

## Unit 8 - Week 5

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### Assignment 5

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

**Due on 2019-09-04, 23:59 IST.**

- 1) In the presence of object with relative permittivity  $\epsilon_r = 2$ , Helmholtz equation in 2D  $E_z$  polarization, can be simplified to the form **1 point**
- $\nabla^2 E(r) + k_0^2(E(r) - E_i(r)) = -2k_0^2 E(r)$   
  $\nabla^2 E(r) + k_0^2 E_i(r) = -2k_0^2 E(r)$   
  $\nabla^2(E(r) - E_i(r)) + k_0^2 E(r) = -k_0^2 E(r)$   
  $\nabla^2(E(r) - E_i(r)) + k_0^2(E(r) - E_i(r)) = -k_0^2 E(r)$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\nabla^2(E(r) - E_i(r)) + k_0^2(E(r) - E_i(r)) = -k_0^2 E(r)$

- 2) Which of the following volume integral equations is a non-homogeneous Fredholm integral equation of the 2nd kind? **1 point**
- $\vec{E}(\vec{r}) - \vec{E}_i(\vec{r}) = \int_D g(\vec{r}, \vec{r}') k_0^2(\epsilon_r(\vec{r}') - 1) \vec{E}(\vec{r}') d\vec{r}'$   
  $\vec{E}(\vec{r}) - \vec{E}_i(\vec{r}) = \int_D g(\vec{r}, \vec{r}') k_0^2(\epsilon_r(\vec{r}') - 1) \vec{E}_i(\vec{r}') d\vec{r}'$   
  $\vec{E}(\vec{r}) = \int_D g(\vec{r}, \vec{r}') k_0^2(\epsilon_r(\vec{r}') - 1) \vec{E}(\vec{r}') d\vec{r}'$   
  $\vec{E}(\vec{r}) = \int_D g(\vec{r}, \vec{r}') k_0^2(\epsilon_r(\vec{r}') - 1) \vec{E}_i(\vec{r}') d\vec{r}'$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\vec{E}(\vec{r}) - \vec{E}_i(\vec{r}) = \int_D g(\vec{r}, \vec{r}') k_0^2(\epsilon_r(\vec{r}') - 1) \vec{E}(\vec{r}') d\vec{r}'$

- 3) While solving volume integral equation, the off-diagonal matrix elements( $m \neq n$ ) of the matrix  $A$  in the equation  $Ax = b$  are directly proportional to **1 point**
- $J_1(ka)H_0^2(k\rho_{mn})$   
  $J_0(ka)H_0^2(k\rho_{mn})$   
  $J_1(ka)H_1^2(k\rho_{mn})$   
  $J_0(ka)H_1^2(k\rho_{mn})$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $J_1(ka)H_1^2(k\rho_{mn})$

- 4) The 2-D radar cross section (RCS) of an object, illuminated by an incident field  $E_i$  which is incident at an angle  $\theta_i$  and observed at an angle  $\theta$ , is given by **1 point**
- $\sigma(\theta, \theta_i) = \lim_{r \rightarrow 0} 2\pi r E^s(r, \theta) |E^i(0, 0)|$   
  $\sigma(\theta, \theta_i) = \lim_{r \rightarrow 0} 2\pi r |E^s(r, \theta)|^2 / |E^i(0, 0)|^2$   
  $\sigma(\theta, \theta_i) = \lim_{r \rightarrow \infty} 2\pi r |E^s(r, \theta)| |E^i(0, 0)|$   
  $\sigma(\theta, \theta_i) = \lim_{r \rightarrow \infty} 2\pi r |E^s(r, \theta)|^2 / |E^i(0, 0)|^2$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $\sigma(\theta, \theta_i) = \lim_{r \rightarrow \infty} 2\pi r |E^s(r, \theta)|^2 / |E^i(0, 0)|^2$

- 5) If  $\vec{E}_n$  and  $\vec{E}_{n-1}$  are the electric field at a point outside the object after solving integral equations using discretization  $n$  and  $n - 1$  respectively, then one of the criteria for achieving numerical convergence is given by **1 point**
- $(|\vec{E}_n - \vec{E}_{n-1}|) < \epsilon$   
  $(|\vec{E}_n - \vec{E}_{n-1}|) > \epsilon$   
  $(||\vec{E}_n| - |\vec{E}_{n-1}||) < \epsilon$   
  $(||\vec{E}_n| - |\vec{E}_{n-1}||) > \epsilon$

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
 $(|\vec{E}_n - \vec{E}_{n-1}|) < \epsilon$

- 6) Which of the following is true for scattering from an infinitely long z-directed cylinder with an arbitrary cross-section in the x-y plane that has been illuminated by a TM-polarized ( $E_z$ ) field in a 2D setting (assume z-direction to be invariant)? **1 point**
- $E_z = 0$   
  $H_z = 0$   
  $E_x = E_y = 0$   
  $H_x = H_y = 0$   
 B and C  
 None of these

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
B and C

- 7) Solving the volume integral equation using method of moments leads to a system of equations in which number of equations is \_\_\_\_\_ the number of unknowns and the system of equations is \_\_\_\_\_. **1 point**
- equal to, sparse  
 equal to, dense  
 less than, under-determined  
 more than, over-determined  
 None of the above

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
equal to, dense

- 8) What is the key difference between integral equation and finite element methods? **1 point**
- Use of Green's function  
 Computation Complexity  
 Storage requirements  
 All of the above

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
All of the above

- 9) In solving integral equations, which choice of testing functions leads to the point matching method, i.e  $L\phi(r)|_{r=r_m} = f(r_m)$ ? **1 point**
- Delta functions  
 cosine functions  
 Pulse functions  
 Gaussian functions

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
Delta functions

- 10) If a linear operator  $L$  is defined by  $L : d^2/dr^2 + 3d/dr + 7$  and  $\phi(r) = 1/r^2 + 10$ , then the value of the expression  $L\phi(r)$  at  $r = 1$  is \_\_\_\_\_.

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Numeric) 77

**1 point**

- 11) Consider the first order Lagrange polynomials in one dimension,  $N_1(x)$  and  $N_2(x)$ , defined in  $1 \leq x \leq 3$ . What is the value of the expression:  $N_1(x)N_2(x) - \frac{dN_1}{dx} \frac{dN_2}{dx}$ , at  $x = 2$ ?

**Hint**

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Numeric) 0.5

**1 point**