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Total Number of Pages: 02

Course: B.Tech
Sub_Code: REL4G002/REE4G002

4thSemester Regular/Back Examination: 2023-24
SUBJECT: OPTOELECTRONIC DEVICES AND INSTRUMENTATION
BRANCH(S): ELECTRICAL, EEE

Time: 3 Hour

Max Marks: 100

Q.Code: P174

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- What is Numerical Aperture (NA) of an optical fiber, what is its significance?
- What is SSMF, its merits, demerits and applications?
- What is the difference between fiber attenuation and dispersion?
- What is the difference between connector and splice?
- Name the detectors used for fiber optic communication system.
- Define responsivity of PIN diode.
- What is the principle of operation of MZ modulator?
- How displacement can be measured with the help of fiber?
- What is an optical polarizer?
- Explain the principle of operation of OTDR.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- A step-index fiber has a numerical aperture of 0.19 and core diameter of 92 μm . Determine the normalized frequency parameter of the fiber when light of wavelength 0.85 μm is transmitted through it. Also estimate the number of guided modes propagating in the fiber.
- What are the types of fiber, explain in detail with their applications?
- A 1550 nm digital fiber optic link needs to operate at 500 Mb/s over 120 km, the fiber has a loss of 0.2 dB/km, and there are splices with loss of 0.11 dB at every km. The coupling loss at the receiver is 1.8 dB and the receiver uses InGaAs APD with sensitivity of -45 dBm, Calculate the laser power need to launch assuming system margin of 8 dB.
- Explain the working details of ILD.
- Calculate the emitted power of a LED operating at 810 nm for which external quantum efficiency is 0.013, internal quantum efficiency is 0.77, current through LED is 32 mA.

- f) Calculate the maximum thickness of the guide slab of a symmetrical planar wave guide so that it supports the 1st 10 modes. Take $n_1=3.65$, $n_2=3.59$, and $\lambda = 0.95 \mu\text{m}$. Calculate also the maximum and minimum values of the propagation constant β .
- g) Write the required characteristics for the sources and detectors of optical systems.
- h) Explain in detail about optical couplers and their performance parameters.
- i) Distinguish between PIN and APD.
- j) What is a fiber-based strain sensor, explain in detail?
- k) Explain the operation of Mach-Zehnder (MZ) modulator with neat diagram.
- l) With neat diagram, explain about fiber optic gyroscope.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 Draw the complete block diagram of fiber optic system. Explain about each block in detail. (16)
- Q4 What are the optical sources used, mention their types, merits, demerits, applications with their constructional details? (16)
- Q5 What are the optical detectors used? Mention their types, merits, demerits, applications with their constructional details. (16)
- Q6 What are the various optical sensing devices used? Explain about their applications with their constructional details. (16)