0\, \Delta y\, \dot{E}_x(i + 0.5, j)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$H_z(i + 0.5, j - 0.5) + \epsilon_0\, \Delta y\, \dot{E}_x(i + 0.5, j)$

3) The time update equation for electric field at integer time instance in 2D TE polarization is given by *1 point*

- $\vec{E}^{n-1} + \frac{\Delta t}{\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$
- $\vec{E}^{n-1} - \frac{\Delta t}{\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$
- $\vec{E}^{n-1} + \frac{\Delta t}{2\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$
- $\vec{E}^{n-1} - \frac{\Delta t}{2\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E}^{n-1} + \frac{\Delta t}{\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$

4) The divergence of the electric field in a heterogeneous region (characterized by $\epsilon(r)$), is given by the following equation: *1 point*

- $\nabla \cdot \vec{E} = 0$
- $\nabla \cdot \vec{E} = -\frac{1}{\epsilon}(\vec{E} \cdot \nabla\epsilon)$
- $\nabla \cdot \vec{E} = \rho/\epsilon$
- $\nabla \cdot \vec{E} = -\frac{1}{\epsilon}(\vec{E} \cdot \nabla\epsilon) + \rho/\epsilon$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\nabla \cdot \vec{E} = -\frac{1}{\epsilon}(\vec{E} \cdot \nabla\epsilon) + \rho/\epsilon$

5) The Courant stability criteria states that time step in 3D with discretization $\Delta x = \Delta y = \Delta z = \Delta s$ satisfies which of the following condition *1 point*

- $\Delta t \geq c/\Delta s$
- $\Delta t \leq c/\Delta s$
- $\Delta t \geq \Delta s/\sqrt{2}c$
- $\Delta t \leq \Delta s/\sqrt{3}c$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Delta t \leq \Delta s/\sqrt{3}c$

6) Numerical dispersion in 1D FDTD occurs when the Courant factor (α) is *1 point*

- $\alpha = 1$
- $\alpha = 0.5$
- $\alpha = 1/\sqrt{2}$
- All of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\alpha = 0.5$
$\alpha = 1/\sqrt{2}$

7) For a perfect electric conductor, the update equation for electric field E becomes *1 point*

- $\vec{E}^{n} = -\vec{E}^{n-1}$
- $\vec{E}^{n} = \vec{E}^{n-1}$
- $\vec{E}^{n} = \vec{E}^{n-1} + \frac{\Delta t}{\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$
- $\vec{E}^{n} = \vec{E}^{n-1} - \frac{\Delta t}{\epsilon_0}[\nabla \times \vec{H}^{n-1/2}]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E}^{n} = -\vec{E}^{n-1}$

8) If the frequency domain relation between electric displacement (D) and field (E) is given by $\tilde{D}(\omega) = \tilde{\epsilon_r}(\omega)\tilde{E}(\omega)$ with $\epsilon_r(t) = \epsilon_r\delta(t)$, then the time domain relation is given by *1 point*

- $D(t) = 1$
- $D(t) = \epsilon_r\epsilon_0 E(t)$
- $D(t) = \epsilon_r^2\epsilon_0 E(t)$
- $D(t) = \frac{1}{\epsilon_r}\epsilon_0 E(t)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$D(t) = \epsilon_r\epsilon_0 E(t)$

9) According to the Debye model, the permittivity $\epsilon_r(t)$ at the relaxation time $t = \tau$ is: According to the Debye model, the permittivity $\epsilon_r(t)$ at the relaxation time $t = \tau$ is: *1 point*

- $\epsilon_r(t) = \epsilon_\infty$
- $\epsilon_r(t) = \epsilon_s - \epsilon_\infty$
- $\epsilon_r(t) = (\epsilon_s - \epsilon_\infty)/\tau$
- $\epsilon_r(t) = (\epsilon_s - \epsilon_\infty)/(e\tau)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\epsilon_r(t) = (\epsilon_s - \epsilon_\infty)/(e\tau)$

10) The second order absorbing boundary condition to minimize reflections at 30^0 and 60^0 for a right traveling wave incident on a wall along $\hat{y}$ is given by: *1 point*

- $\left(\frac{\partial}{\partial x} + \frac{\sqrt{3}}{2c}\right)\left(\frac{\partial}{\partial x} + \frac{1}{2c}\right) E = 0$
- $\left(\frac{\partial}{\partial x} - \frac{\sqrt{3}}{c}\right)\left(\frac{\partial}{\partial x} + \frac{1}{2c}\right) E = 0$
- $\left(\frac{\partial}{\partial x} - \frac{\sqrt{3}}{2c}\right)\left(\frac{\partial}{\partial x} + \frac{1}{2c}\right) E = 0$
- $\left(\frac{\partial}{\partial x} + \frac{\sqrt{3}}{c}\right)\left(\frac{\partial}{\partial x} + \frac{1}{2c}\right) E = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\left(\frac{\partial}{\partial x} + \frac{\sqrt{3}}{2c}\right)\left(\frac{\partial}{\partial x} + \frac{1}{2c}\right) E = 0$