CBCS SCHEME

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18TE71

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Optical Communication

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Discuss the advantages/disadvantages of optical fiber communication. **(06 Marks)**

b. Derive the equations of Numerical Aperture considering the ray path for meridonial ray in optical fiber communication. **(08 Marks)**

c. A relative refractive index difference for an optical fiber is 1%. Estimate the numerical aperture and solid acceptance angle in air for the fiber when the core index is 1.46. Calculate the critical angle at the interface. **(06 Marks)**

OR

2 a. Discuss photonic crystal fibers and explain index guided microstructures and photonic bandgap fibers with suitable diagrams. **(08 Marks)**

b. With neat schematic, explain refractive index profile and ray transmission in multi-mode step index and graded index. **(08 Marks)**

c. Determine the cut off wavelength for a step index fiber for single mode operation when the core refractive index and radius are 1.46 and 4.5 μm, with relative index difference being 0.25%. **(04 Marks)**

Module-2

3 a. Explain the linear and Non-Linear scattering losses with suitable equations. **(10 Marks)**

b. A 6km optical link consists of multimode step index fiber with core refractive index of 1.5 and relative refractive index difference of 1%. Estimate:

i) The delay difference between the slowest and fastest modes at fiber output.
ii) The rms pulse broadening due to intermodal dispersion on link.
iii) The maximum bit rate.
iv) The Bandwidth-Length product. **(10 Marks)**

OR

4 a. Discuss the Fusion and Mechanical fiber splices. **(08 Marks)**

b. Explain the significance of fiber connectors and with schematics, discuss cylindrical ferrule connectors. **(06 Marks)**

c. A graded index fiber has a parabolic refractive index profile ($\alpha = 2$) and core diameter of 50μm. Estimate the insertion loss due to 3μm lateral misalignment at fiber joint when there is index matching and assuming.

i) There is uniform illumination of all guided modes only.
ii) There is uniform illumination of all guided and leaky modes. **(06 Marks)**

Module-3

5 a. Explain the electron recombination and associated photon emission for direct and indirect bandgap materials with relevant diagrams. **(08 Marks)**

b. Explain and derive the equations for quantum efficiency and LED power. **(06 Marks)**

c. With neat schematic, explain the basic methods for achieving current confinement in laser diodes. **(06 Marks)**

OR

6 a. Explain the generic structure of front end amplifiers in optical receiver. **(08 Marks)**

b. Discuss Double-Heterostructure photodiodes. **(04 Marks)**

c. In InGaAs in photodiode has following parameters at wavelength of 1300nm, I_D = 4nA, η = 0.90, R_L = 1000Ω, surface leakage current is negligible. The incident optical power is 300nW (-35dBm) and receiver bandwidth is 20MHZ. Find: i) Photocurrent ii) Shot-noise current iii) Dark current iv) Thermal noise. **(08 Marks)**

Module-4

7 a. Explain in detail the polarization independent isolators and 3 port circulators with relevant diagrams. **(10 Marks)**

b. Explain in detail the operational principles and implementation of WDM network with optical amplifiers. **(07 Marks)**

c. The input wavelength of 2 × 2 silicon Mach-Zender interferometer multiplexer are separated by 10GHZ (i.e $\Delta\lambda$ = 0.08nm at 1550nm) with η_{eff} = 1.5. Determine waveguide length difference. **(03 Marks)**

OR

8 a. Write a short note on FBG applications. **(05 Marks)**

b. Discuss three methods of adjusting the wavelength of tunable Bragg grating of Tunable optical fibers. **(07 Marks)**

c. Explain the amplification mechanism of Erbium-Doped fiber amplifiers. **(08 Marks)**

Module-5

9 a. Explain optical networking node elements and Optical Cross Connect (OXC) with neat diagrams. **(08 Marks)**

b. Explain Broadcast and select network and wavelength routing in wavelength. **(08 Marks)**

c. Describe the different implementation schemes for IP over WDM/DWDM. **(04 Marks)**

OR

10 a. Explain the optical circuit switched network with suitable diagram. **(05 Marks)**

b. Describe the waveband switching network architecture employing a Multi Granular Optical Cross Connect (MG-OXC). **(07 Marks)**

c. Write short notes on optical fiber access networks and local area networks. **(08 Marks)**

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