Course outline

How does an NPTEL online course work?

Week 0

MATLAB

Week 1

Week 2

- Fundamentals of Lightwaves: EM Waves: Maxwell Equations and Plane Wave Solutions
- Fundamentals of Lightwaves: EM Waves: Wave Propagation in Lossy Dielectric Medium
- Fundamentals of Lightwaves: EM Waves in Metals and Semiconductors
- Fundamentals of Lightwaves: EM Waves: Plasma Dispersion
- Week 2: Lecture notes
- Quiz: Week 2: Assignment 2
- Week 2 Feedback Form: Integrated Photonics Devices and Circuits

Week 3

Week 4

Week 5

Week 6

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Week 8

Week 9

Week 10

Week 11

Week 12

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Week 2: Assignment 2

The due date for submitting this assignment has passed.

Due on 2021-08-18, 23:59 IST.

As per our records you have not submitted this assignment.

Mark whether the following statements are True or False.

1) In a lossy dielectric medium, the refractive index is real. *1 point*

- True
- False

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

2) For an applied electric field, the conduction current inside a lossless dielectric medium is zero. *1 point*

- True
- False

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

3) For an applied electric field, the displacement current inside a lossless dielectric is zero. *1 point*

- True
- False

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

4) The skin depth of a highly conductive medium ($\sigma \rightarrow \infty$), tends to zero. *1 point*

- True
- False

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

5) For an EM plane wave in free space, at a given instant of time if the orientation of $\vec{E}$ and $\vec{H}$ are in $+y$ and $-z$ direction respectively, then the wave will be propagating in $+x$ direction. *1 point*

- True
- False

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

6) Which of the following is not correct for a lossy dielectric medium? *1 point*

- $\epsilon_r \neq 1$
- $\mu_r = 1$
- $\sigma = 0$
- $\rho_v = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\sigma = 0$

7) Calculate the intrinsic impedance (in Ω), phase velocity (in Km/sec) and propagation constant k (in 1/m) for an EM wave propagating in a lossless dielectric medium with the relative perimittivity $\epsilon_r = 2.5$. Consider the frequency of the EM wave as 10 GHz. *1 point*

- $238, 1.9 \times 10^8, 523$
- $377, 3 \times 10^5, 209$
- $150, 1.2 \times 10^8, 523$
- $238, 1.9 \times 10^5, 331$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$238, 1.9 \times 10^5, 331$

8) If an EM wave with frequency $f = 10$ GHz is incident on the Aluminium ($\sigma = 3.5 \times 10^5 \Omega^{-1} cm^{-1}$), the skin depth δ is *1 point*

- 0.85μm
- 8.5μm
- 2.13μm
- 21.3μm

No, the answer is incorrect.
Score: 0
Accepted Answers:
$0.85\mu m$

Common data for questions 9 – 10: In a non magnetic medium, the electric field of an EM wave is given as $\vec{E} = 5\sin(2\pi \times 10^{10} t - 331z)\hat{x}$ V/m

9) The propagating medium is the free space. *1 point*

- True
- False

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

10) The time-average power carried by the wave is *1 point*

- $52.4\hat{y}$ mW/m^2
- $52.4\hat{z}$ mW/m^2
- $102.8\hat{y}$ mW/m^2
- $102.8\hat{z}$ mW/m^2

No, the answer is incorrect.
Score: 0
Accepted Answers:
$52.4\hat{z}$ *mW/m^2*

11) An em wave with 50 MHz frequency is propagating in $+z$ direction inside a medium with $\epsilon_r = 100$, $\mu_r = 1$ and $\sigma = 5$ S/m. The amplitude of E field is 1 V/m at $z = 0$. At what value of z, the amplitude of E will be 0.001 V/m. _____ m *1 point*

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.22,0.23

12) At a particular frequency, the skin depth of a metal is $76\ \mu m$. The amplitude of propagation constant(γ) is at the same frequency given by _____ $\times 10^4 m^{-1}$ *1 point*

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.84,1.88

13) The electric and magnetic fields are given as followings. *1 point*

$E = (j\hat{x} + \hat{y} - j\hat{z})e^{\beta z}$ V/m
$H = (-j\hat{x} - 2j\hat{y} + j\hat{z})e^{\beta z}$ H/m

What is the percentage of average power density in the positive y direction? _____ %

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 0

14) The attenuation constant(α) in a medium is 250 Np/m. The average power density at a point is 5 W/m^2 . What will be the average power density after travelling 1 cm from that point? _____ $\times 10^{-3}$ W/m^2 *1 point*

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 33.5,33.9