Printed Pages: 02 **Sub Code: KEC-058**

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B.TECH
(SEM V) THEORY EXAMINATION 2022-23
OPTICAL COMMUNICATION

Time: 3 Hours ***Total Marks: 100***

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

(a) Define goos- haenchen shift in optical fiber waveguide.
(b) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine the critical angle at the core–cladding interface.
(c) What are the causes of attenuation in optical communication?
(d) Define the polarization of light in optical communication.
(e) A lens-coupled surface-emitting LED launches 190 μW of optical power into a multimode step index fiber when a forward current of 25 mA is flowing through the device. Determine the overall power conversion efficiency when the corresponding forward voltage across the diode is 1.5 V.
(f) What are the advantages of LED light?
(g) When $3x10^{11}$photons each with a wavelength of 0.85 μm are incident on a photodiode, on average 1.2×10^{11}electrons are collected at the terminals of the device. Determine the quantum efficiency.
(h) Define optical detector in optical communication.
(i) Define quantum limit in optical communication.
(j) What is mean by Eye pattern in optical communication?

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

(a) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. determine: (i) the critical angle at the core–cladding interface; (ii) the *NA* for the fiber; (iii) the acceptance angle in air for the fiber.
(b) What is mean by dispersion? Describe the Intramodal dispersion.
(c) What are the drawbacks of LEDs in comparison with injection lasers? Describe various type of LED structure with their diagram.
(d) A germanium *p–i–n* photodiode with active dimensions of 100 × 50μm has a quantum efficiency of 55% when operating at a wavelength of 1.3 μm. The measured dark current at this wavelength is 8 nA. Calculate the noise equivalent power and specific detectivity for the device. It may be assumed that dark current is the dominant noise source.
(e) Describe the homodyne detection and heterodyne detection.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Draw and explain the basic block diagram of optical fiber communication system and also describe the advantage of optical fiber communication.

(b) What is graded index fibers in optical fiber communication? A graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fiber has a numerical aperture of 0.2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1μm.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is kerr effect in optical fiber communication? Describe the fiber bend losses in optical fiber.

(b) Describe the various types of nonlinear scattering losses in optical wave guide.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) The radiative and non radiative recombination lifetimes of the minority carriers in the active region of a double-heterojunction LED are 80 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87μm at a drive current of 40 mA.

(b) Describe the optical feedback and laser oscillation in optical waveguide.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Describe the working principle of PIN photodiode with proper diagram.

(b) Define the mode of laser and describe the threshold condition for laser oscillation.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the basic concept of Free Space Optics (FSO) based communication System with its application in fiber optics.

(b) Describe the multichannel & multiplexing transmission techniques in fiber optics.