

Unit 7 - Week 4 Lectures

Course outline

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Week 2 Lectures

Week 3 Lectures

Week 4 Lectures

- Systematic analysis of dielectric slab waveguides
- Further discussion on slab waveguides
- Modal analysis of step index optical fiber
- Properties of modes of step-index optical fiber -I
- Properties of modes of step-index optical fiber -II

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Assignment-4

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

Due on 2019-08-28, 23:59 IST.

1) Which of the following expressions is incorrect 1 point

$$E_r = \frac{-j}{\omega^2 \mu \epsilon - \beta^2} \left(\beta \frac{\partial E_z}{\partial r} + \frac{\mu \omega}{r} \frac{\partial H_z}{\partial \phi} \right)$$

$$E_\phi = \frac{-j}{\omega^2 \mu \epsilon - \beta^2} \left(\frac{\beta}{r} \frac{\partial E_z}{\partial r} - \mu \omega \frac{\partial H_z}{\partial \phi} \right)$$

$$H_r = \frac{-j}{\omega^2 \mu \epsilon - \beta^2} \left(\beta \frac{\partial H_z}{\partial r} - \frac{\omega \epsilon}{r} \frac{\partial E_z}{\partial \phi} \right)$$

$$H_\phi = \frac{-j}{\omega^2 \mu \epsilon - \beta^2} \left(\frac{\beta}{r} \frac{\partial H_z}{\partial \phi} + \omega \epsilon \frac{\partial E_z}{\partial r} \right)$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$E_\phi = \frac{-j}{\omega^2 \mu \epsilon - \beta^2} \left(\frac{\beta}{r} \frac{\partial E_z}{\partial r} - \mu \omega \frac{\partial H_z}{\partial \phi} \right)$$

2) The expression for E_z outside the step-index fiber core is ($\omega^2 = \beta^2 - k_2^2, u^2 = k_1^2 - \beta^2, k_1 = \frac{2\pi n_{core}}{\lambda}, k_2 = \frac{2\pi n_{clad}}{\lambda}$, consider C to be an arbitrary constant) 1 point

$C K_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$C K_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$C J_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$C J_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$C K_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

3) The expression for E_z inside the step-index fiber core is ($\omega^2 = \beta^2 - k_2^2, u^2 = k_1^2 - \beta^2, k_1 = \frac{2\pi n_{core}}{\lambda}, k_2 = \frac{2\pi n_{clad}}{\lambda}$, consider A to be an arbitrary constant) 1 point

$A J_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$A K_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$A J_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

$A K_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$A J_v(ur) e^{jv\phi} e^{j(\omega t - \beta z)}$

4) In a step-index optical fiber, the condition for mode propagation constant (β) of an excited mode is ($k_1 = \frac{2\pi n_{core}}{\lambda}, k_2 = \frac{2\pi n_{clad}}{\lambda}$) 1 point

$\beta \leq k_2$

$k_2 \leq \beta \leq k_1$

$\beta \geq k_1$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$k_2 \leq \beta \leq k_1$

5) A certain optical fiber has the following parameters: core radius of $4 \mu\text{m}$, core and cladding refractive indices of 1.45 and 1.444 respectively, and operating wavelength of 1064 nm. V-number of the fiber is 1 point

3.11

1.82

2.405

3.5

No, the answer is incorrect.

Score: 0

Accepted Answers:

3.11

6) For the fiber given in Question 5 to act as a single mode fiber, the minimum operating wavelength is 1 point

1550 nm

1377 nm

1250 nm

880 nm

No, the answer is incorrect.

Score: 0

Accepted Answers:

1377 nm

7) HE_{11} mode is the fundamental mode of an optical fiber. 1 point

True

False

No, the answer is incorrect.

Score: 0

Accepted Answers:

True

8) If a mode propagating in an optical fiber has $|H_z| > |E_z|$ ($H_z \neq 0, E_z \neq 0, v \neq 0$) the mode is called as 1 point

TE mode

TM mode

HE mode

EH mode

No, the answer is incorrect.

Score: 0

Accepted Answers:

EH mode

9) Which of the following Bessel function properties is incorrect 1 point

$2J'_v(z) = J_{v-1}(z) - J_{v+1}(z)$

$J_{-v}(z) = (-1)^v J_v(z)$

$2K'_v(z) = K_{v-1}(z) - K_{v+1}(z)$

$K_{-v}(z) = K_v(z)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$2K'_v(z) = K_{v-1}(z) - K_{v+1}(z)$