



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

- Outline any light advantages of optical fibers over copper wires or coaxial cables that are used in communication links as transmission media. (08 Marks)
 - 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 n_1 . (08 Marks)
 - With a simple block diagram, briefly explain the digital optical communication link that employs optical fiber. (04 Marks)

OR

- 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)
 - A multimode step index fiber with core diameter of $80\mu\text{m}$ and a relative index difference of 1.5% is operating at a wave length of $0.85\mu\text{m}$. If core RI is 1.48, find :
 - The normalized frequency (or V number for the fiber)
 - The number of modes guided by the fiber. (04 Marks)
 - Compare the Meridional optical rays and skew optical rays in an optical fiber. (05 Marks)

Module-2

- Discuss the Rayleigh scattering losses. (08 Marks)
 - A low loss fiber has average loss of 3dB/km at 900nm compute the length over which
 - Power decreases by 50%
 - Power decreases by 75%. (08 Marks)
 - Write short note on Absorption in Optical fiber. (04 Marks)

OR

- Discuss the Intramodal dispersion. (08 Marks)
 - When mean optical power launched in to 8km length of fiber is $12\mu\text{w}$, the mean optical power at the output is $3\mu\text{w}$. Determine :
 - Overall signal attenuation in dB
 - The overall signal attenuation for 10km, optical link using the same fiber with splices at 1km intervals, each giving attenuation of 1dB. (08 Marks)
 - Write brief note on Fiber splices. (04 Marks)

Module-3

- With proper energy diagram, explain the construction and working of Hetro junction LED structure. (10 Marks)
 - Describe Feby – Perot Resonator. (04 Marks)
 - 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 nm 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)
