Unit 10 - 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 2019-09-18, 23:59 IST.

1) Given the scalar basis function $L_i(x,y) = (a_i + b_i x + c_i y)/2\Delta$, the shape functions for 2D vector FEM ($i \neq j$) are given by *1 point*

- $\vec{T_k} = l_k(L_i \nabla L_j - L_j \nabla L_i)$
- $\vec{T_k} = l_k(L_i \nabla L_i - L_j \nabla L_j)$
- $\vec{T_k} = l_k(L_i \nabla L_j + L_j \nabla L_i)$
- $\vec{T_k} = l_k(L_i \nabla L_i + L_j \nabla L_j)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{T_k} = l_k(L_i \nabla L_j - L_j \nabla L_i)$

2) Given the scalar basis function $L_i(x,y) = (a_i + b_i x + c_i y)/2\Delta$, if the shape functions for 2D vector FEM are written in vector form as $(l_k/4\Delta^2)(A_k + B_k y, C_k + D_k x)$, then the value of these constants in terms of a_i, b_i, c_i are *1 point*

- $A_k = a_i b_j + a_j b_i,\ B_k = b_j c_i + c_j b_i$
- $A_k = a_i b_j + a_j b_i,\ B_k = b_j c_i - c_j b_i$
- $A_k = a_i b_j - a_j b_i,\ B_k = b_j c_i - c_j b_i$
- $A_k = a_i b_j - a_j b_i,\ B_k = b_j c_i + c_j b_i$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$A_k = a_i b_j - a_j b_i,\ B_k = b_j c_i - c_j b_i$

3) For a triangle in 2D FEM with basis functions $\vec{T_k}$, the magnitude of dot product between the edge $\hat{r}_{31}$ and basis element $\vec{T_2}$ (opposite to node-2) is given by *1 point*

- $\vec{T_2} \cdot \hat{r}_{31} = 0$
- $|\vec{T_2} \cdot \hat{r}_{31}| = 1$
- $|\vec{T_2} \cdot \hat{r}_{31}| = 0.5$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$|\vec{T_2} \cdot \hat{r}_{31}| = 1$

4) The weighted residue method says that the integral $\int_\Omega \vec{T}_m(\vec{r}) \cdot \left(\nabla \times (\frac{1}{\epsilon_r} \nabla \times \vec{H(\vec{r})})\right) d\vec{r}$ *1 point*

- 0
- $k_0^2 \mu_r \vec{H}(\vec{r})$
- $\int_\Omega k_0^2 \mu_r \vec{H}(\vec{r}) \cdot \vec{T}_m(\vec{r}) d\vec{r}$
- $-\int_\Omega k_0^2 \mu_r \vec{H(\vec{r})} \cdot \vec{T}_m(\vec{r}) d\vec{r}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\int_\Omega k_0^2 \mu_r \vec{H}(\vec{r}) \cdot \vec{T}_m(\vec{r}) d\vec{r}$

5) The radiation boundary condition for TM polarization can be expressed in vector form as: *1 point*

- $\hat{n} \times (1/\epsilon_r (\nabla \times \vec{H})) = k_0^2 \mu_r \vec{H}$
- $\hat{n} \times (1/\epsilon_r \nabla \times \vec{H}) = -j\omega \vec{H}$
- $\hat{n} \times (1/\epsilon_r \nabla \times \vec{H}) = -jk/\epsilon_r (\hat{n} \times \vec{H})$
- $\hat{n} \times (1/\epsilon_r \nabla \times \vec{H}) = -jk/\epsilon_r (\hat{n} \times (\hat{n} \times \vec{H}))$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\hat{n} \times (1/\epsilon_r \nabla \times \vec{H}) = -jk/\epsilon_r (\hat{n} \times (\hat{n} \times \vec{H}))$

6) If the boundary of computational domain is Γ and that of object is Γ', then the incident field in the total field(TF) and scattered field(SF) formulation is introduced at *1 point*

- Γ for TF and Γ' for SF
- Γ' for TF and Γ for SF
- Γ for both TF and SF
- Γ' for both TF and SF

No, the answer is incorrect.
Score: 0
Accepted Answers:
Γ for TF and Γ' for SF

7) After doing the matrix assembly in 2D vector FEM, the maximum number of non-zero elements in a row for an $N \times N$ *1 point*

- 3
- 5
- N/2
- N

No, the answer is incorrect.
Score: 0
Accepted Answers:
5

8) **{Statement A}:** First order Absorbing Boundary Condition (ABC) in 2D FEM is not exact *1 point*
{Statement B}: First order ABC introduces numerical reflections

- Both Statement A and Statement B are correct and Statement B is the correct reason for Statement A
- Both Statement A and Statement B are correct but Statement B is not the correct reason for Statement A
- Only Statement A is correct
- Both Statement A and Statement B are wrong

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both Statement A and Statement B are correct and Statement B is the correct reason for Statement A

9) **{Statement A}:** FEM can be used to solve for scattering from inhomogeneous objects *1 point*
{Statement B}: FEM results in a sparse system matrix

- Both Statement A and Statement B are correct and Statement B is the correct reason for Statement A
- Both Statement A and Statement B are correct but Statement B is not the correct reason for Statement A
- Only Statement A is correct
- Both Statement A and Statement B are wrong

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both Statement A and Statement B are correct but Statement B is not the correct reason for Statement A

10) 2D vector shape functions (Whitney Elements) are: *1 point*

- Perpendicular to two sides of the triangle
- Have unit magnitude along one side of the triangle
- Have unit magnitude everywhere inside the triangle
- Both A and B

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both A and B

11) Which boundary condition is automatically satisfied by the Whitney basis functions in 2D vector FEM? *1 point*

- Continuity of normal electric displacement D
- Continuity of tangential magnetic field H
- Continuity of tangential electric displacement D
- Continuity of normal magnetic field H
- Both A and B
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Continuity of tangential magnetic field H

12) The magnitude of the curl of the 2D vector FEM basis function (Whitney element) $\vec{T}_k$ (where Δ is the area of triangle and l_k is the length of k^{th} edge) is given by *1 point*

- $(l_k/4\Delta^2)(A_k - B_k)$
- $(l_k/4\Delta^2)(D_k - C_k)$
- $(l_k/4\Delta^2)(C_k - A_k)$
- $(l_k/4\Delta^2)(D_k - B_k)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$(l_k/4\Delta^2)(D_k - B_k)$