15EC82

USN

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fiber Optics and Networks

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. What are the advantages of optical fiber communication? **(04 Marks)**
    b. Explain the photonic crystal fiber with cross-sectional end view of the structure of an index guiding photonic crystal fiber. **(06 Marks)**
    c. A silica 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 in air for the fiber
    ii) The numerical aperture for the fiber
    iii) The acceptance angle in air for the fiber. **(06 Marks)**

OR

2   a. With suitable structures give comparison of conventional single mode and multi mode step index and graded index optical fibers. **(06 Marks)**
    b. Explain briefly about fiber materials used in optical communication. **(06 Marks)**
    c. A multimode step index fiber with a core diameter of 80μm and a relative index difference of 1.5% is operating at a wavelength of 0.85μm. If the core refractive index is 1.48.
    Estimate:
    i)   The normalized freq. for the fiber
    ii) The number of guided modes. **(04 Marks)**

Module-2

3   a. Explain about material absorption losses in an optical fiber. **(06 Marks)**
    b. Explain the significance of fiber connector with relevant diagram explain the function of cylindrical ferrule connector. **(06 Marks)**
    c. A glass fiber exhibits material dispersion given by $\left|\lambda^2(d^2n_1/d\lambda^2)\right|$ of 0.025. Determine the material dispersion parameter at a wavelength of 0.85μm and estimate the rms pulse broadening per kilometer for a good LED source with an rms spectral width of 20nm in this wavelength. **(04 Marks)**

OR

4   a. Explain the fiber bend loss with relevant diagram and expressions. **(06 Marks)**
    b. Explain intermodal dispersion. With suitable diagram show the paths taken by the axial and an extreme meridional ray in a perfect multimode step index fiber. **(06 Marks)**
    c. Write a note on fiber splices. **(04 Marks)**

Module-3

5   a. Draw the diagram of a typical GaAIAS double Hetrostructure LED along with energy band diagram and refractive index profile and explain. **(10 Marks)**

b. Explain the terms :
   (i) Spontaneous emission
   (ii) Stimulated emission
   (iii) Quantum efficiency. (06 Marks)

OR

6 a. Explain Fabry–Perot resonator cavity of laser with a neat diagram. (06 Marks)
   b. Briefly discuss the possible sources of noise in optical fiber receiver. (06 Marks)
   c. A GaAs laser operating at 850nm Los 560µm length and refractive index n = 3.7. What are the frequency and over length spacing's? (04 Marks)

Module-4

7 a. Explain the operational principle and implementations of WDM with diagram. (08 Marks)
   b. Explain polarization independent Isolator with a neat diagram. (08 Marks)

OR

8 a. Explain optical circulators and optical add/drop multiplexers in detail. (06 Marks)
   b. Explain the amplification mechanism in EDFA amplifier with the help of energy band diagram. (10 Marks)

Module-5

9 a. Explain public telecommunication network review with neat diagram. (08 Marks)
   b. Explain an optical packet switched network with neat diagram. (08 Marks)

OR

10 a. Explain the concept of optical burst switching. (08 Marks)
   b. Explain the different types of optical networking node elements. (08 Marks)

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