B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(8th Semester)

Course No: ECC-802A

(Fiber Optics Communication)

Full Marks: 50
Pass Marks: 25
Time: 2 hours

Note:

1. Attempt any five questions.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

1. a) Explain with block diagram the fundamentals of optical communication.

   b) What is normalized frequency?

   c) A multimode step index fiber with a core diameter of 80 μm and a relative refractive index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48, estimate the normalized frequency for the fiber and number of guided modes. 5+2+3

2. a) What is dispersion in optical fiber?

   b) Explain different types of dispersion which affects the performance of fiber optic system.

c) A step-index optical fiber has numerical aperture of 0.2 and a cladding refractive index 1.59. Determine-

i) The acceptance angle of the fiber in water.

ii) The critical angle of core-cladding interface.

iii) Number of mode transmitted at a 1300nm and 25μm core radius. 1+6+3

3. a) Discuss the principle of operation of laser diode. Mention the effect of temperature on the performance of a laser diode.

b) Compare LED and LASER as source in optical fiber communication. 4+1+5

4. a) Discuss with the aid of suitable diagram, the three types of fiber-to-fiber misalignment which may contribute to insertion loss at a joint.

b) Discuss the pulse broadening in graded index fibres.

c) A multimode graded index fiber exhibits total pulse broadening of 0.1μsec over a distance of 12km. Calculate–

i) The maximum possible bandwidth on the link assuming no ISI

ii) The pulse broadening per unit length

iii) The bandwidth length product of the fiber. 5+2+3

5. a) What is fiber optic connector?

b) Explain with proper diagram, the different types of fiber optic connectors.

c) A photo diode has quantum efficiency of 65% when photons of energy 1.5×10^{-19} are incident on it. Calculate-

i) At what wavelength is the photo diode operating.

ii) The incident optical power required to obtain a photo current of 2.5μA when the photo diode is operating on given condition. 1+5+4

6. a) What is wavelength converter? Mention its different categories.

b) A 2x2 bi-conical tapered fiber coupler has an input optical power $P_0 = 300\mu W$. The output powers at the three other ports are $P_1 = 150\mu W, P_2 = 65\mu W, and\ P_3 = 8.3nW$. Compute the performance parameters of the fiber coupler.

c) Define tuneable filters and name different types of tuneable filter. 2+5+3

7. a) Explain the principle of operation of circulator.

b) Name various performance parameters of optical coupler.

c) Describe the operation of optical amplifier. 4+2+4

8. a) Explain the different types of multiplexing schemes that are used in optical fiber communication.

b) With the neat sketch explain WDM scheme. Also mention its features. 5+5

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