X

NPTEL

reviewer3@nptel.iitm.ac.in ▾

Unit 6 - Week 5

Week 5 Assignment 5

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

Due on 2018-09-12, 23:59 IST.

1) ***1 point***

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

Consider an optical directional coupler consisting of two parallel ***identical*** planar optical waveguides which are at close proximity over a length L. Let the mode of any individual waveguide has propagation constant β_0. Th composite structure supports two lowest order modes- symmetric and antisymmetric modes (ψ_s , ψ_a) having propagation constants β_s, β_a respectively.

The coupling constant κ of this directional coupler

(A) is given by $\kappa = \frac{1}{2}(\beta_s + \beta_a)$

(B) defines the strength of coupling between the symmetric and antisymmetric modes of the **composite waveguide** per unit length of interaction

(C) is a measure of the strength of overlap between the modes of **individual waveguides** constituting the directional coupler

(D) is larger for smaller wavelength of light and vice versa

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:

Week 6
Week 7
Week 8
Week 9
Week 10
Week 11
Week 12
Download Videos
Assignment Solution

Which of the following is/are true about the interaction length of the coupler?

(A) The interaction length defines the coupling length (corresponds to complete power transfer for the first time) when $L = L_{co} = \frac{\pi}{2\kappa}$

(B) For a coupling of **50%** (3dB coupling), *i.e.*, equal power flowing in the two waveguides of the directional coupler, the interaction length required will be $L = \frac{\pi}{4(\beta_s+\beta_a)}$

(C) One coupling length L_{co} corresponds to a phase difference of π between the symmetric and antisymmetri modes of the composite waveguide

(D) An odd multiple of coupling length L_{co} corresponds to entire power flowing in the input waveguide (throughput waveguide)

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(C)

3) ***1 point***

Which of the following statements is/are true about power transfer between two waveguides forming the directional coupler?

(A) If the phase difference between the symmetric and antisymmetric modes correspond to $0, 2\pi, 4\pi, 6\pi, ..$, then the optical power becomes periodically maximum in the coupled waveguide

(B) For **unit** optical power launched at the input of this coupler having interaction length L, the power coupled to coupled waveguide will be $\cos^2 \kappa L$

(C) The period of power transfer (maximum to maximum) is larger at longer wavelength as compared to shorter wavelengths

(D) When the optical power in the two outputs of this directional coupler is equal, then the phase difference of the waves at the exit of these two waveguides is $\frac{\pi}{2}$

- ( ) (A)
- ( ) (B)
- ( ) (C)
- ( ) (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(D)

4) ***1 point***

Which of the following is/are true about the magnitude of coupling constant κ of this coupler?

(A) coupling constant κ is larger for higher wavelengths

(B) coupling constant κ depends on the length of interaction of the two interacting waveguides forming the coupler

(C) coupling constant κ is larger for smaller separation between the two interacting waveguides forming the coupler

(D) coupling constant κ is a function of the input power launched into one of the waveguides

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(C)

5) ***1 point***

Choose the correct answer. (SINGLE CORRECT OPTION) Q.5 - Q.10

In an optical directional coupler, the interaction length corresponds to $3L_{co}$ (coupling length) for a light of wavelength λ_{Blue} but the interaction length corresponds to $4L_{co}$ for a light of wavelength λ_{Red}. Then if both the wavelengths (light) are launched at one input, what happens to the outputs?

(A) Light of wavelength λ_{Blue} appears at the coupled port while that of wavelength λ_{Red} appears at the throughput port

(B) Light of wavelength λ_{Red} appears at the coupled port while that of wavelength λ_{Blue} appears at the throughput port

(C) Both the wavelengths λ_{Red} and λ_{Blue} appear at the coupled port only

(D) Both the wavelengths λ_{Red} and λ_{Blue} appear at the throughput port only

- ( ) (A)
- ( ) (B)
- ( ) (C)
- ( ) (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

6) ***1 point***

The two output fibers of a **3dB** (50% splitting) fiber direction coupler are joined end-to-end (spliced). If light injected at one of the input fibers, then what happens?

(A) The entire input light after passing through the loop will appear at the exit of second input fiber

(B) The entire input light will be finally reflected back into the first fiber

(C) Half the intensity (50%) of input light will appear at the exit of second input fiber and remaining half will back reflected into the input fiber

(D) The injected light will be circulating in the loop and will not exit at any of the input fibers

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(B)

7) ***1 point***

For a step-index optical fiber with core and cladding refractive indices **1.48** and **1.47** respectively, the core-radius necessary for single mode operation at **850 nm** is close to

(A) 1.54 µm

(B) 1.89 µm

(C) 3.78 µm

(D) 3.08 µm

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(B)

8) ***1 point***

For the above step-index optical fiber having with core and cladding refractive indices **1.48** and **1.47** respectively, what are the values of numerical aperture and maximum acceptance angle ?

(A) 0.2994, 2.96°

(B) 0.2994, 9.89°

(C) 0.1717, 2.96°

(D) 0.1717, 9.89°

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(C)

9) ***1 point***

The core of an optical fiber possesses refractive index **1.5** and the cladding is down-doped with a fraction index difference of **0.0005**. The cladding refractive index is close to

(A) 1.49925
(B) 1.46995
(C) 1.48925
(D) 1.47925

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)

10) ***1 point***

For the above fiber mentioned in Q.9, what is the critical angle for internal reflection at core-cladding interface of the fiber?

(A) 78.2°
(B) 80.2°
(C) 82.2°
(D) 88.2°

- (A)
- (B)
- (C)
- (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(D)

11) ***1 point***

Choose the correct answer/s. (MULTILE CORRECT OPTION) Q.11-Q.12

In prism coupling method of launching light into a planar film waveguide, the prism is kept close to waveguide (with a small air-gap between the two) satisfying the phase matching condition. Let the RI's of prism, air and the waveguide be n_{Prism}, n_{air} and n_{Film} respectively. Assume the prism and waveguide are in close proximity along z-direction. Then which of the following is/are true about this prism coupling?

(A) The phase matching leads to continuity of z-components of propagation vectors of the waves in the waveguide and the prism at interface
(B) The evanescent wave in air region couples to guided mode of the waveguide
(C) The coupling can also be thought of frustrated total internal reflection
(D) The necessary condition of coupling is $n_{Prism} > n_{Film}$ and $n_{Film} > n_{air}$

- (A)

- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A)
(B)
(C)
(D)

12) ***1 point***

Which of the following statements is/are not correct about the grating coupling of light into optical waveguides?

(A) grating input-output coupling enables direct coupling from optical fibers to waveguides
(B) In grating coupling, the grating period is such that the scattered wave constructively interferes at the giver angle so as to get coupled into fiber
(C) The coupling can also be thought of frustrated total internal reflection
(D) The condition for coupling is that the phase difference between waves from same positions of successive periods meeting at the fiber input are integer multiples of π

- [ ] (A)
- [ ] (B)
- [ ] (C)
- [ ] (D)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(C)
(D)

Previous Page End