

(b) A planar LED is fabricated from GaAs which has a refractive index of 3.6. (i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68. (ii) When the optical power generated internally is 50% of the electric power supplied, determine the external power efficiency. (5)

7. (a) What are the underlying principles of the WDM techniques?
- (b) Summarize the main categories of nonlinear effects that occur in optical communication systems. (15)

008702

December 2023

B.Tech. (ECE) - VII SEMESTER

Fiber Optic Communication

(ECEL-704)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

1. (a) Describe the function of core and cladding in optical fiber. (1.5)
- (b) Calculate number of modes of an optical fiber having diameter of 50 μm & $n_1 = 1.48$ & $n_2 = 1.46$ having operating wavelength 0.82 μm . (1.5)

- (c) Define direct bandgap materials and indirect bandgap materials. (1.5)
- (d) Calculate the refractive indices of the core and the cladding of an optical fibre whose $NA = .204$ and $\Delta = 0.01$. (1.5)
- (e) What will be the transmission length caused by the fiber loss if $P_{in} = 1$ mW and $P_{out} = 0.75$ mW with fiber attenuation $a = 0.5$ dB/Km? (1.5)
- (f) A photo diode has a quantum efficiency of 65% when photons of energy of 1.5×10^{-19} J are incident upon it. (i) Find the operating wavelength of the photodiode, (ii) Calculate the incident optical power required to obtain a photo current of 2.5 nA when the photodiode is operating as described above. (1.5)
- (g) Explain the need of isolator in optical network. (1.5)
- (h) Write the working Principle of OTDR. (1.5)
- (i) List the advantages and disadvantages of using WDM in optical fiber communication system. (1.5)
- (j) Narrate the characteristics of Solitons along with its advantage. (1.5)

PART-B

2. (a) Differentiate between step index and Graded index fiber. How the rays do propagates in graded index fiber? (10)

- (b) Draw a block diagram of fibre optic communication system and describe the function of each component. (5)
3. (a) A long single mode fiber has an attenuation of 0.5 dB/Km, when operating at a wavelength of $1.55 \mu\text{m}$. The fiber core diameter is $6 \mu\text{m}$ and laser source bandwidth is 400 MHz. Compare the threshold optical powers for Stimulated Brillouin and Raman Scattering within the fiber for the wavelength of $1.55 \mu\text{m}$. (5)
- (b) Explain the surface emitters and edge emitter LEDs. (10)
4. (a) Develop the expression for total dispersion in single mode fiber.
- (b) What is a fiber coupler? Explain about three and four port couplers. (15)
5. (a) Why is erbium used in EDFA? Describe the structure of an EDFA & explain the function of each component. (5)
- ⇒ (b) Explain in detail the operation of Avalanche Photo Diode with its structure. (10)
6. ⇒ (a) Explain in detail the operation of Avalanche Photo Diode with its structure. (10)