Unit 5 - Week 4

Week 4 Assignment 4

The due date for submitting this assignment has passed. **Due on 2018-09-05, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *1 point*

Read the following paragraph and answer the questions? (SINGLE CORRECT OPTION) Q.1 - Q.4

Consider a planar symmetric dielectric waveguide structure having two horizontal parallel interfaces such that the lower one lies in xy −plane at $z = 0$ and the upper interface is at $z = d$. The core and cladding layers have RI's n_1 and n_2 respectively. The EM wave is travelling from left to right along the waveguide.

The set of electric and magnetic field components that constitute the **TM** mode of this structure is

(A) H_y, E_z, E_x	(B) H_x, E_y, E_z	(C) H_z, E_x, E_y	(D) H_x, H_y, E_z

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
B.

2) *1 point*

For this planar waveguide, the RI varies as $n^2 = n^2(z)$, *i.e.*, independent of x − and y −coordinates. Then the solution of wave equation for this structure can be written as

(A) $\vec{E} = \vec{E}(x)\ e^{i(\omega t - k_x x - k_y y)}$	(B) $\vec{E} = \vec{E}(x, y)\ e^{i(\omega t - k_z z)}$
(C) $\vec{E} = \vec{E}(y)\ e^{i(\omega t - k_x x - k_z z)}$	(D) $\vec{E} = \vec{E}(z)\ e^{i(\omega t - k_y y)}$

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
D.

3) *1 point*

Assignment Solution

About the electric and magnetic field components of guided modes of this waveguide which of the following is true?
(A) Each of the field components H_x, H_z, E_x, E_z can be expressed in terms of H_y and E_y
(B) Each of the field components H_x, H_y, E_x, E_y can be expressed in terms of H_z and E_z
(C) All the field components H_x, H_y, H_z, E_x, E_y , and E_z cannot satisfy time-independent wave equation (Helmholtz's equation)
(D) Both **TE-** and **TM** modes cannot co-exist/ propagate simultaneously in this waveguide

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

4) ***1 point***

Which of the following statements about the modes of this waveguide is true?
(A) For a **TE-** mode to be guided in this structure the condition: $k_0^2 n_1^2 > k_y^2 > k_0^2 n_2^2$ must be satisfied
(B) A mode whether **TE** or **TM** will be guided in this waveguide only if $k_y^2 < k_0^2 n_2^2$
(C) If the field amplitude in the cladding is oscillatory, *i.e.,* of the form $e^{\pm ik_x z}$, then it corresponds to a guided mode
(D) the condition that the waveguide will carry more than one guided **TE** modes for a light of wavelength λ_0 is $\lambda_0 \geq 2d\sqrt{n_1^2 - n_2^2}$

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

5) ***1 point***

Read the following paragraph and answer the questions? (SINGLE CORRECT OPTION) Q.5 - Q.8			
Given that the RI's of core and cladding of a symmetric planar dielectric waveguide are respectively $n_1 = 1.50$ and $n_2 = 1.48$. The width of the core is d.			
For a light of wavelength $\lambda_0 = 1.5\ \mu m$, the waveguide supports only one mode (single-mode operation). The width of the core is then			
(A) $d \leq 3.07\ \mu m$	(B) $d \geq 4.13\ \mu m$	(C) $d = 4.07\ \mu m$	(D) $d \geq 6.13\ \mu m$

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

6) ***1 point***

If the wavelength of light used is halved *i.e.*, $\lambda_0 = 750\ nm$, then for single-mode operation, the required thickness of the waveguide will be

(A) $d \leq 1.53\ \mu m$	(B) $d \geq 2.06\ \mu m$	(C) $d = 2.03\ \mu m$	(D) $d \geq 3.06\ \mu m$

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

7) ***1 point***

How many guided modes (total number of modes) will be supported in this waveguide when its core-width is $d = 12.3\ \mu m$ and the operating wavelength is $\lambda_0 = 750\ nm$?

(A) 8	(B) 6	(C) 4	(D) 2

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

8) ***1 point***

One such waveguide having core-cladding RI's as $n_1 = 1.5$ and $n_2 = 1.0$ has $V = 3.0$ at a wavelength $\lambda_0 = 1.3\ \mu m$. Then which one of the following corresponds to propagation constant of the **TE** mode?

(A) $\beta_{TE} = 6.4574\ \mu m^{-1}$	(B) $\beta_{TE} = 64.574\ \mu m^{-1}$
(C) $\beta_{TE} = 645.74\ \mu m^{-1}$	(D) $\beta_{TE} = 6457.4\ \mu m^{-1}$

- A.
- B.
- C.
- D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.

9) ***1 point***

Choose the correct answer/s. (MULTIPLE CORRECT OPTION) Q.9-Q.12

For practical waveguides, the difference in the core-cladding RI's is small, *i.e.*, $n_1 \approx n_2$ (weakly guiding structure). For such waveguides that supports only one **TE-** and one **TM** modes, which of the following facts is/are true?

(A) Propagation constants of **TE** mode and corresponding **TM** mode are nearly equal

(B) A **TE** mode and the corresponding **TM** mode exhibit very nearly similar field pattern

(C) The longitudinal field components for both **TE-** and corresponding **TM** mode are very large compared to the transverse field components

(D) The modes are almost transverse (like free space propagation), *i.e.*, transverse field components are nearly continuous across the interface

- A.
- B.

C.

D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.
B.
D.

10) ***1 point***

For the fundamental **TE** mode (**0**th order **TE**) of a symmetric planar slab waveguide, the value of which of the following quantity/quantities will lie between **0** to **/2** ?

(A) $\kappa\frac{d}{2}$	(B) $\gamma\frac{d}{2}$	(C) $V = k_0\frac{d}{2}\sqrt{n_1^2 - n_2^2}$	(D) $\kappa\frac{d}{2}\tan\kappa\frac{d}{2}$

A.

B.

C.

D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A.
B.
C.
D.

11) ***1 point***

In a symmetric planar slab waveguide, the transverse field amplitude of a guided mode will be ***zero*** at the center of the waveguide, *i.e.*, along all axial positions. Then this mode must be

(A) a symmetric **TE** mode	(B) an antisymmetric **TE** mode
(C) a symmetric **TM** mode	(D) an antisymmetric **TM** mode

A.

B.

C.

D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
B.
D.

12) ***1 point***

For a parabolic index profile symmetric planar slab waveguide, the field pattern of the lowest order (fundamental) mode is given by

(A) a Hermite-Gaussian function	(B) a purely Gaussian function
(C) a Bessel's functions	(D) Airy functions

A.

B.

C.

D.

No, the answer is incorrect.
Score: 0

Accepted Answers:
B.

Previous Page End