

Unit 4 - Week 1 Lectures

Course outline

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Week 1 Lectures

- Overview of fiber-optic communication systems
- Review of Maxwell's equations
- Uniform plane waves (UWPs) in free-space
- Properties of UWPs (propagation constant, polarization, and Poynting vector)
- Boundary conditions and reflection from a PEC

Quiz : Assignment-1

Assignment-1 Solutions

Feedback For Week 1

Week 2 Lectures

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Assignment-1

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

Due on 2019-08-14, 23:59 IST.

1) What is the energy of blue ($\lambda = 400nm$) photons? 1 point

- $79.56 \times 10^{-19} J$
- $4.97 \times 10^{-19} J$
- $1.8 \times 10^{-19} J$
- $8 \times 10^{-19} J$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $4.97 \times 10^{-19} J$

2) Which of the following electric fields represents a uniform plane wave travelling in z-direction? 1 point

- $\hat{x}E_0 \cos(\omega_0 t - \beta z)$
- $\hat{x}E_0 \cos(\omega_0 t - \beta x)$
- $\hat{x}E_0 \cos(\omega_0 t) \cos(\beta z)$
- $\hat{x}E_0 \cos(\omega_0 t + \beta y)$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $\hat{x}E_0 \cos(\omega_0 t - \beta z)$

3) The wave equation for the magnetic field $\vec{H}(\vec{r}, t)$ corresponding to a uniform plane wave propagating in free-space medium is 1 point

- $\nabla^2 \vec{H}(\vec{r}, t) = c^2 \frac{\partial^2 \vec{H}(\vec{r}, t)}{\partial t^2}$
- $\nabla^2 \vec{H}(\vec{r}, t) = \frac{1}{c^2} \frac{\partial^2 \vec{H}(\vec{r}, t)}{\partial t^2}$
- $\nabla^2 \vec{H}(\vec{r}, t) = \frac{\partial^2 \vec{H}(\vec{r}, t)}{\partial t^2}$
- $\nabla^2 \vec{H}(\vec{r}, t) = c \frac{\partial^2 \vec{H}(\vec{r}, t)}{\partial t^2}$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $\nabla^2 \vec{H}(\vec{r}, t) = \frac{1}{c^2} \frac{\partial^2 \vec{H}(\vec{r}, t)}{\partial t^2}$

4) For the electric field given in Question 2, the corresponding magnetic field component is 1 point

- $\hat{x}120\pi E_0 \cos(\omega_0 t - \beta z)$
- $\hat{x} \frac{E_0}{120\pi} \cos(\omega_0 t - \beta y)$
- $\hat{z} E_0 \cos(\omega_0 t - \beta y)$
- $\hat{y} \frac{E_0}{120\pi} \cos(\omega_0 t - \beta z)$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $\hat{y} \frac{E_0}{120\pi} \cos(\omega_0 t - \beta z)$

5) Given $\vec{E}(x, t) = \hat{y} E_0 \cos(62.831 \times 10^6 t - 0.42x)$, determine the polarization of the plane wave 1 point

- Elliptical
- Linear
- Right-circular
- Left-circular

No, the answer is incorrect. Score: 0

Accepted Answers:
Linear

6) For the electric field given in Question 5, the direction of propagation of the uniform plane wave is 1 point

- y
- x
- x
- y

No, the answer is incorrect. Score: 0

Accepted Answers:
x

7) Using the electric field equation given in Question 5, the relative dielectric permittivity of the medium is 1 point

- 3
- 4
- 2
- 1

No, the answer is incorrect. Score: 0

Accepted Answers:
4

8) The instantaneous Poynting vector of the uniform plane wave given in Question 5 is 1 point

- $\hat{x} \frac{E_0^2}{120\pi} \cos^2(\omega_0 t - \beta z)$
- $\hat{y} \frac{E_0^2}{120\pi} \cos^2(\omega_0 t - \beta y)$
- $\hat{x} \frac{E_0^2}{120\pi} \cos^2(\omega_0 t - \beta x)$
- $\hat{y} \frac{E_0^2}{120\pi} \cos^2(\omega_0 t - \beta z)$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $\hat{x} \frac{E_0^2}{120\pi} \cos^2(\omega_0 t - \beta x)$

9) The electric field of a uniform plane wave that is propagating in the x-z plane with the propagation vector making an angle of 30° with respect to x-axis is (assume that the electric field is perpendicular to the x-z plane) 1 point

- $\hat{y} E_0 \cos(\omega_0 t - \frac{\sqrt{3}}{2} kx - \frac{1}{2} kz)$
- $\hat{x} E_0 \cos(\omega_0 t + \frac{\sqrt{3}}{2} kx - \frac{1}{2} kz)$
- $\hat{y} E_0 \cos(\omega_0 t - \frac{\sqrt{3}}{2} kx + \frac{1}{2} kz)$
- $\hat{x} E_0 \cos(\omega_0 t - \frac{\sqrt{3}}{2} kx - \frac{1}{2} kz)$

No, the answer is incorrect. Score: 0

Accepted Answers:
 $\hat{y} E_0 \cos(\omega_0 t - \frac{\sqrt{3}}{2} kx - \frac{1}{2} kz)$