CBCS SCHEME

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15EC82

Eighth Semester B.E. Degree Examination, July/August 2022
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. Describe any five important advantages of optical fiber communication over other communication. **(10 Marks)**

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

(i) The critical angle at the core-cladding interface.
(ii) The NA for the fiber.
(iii) The acceptance angle in air for the fiber. **(06 Marks)**

OR

2 a. With relevant diagrams, explain the different types of optical fibers, considering the refractive index profile, number of modes and material used. **(12 Marks)**

b. A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm, If the core refractive index is 1.48, estimate:

(i) The normalized frequency for the fiber;
(ii) The number of guided modes. **(04 Marks)**

Module-2

3 a. Derive an expression for r.m.s pulse broadening due to intermodal dispersion in multimode step index fiber. **(08 Marks)**

b. Explain different absorption mechanisms in optical fiber. **(08 Marks)**

OR

4 a. Explain the different types of bending losses in optical fiber. **(06 Marks)**

b. A step index fiber has a core refractive index of 1.5 and a core diameter of 50 μm. The fiber is jointed with a lateral misalignment between the core axes of 5 μm. Estimate the insertion loss at the joint due to the lateral misalignment assuming a uniform distribution of power between all guided modes when :

(i) There is a small air gap at the joint ;
(ii) The joint is considered index matched. **(06 Marks)**

c. Explain V-groove optical fiber splices technique. **(04 Marks)**

Module-3

5 a. Derive the expression for quantum efficiency and output power for an LED. **(08 Marks)**

b. Describe the different noise sources affecting the photo-detector along with appropriate expressions. **(08 Marks)**

OR

6 a. Starting from rate equations, derive the expression for the number of photons / unit volume resulting from stimulated and spontaneous emissions in LASER diode. **(10 Marks)**

b. Draw and explain two types of front-end amplifier used in optical fiber communication. **(06 Marks)**

Module-4

7 a. Explain the operational principle and implementations of WDM with diagram. **(08 Marks)**

b. Describe the working principle of isolators and circulators with suitable diagram. **(08 Marks)**

OR

8 a. Draw the energy-level diagram indicating the transition processes in erubium – doped silica fiber amplifier and explain the amplification mechanism. **(06 Marks)**

b. Based on general application, explain three types of optical amplifiers with relevant diagram. **(10 Marks)**

Module-5

9 a. Explain the different types of optical networking node elements. **(10 Marks)**

b. Explain ATM protocol architecture. **(06 Marks)**

OR

10 a. Explain public telecommunications networks review with neat diagram. **(10 Marks)**

b. Explain an optical packet switching network with neat diagram. **(06 Marks)**

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