OPTICAL FIBER COMMUNICATION

Time: 3 hrs   **Max. Marks:100**

PART-A

1 a. What are the advantages, applications and disadvantages of optical fiber as compared to copper cables?(8M)

  b. Derive the numerical aperture of step index fiber (SI) from Snell's law.(6M)

  c. A multimode SIF has V number of 75, NA= 0.3, R.I. of core is 1.458 and operates at 820nm. Find core radius, R.I of cladding, fractional change in R.I. and number of modes gets propogated.(6M)

2 a. A 30 km long fiber at 1300 nm has an attenuation of 0.8 dB/km. If 200μm power is launched into the fiber, find the output power in dBm and in watts.(6M)

  b. Briefly explain, different mechanisms which cause absorption losses in optical fibers.(6M)

  c. Derive an expression for pulse spreading and dispersion, which is a function of wavelength, using time delay.(8M)

3 a. Draw the diagram of typical GaAlAs double hetero structure LED, along with energy band diagram and refractive index profile and explain.(8M)

  b. Sketch and explain the Fabry-Perot resonator cavity of laser.(6M)

  c. A photodiode has a quantum efficiency of 65%, when photons of energy 1.5×10^{-19} Joules are incident upon it.

   1) At what wavelength is the photodiode operating?

   2) Calculate the incident optical power required, to obtain a photocurrent of $2.5\mu A$.(6M)

4 a. A silica multimode step index fiber has a core refractive index of 1.46. Determine the optical loss in decibels due to Fresnel reflection at a fiber joint with:

   1) A small air gap, 2) an index matching epoxy which has a refractive index of 1.40.

   It may be assumed that the fiber axes and end faces are perfectly aligned at the joint.(6M)

  b. explain different types of fiber splicing techniques.(6M)

  c. Briefly describe the principle of operation of the following:

   1) Expanded beam connectors.

   2) Fiber fused biconical taper coupler.(8M)

PART-B

5 a. With a schematic diagram, explain the working of an optical receiver.(6M)

  b. What are the noise sources and distributions that arise in optical pulse detection mechanism? Explain.(8M)

  c. Write a note on Burst-mode receivers.(6M)

6 a. Explain multichannel A.M. technique employed in broadband analog applications.(5M)

  b. What is RF-over-fiber technique? Explain.(5M)

  c. What is rise time budget analysis? Derive an expression for the total system rise time budget in terms of transmitter fiber and receiver rise time.(10M)

7 a. What is WDM? How is it implemented?(5M)

  b. Explain the design and operation of a polarization independent isolator.(5M)

  c. Explain the importance of the following active components used in WDM based on MEMS.

    1) Variable optical attenuators

    2) Tunable optical filters.(10M)

8 a. What are the applications of optical amplifiers?(4M)

  b. An EDFA is pumping 28mw of pump power at 970nm. If the gain at 1570 nm is 30 dB. Determine maximum input and output signal power and also determine power conversion efficiency.(6M)

  c. Describe

    1) SONET/SDH frame formats

    2) SONET/SDH Rings.(10M)

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