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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 erbium – 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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