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06EC72

Seventh Semester B.E. Degree Examination, December 2010

Optical Fiber Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What are the advantages of optical fiber communication? **(06 Marks)**

b. Explain the structure of single mode and multimode step index and graded-index optical fibers with cross section and ray path. **(07 Marks)**

c. What are the different fiber materials used in optical communication? Explain briefly. **(07 Marks)**

2 a. Explain the different types of bending losses in optical fiber. **(08 Marks)**

b. Explain the material dispersion in optical waveguides. **(06 Marks)**

c. Explain the following parameters on optical fiber:
   i) Absorption
   ii) Scattering loss **(06 Marks)**

3 a. With schematic of an edge-emitting double heterojunction LED, explain the operation. **(06 Marks)**

b. Give comparison between LED and laser diode considering the different parameters. **(06 Marks)**

c. A given APD has a quantum efficiency of 65% at wavelength of 900 nm. If 0.5 microwatt of optical power produces a multiplied photocurrent of 10 micro Amps, find the multiplication factor M. **(08 Marks)**

4 a. Explain the mechanical misalignment between two fibers. **(06 Marks)**

b. An optical source has refractive index of 3.6 and is coupled to a fiber of 1.48 refractive index. Consider the medium between fiber and source has similar index as that of fiber. Calculate Fresnel reflection and loss of power in dBs. **(06 Marks)**

c. Explain the following briefly:
   i) Fiber splices
   ii) Fiber connectors. **(08 Marks)**

PART – B

5 a. With a neat diagram, explain the operation of transimpedance preamplifier equivalent circuit. **(06 Marks)**

b. An In GaAs PIN photodiode has the following parameters at a wavelength of 1300 nm : $I_D = 4$ nA, $\eta = 0.9$, $R_L = 1000\ \Omega$ and the surface leakage current is negligible. The incident optical power is 300 nw (-35 dBm) and the receiver bandwidth is 20 MHz. Find the various noise terms of the receiver. **(08 Marks)**

c. Explain the analog receiver briefly. **(06 Marks)**

6 a. With a diagram, explain the operation of multichannel AM briefly. **(06 Marks)**

b. Explain the radio over fiber concept of a broadband wireless access network for interconnecting antenna base stations with the central controlling office. **(07 Marks)**

c. What is rise time budget? Explain. Derive an expression for total rise time or total system rise time (t_{sys}). **(07 Marks)**

7 a. Explain the implementation of a typical WDM network containing various types of optical amplifiers. **(06 Marks)**

b. Explain the operation of a polarization-independent isolator made of three miniature optical components. **(07 Marks)**

c. Explain the operation of optical adding and dropping wavelengths with a 4 × 4 OADM device that uses miniature switching mirrors. **(07 Marks)**

8 Write short notes on the following: **(20 Marks)**

a. Optical amplifier

b. Semiconductor optical amplifier

c. SONET / SDH network services

d. Optical interface.

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