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Eighth Semester B.E. Degree Examination, July/August 2022 Optical Communication Networks

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. With the help of neat diagram, explain the main blocks of an optical fiber communication link. (08 Marks)
- b. Derive an expression for Numerical aperture using ray theory transmission. (08 Marks)
- c. What are the advantages and disadvantages of optical fiber? (04 Marks)

OR

- 2 a. With the help of neat diagram, discuss the structure of single mode and multimode step index fiber with appropriate mathematical equations. (08 Marks)
- b. Determine the normalized frequency and guided modes at 820 nm for a SIF having core diameter of 50 μm , $n_1 = 1.48$, $n_2 = 1.46$. (06 Marks)
- c. Explain photonic crystal fiber. (06 Marks)

Module-2

- 3 a. Explain different absorption mechanism in optical fibers. (08 Marks)
- b. Illustrate the different types of scattering losses in fiber with suitable equations. (08 Marks)
- c. A multimode fiber with core RI of 1.5 a relative refractive index difference of 3% and an operating wavelength of 0.82 μm . Estimate the critical radius of curvature at which large bending losses occur. (04 Marks)

OR

- 4 a. Derive an expression for pulse spreading due to material dispersion. (08 Marks)
- b. A 6 km optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative refractive index difference 1%. Estimate the delay between the slowest and fastest modes at the fiber output and also find the rms pulse broadening due to intermodal dispersion on the link. (08 Marks)
- c. With a neat diagram, explain the fusion splice technique for optical fibers. (04 Marks)

Module-3

- 5 a. Draw and explain the cross sectional view of typical Al Ga As heterojunction LED along with energy band diagram. (08 Marks)
- b. Explain Fabry-Perot resonator cavity of Laser with a neat diagram. (08 Marks)
- c. Explain the terms :
(i) Spontaneous emission (ii) Stimulated emission (iii) Quantum efficiency. (04 Marks)

OR

- 6 a. Explain the principles of photodiode with suitable diagram. (08 Marks)
- b. Derive an equation for optical receiver sensitivity. (08 Marks)
- c. Explain the different amplifiers used in optical receiver. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

**Module-4**

- 7 a. Explain the operational principles of WDM with relevant diagram. (06 Marks)
b. With a layout, explain basic 2*2 Mach Zehender interferometer and derive the length difference in the interferometer. (08 Marks)
c. Describe the principle of working of isolators and circulators using suitable diagrams. (06 Marks)

OR

- 8 a. Write the amplification mechanism of an EDFA amplifier with the help of energy band diagram. (08 Marks)
b. Explain briefly the working of thin film resonant cavity filter and its applications. (08 Marks)
c. Explain semiconductor optical amplifiers. (04 Marks)

Module-5

- 9 a. Explain public telecommunication network with relevant diagram. (08 Marks)
b. Explain briefly OSI reference model. (06 Marks)
c. Explain an optical packet switched network with neat diagram. (06 Marks)

OR

- 10 a. With a neat diagram, explain synchronous networks. (08 Marks)
b. Explain an optical circuit switched network with a neat diagram. (06 Marks)
c. Explain generic structure of an optical burst switching networks. (06 Marks)

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