CBCS SCHEME

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17EC82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fiber Optics and Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Outline any light advantages of optical fibers over copper wires or coaxial cables that are used in communication links as transmission media. **(08 Marks)**

b. Define Numerical Aperture(NA) and what is its significance. With an optical ray diagram and by derivation relate NA and core-cladding refractive indices as well as NA and relative refractive index 8. **(08 Marks)**

c. With a simple block diagram, briefly explain the digital optical communication link that employs optical fiber. **(04 Marks)**

OR

2 a. With neat sketches of the refractive index profile and light ray transmissions, explain the features of : i) multimode step index fiber ii) single mode step index fiber iii) multimode graded index fiber (parabolic RI profile). **(11 Marks)**

b. A multimode step index fiber with core diameter of 80μm and a relative index difference of 1.5% is operating at a wave length of 0.85μm. If core RI is 1.48, find :
i) The normalized frequency (or V number for the fiber)
ii) The number of modes guided by the fiber. **(04 Marks)**

c. Compare the Meridional optical rays and skew optical rays in an optical fiber. **(05 Marks)**

Module-2

3 a. Discuss the Rayleigh scattering losses. **(08 Marks)**

b. A low loss fiber has average loss of 3dB/km at 900nm compute the length over which
i) Power decreases by 50% ii) Power decreases by 75%. **(08 Marks)**

c. Write short note on Absorption in Optical fiber. **(04 Marks)**

OR

4 a. Discuss the Intramodal dispersion. **(08 Marks)**

b. When mean optical power launched in to 8km length of fiber is 12μw, the mean optical power at the output is 3μm. Determine : i) Overall signal attenuation in dB
ii) The overall signal attenuation for 10km, optical link using the same fiber with splices at 1km intervals, each giving attenuation of 1dB. **(08 Marks)**

c. Write brief note on Fiber splices. **(04 Marks)**

Module-3

5 a. With proper energy diagram, explain the construction and working of Hetro junction LED structure. **(10 Marks)**

b. Describe Febry – Perot Resonator. **(04 Marks)**

c. The radiative and non – radiative life times of minority carrier in the active regions of a double hetrojunction LED are 60 ns and 90 ns respectively. Determine the total carrier recombination time and optical power generated internally if peak emission wavelength is 870 n m and drive current is 40 mA. **(06 Marks)**

OR

6 a. Explain the working principle of APD photodetector with neat diagram. **(06 Marks)**
b. Explain the comparison between LED and Laser Diode. **(06 Marks)**
c. Derive the expression for Quantum efficiency and Responsivity of Photodetector. **(08 Marks)**

Module-4

7 a. With a neat block diagram, explain the operational principles and implementation of a WDM optical network. **(06 Marks)**
b. Explain the construction and working of an optical isolator. **(08 Marks)**
c. Based on the general applications, explain the three types of optical amplifiers with relevant block diagrams. **(06 Marks)**

OR

8 a. Explain the construction and working of a dielectric thin film optical filter. **(06 Marks)**
b. With relevant diagrams, explain the construction and operation of reflection and transmission type diffraction gratings. **(08 Marks)**
c. With neat diagram, explain the operation of a MEMS technology based actuation mechanism. **(06 Marks)**

Module-5

9 a. Discuss SONET and STS – 1/N frame structure. **(10 Marks)**
b. Write note on: optical network topologies and network routing. **(10 Marks)**

OR

10 a. Describe OSI reference model used for networks design. **(10 Marks)**
b. Write short note on LAN or FDDI and long haul optical networks. **(10 Marks)**

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