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M.E. 2nd Semester (E.C.E.) Examination, May-2015

OPTICAL COMMUNICATION

Paper-MEEC-504

Time allowed : 3 hours] [Maximum marks : 100

Note : Attempt any five questions. All questions carry equal marks.

1. (a) Draw a block diagram of fiber optic communication system and describe the function of each component. 10
- (b) A typical relative refractive index difference for an optical fiber designed for long distance transmission is 1%. Estimate the N.A. and the solid acceptance angle in air for the fiber, when the core index is 1.46. Further, calculate the critical angle at the core-cladding interface within the fiber. It may be assumed that the concepts of geometric optics hold for the fiber. 10
2. (a) Show the electromagnetic spectrum region used for optical fiber communications. Why is it necessary to meet the total reflection requirement inside an optical fiber ? 4
- (b) Explain the difference between linear and non-linear scattering losses. 10
- (c) Explain in detail about the methods of fiber splicing. 6

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3. (a) What is the requirement for optical sources to feed into a fiber ? Enlist the advantage and disadvantages of LASER and LED. 10
- (b) Explain the concept of quantum-dot and quantum wire lasers and describe their operation in comparison with conventional injection laser diodes. <http://www.HaryanaPapers.com> 10
4. (a) What are the Benefits and drawbacks with the avalanche photodiode ? 10
- (b) Outline the advantages and drawbacks with the use of the RAPD as a detector for optical fiber communications. 10
5. (a) Explain different types of pre-amplifiers used in optical communication receivers. 10
- (b) Explain the three basic performance criteria of wavelength division multiplexing. 10
6. (a) Compare and contrast the attributes and drawbacks associated with direct modulation of the laser signal source and indirect modulation of the source in both ASK and FSK coherent optical fiber communication systems. 10

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- (b) Describe what is meant by phase diversity reception for coherent optical fiber communication systems. Discuss with the aid of a suitable block diagram the salient features of the in-phase and quadrature receiver when used for optical ASK demodulation. 10
7. (a) Explain the characteristics of LED with emphasis on optical output power, output spectrum modulation bandwidth and reliability.
- (b) Distinguish between the structures of Edge emitter and Surface emitter LED.
8. (a) Explain the various measures of efficiency in PIN photodiode and briefly explain the working principle of Schottky barrier photodiodes. 10
- (b) A silicon p-i-n photodiode has a quantum efficiency of 65% at a wavelength of $0.8 \mu\text{m}$. Determine :
- (i) The mean photocurrent when the detector is illuminated at a wavelength of $0.8 \mu\text{m}$ with $5 \mu\text{W}$ of optical power ;
- (ii) The rms quantum noise current in a post-detection bandwidth of 20 MHz;
- (iii) The SNR in dB, when the mean photocurrent is the signal. 10