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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 :
 $I_D = 4 \text{ nA}$, $\eta = 0.9$, $R_L = 1000 \Omega$ 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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, af 1 to evaluator and /or equations written eg, 42+8 = 50, w... be treated as malpractice.

- 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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