

Unit 4 - Week 3

Course outline

How does an NPTEL online course work?

Week 1

Week 2

Week 3

● Electromagnetic Analysis of Waveguides - I

● Electromagnetic Analysis of Waveguides - II

● Electromagnetic Analysis of Waveguides - III

● Electromagnetic Analysis of Waveguides - IV

○ Electromagnetic Analysis of Waveguides - V

○ Quiz : Assignment 3

● Solution : Assignment 3

Week 4

Week 5

Week 6

Week 7

Week 8

Text Transcripts

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Assignment 3

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

Due on 2020-02-19, 23:59 IST.

1) Which of the following is INCORRECT. 1 point

- Penetration depth of a mode increases with wavelength
 n_{eff} decreases with mode number.
 Lower order modes are less confined into the guiding film.
 None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Lower order modes are less confined into the guiding film.

2) Consider a dielectric step-index symmetric planar waveguide with $n_1 = 1.475$, $n_2 = 1.450$ and $d = 2 \mu m$. Out of the wavelengths 1 point
at which the waveguide will be single moded.

- $1.5 \mu m$
 $0.8 \mu m$
 $0.5 \mu m$
 None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.5 μm

3) Out of the following, which may be the possible combination of the non-vanishing components of electric and magnetic fields for TE-modes? 1 point

- E_x, E_y, E_z
 E_x, E_y, H_z
 H_x, E_y, H_z
 H_x, H_y, H_z

No, the answer is incorrect.
Score: 0

Accepted Answers:
 H_x, E_y, H_z

4) Determine the angle that constituent plane waves corresponding to $m = 2$ mode make with the direction of propagation for a planar mirror waveguide with $n = 1.46$, $d = 1 \mu m$ at $\lambda_0 = 0.6 \mu m$. 1 point

- 10.6°
 24.3°
 52.3°
 73.6°

No, the answer is incorrect.
Score: 0

Accepted Answers:
 24.3°

5) Consider a planar mirror waveguide with $n = 1.46$, $d = 1 \mu m$ at $\lambda_0 = 0.6 \mu m$. The effective index of the 2nd mode is 1 point

- 3.15
 2.85
 1.33
 0.85

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.33

6) Determine the operating wavelength (λ_0) at which the planar mirror waveguide with $n = 1.45$, $d = 2 \mu m$ will support maximum 4 modes. 1 point

- $1.45 \mu m$
 $0.90 \mu m$
 $0.52 \mu m$
 $0.42 \mu m$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $1.45 \mu m$

7) Number of guided symmetric and anti-symmetric modes for $\frac{11}{2}\pi < V < 6\pi$ will be 1 point

- 6, 5
 6, 6
 2, 3
 3, 3

No, the answer is incorrect.
Score: 0

Accepted Answers:
6, 6

8) Consider a dielectric step-index symmetric planar waveguide with $n_1 = 1.475$, $n_2 = 1.450$ at $\lambda = 0.8 \mu m$. Calculate the number of modes for $d = 2 \mu m$. 1 point

- 2
 3
 4
 6

No, the answer is incorrect.
Score: 0

Accepted Answers:
2

9) Consider a symmetric planar waveguide with $n_1 = 1.48$, $n_2 = 1.46$, $d = 5 \mu m$ and effective indices of supported TE₀ and TE₁ modes are 1.4772 and 1.4730, respectively at $\lambda_0 = 1.06 \mu m$. Calculate the angles that the constituent plane waves make with the direction of propagation. 1 point

- $3.5^\circ, 5.6^\circ$
 $4.7^\circ, 7.8^\circ$
 $6.2^\circ, 9.5^\circ$
 $8.8^\circ, 10.2^\circ$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $3.5^\circ, 5.6^\circ$

10) Consider a symmetric planar waveguide with $n_1 = 1.48$, $n_2 = 1.46$, $d = 5 \mu m$ and effective indices of supported TE₀ and TE₁ modes are 1.4772 and 1.4730, respectively at $\lambda_0 = 1.06 \mu m$. Calculate the penetration depth of modal field in n_2 region respectively 1 point

- $0.42 \mu m, 0.61 \mu m$
 $0.75 \mu m, 0.86 \mu m$
 $1.91 \mu m, 2.10 \mu m$
 $3.12 \mu m, 3.18 \mu m$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $0.75 \mu m, 0.86 \mu m$