CBCS SCHEME

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18TE71

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With neat diagrams, explain optical fiber communication system and also a digital optical fiber link. **(10 Marks)**

b. Explain total internal reflection and acceptance angle in ray theory transmission with diagrams. **(07 Marks)**

c. List out the advantages of optical fiber communication. **(03 Marks)**

OR

2 a. What are skew rays? Describe the transmission of skew rays and derive equations to calculate acceptance angle for skew ray in optical fiber communication. **(10 Marks)**

b. Discuss on photonic crystal fibers. **(06 Marks)**

c. A silica optical fiber with a core diameter large enough has a refractive core 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 acceptangle angle in air for the fiber. **(04 Marks)**

Module-2

3 a. Explain linear and non-linear scattering losses. **(10 Marks)**

b. Write a note on the following;
i) Attenuation
ii) Material absorption losses. **(07 Marks)**

c. A long single-mode optical fiber has an attenuation of 0.5 dB km^{-1} when operating at wavelength of 1.3μm. The fiber core diameter is 6μm and the laser source band width is 600MHz. Compare the threshold optical powers for stimulated Brillouin and Raman scattering within the fiber at the wavelength specified. **(03 Marks)**

OR

4 a. With neat diagrams, explain fiber alignment and joint loss. **(05 Marks)**

b. Describe the process of fusion splices with relevant sketches. **(05 Marks)**

c. Give a brief description of optical fiber couplers and connectors with relevant diagrams. **(10 Marks)**

Module-3

5 a. Explain surface emitters and edge emitters of LED configurations with diagrams. **(10 Marks)**

b. Discuss Quantum efficiency and LED power with necessary mathematical equations. **(06 Marks)**

c. A GaAs laser operating at 850nm has a 500 - μm length and a refractive index n = 3.7.
i) What are the frequency spacing and wavelength spacing?
ii) I_{f_1} at the half-power point, $\lambda - \lambda_0 = 2nm$, what is the spectral width σ of the gain? **(04 Marks)**

OR

6 a. Explain Fabry-Perot resonator cavity for a laser diode with diagrams and sketch its characteristics. **(10 Marks)**

b. Derive the laser diode rate equations for the relationship between optical output power and diode drive current. **(06 Marks)**

c. A double-hetero junction InGaAsP LED emitting at wavelength 1310nm has radiative and non-radiative recombination times of 30 and 100ns respectively. The drive current is 40mA. Find:

i) The bulk recombination time

ii) The internal quantum efficiency

iii) The internal power level. **(04 Marks)**

Module-4

7 a. Explain the operational principles of WDM. Also sketch the transmission bandwidths in the O and C bands. **(10 Marks)**

b. Discuss the operation of optical isolators and circulators. **(06 Marks)**

c. Brief about the concept of demultiplexers function using Fiber Bragg Grating filter. **(04 Marks)**

OR

8 a. Explain active optical components. **(10 Marks)**

b. Give a brief description of diffraction gratings and tunable light sources. **(06 Marks)**

c. Explain Raman amplifier with setup diagram for amplification system and spectrum. **(04 Marks)**

Module-5

9 a. Explain optical network concepts with suitable diagrams. **(10 Marks)**

b. Discuss with neat sketches the function of optical node and switching elements. **(06 Marks)**

c. Brief on Public Telecommunications network. **(04 Marks)**

OR

10 a. Explain Wavelength Division Multiplexing networks. **(06 Marks)**

b. Describe an Internet Protocol for optical networks. **(10 Marks)**

c. Discuss on the structure of a metropolitan area network. **(04 Marks)**

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