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10EC/TE72

Seventh Semester B.E. Degree Examination, June/July 2019

## 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? (04 Marks)  
b. What is Numerical Aperture? Derive an expression for Numerical Aperture and Maximum acceptance angle in the case of step index optical fiber in terms of refractive indices of core and cladding material. (10 Marks)  
c. Compare step index fiber with Graded index fiber. (06 Marks)
- 2 a. Explain different types of attenuation in optical fiber. (08 Marks)  
b. Derive an expression for the pulse spread due to material dispersion using group delay concept. (06 Marks)  
c. A step index multimode fiber with a Numerical aperture of a 0.20 supports approximately 1000 modes at an 850 nm wavelength.  
i) What is the diameter of its core?  
ii) How many does the fiber support at 1320 nm and 1550 nm?  
iii) What percent of the optical power flows in the cladding in each case? (06 Marks)
- 3 a. Give comparison between LASER and LED. (06 Marks)  
b. i) With the diagram, describe the operation of surface emitting LED.  
ii) Explain the working of PIN photo detector with diagrams. (10 Marks)  
c. A given Silicon Avalanche photo diode has a quantum efficiency of 65% at a wavelength of 900 nm. Suppose 0.5  $\mu$  Watt of optical power produces a multiplied photocurrent of 10  $\mu$ A. Find the primary photocurrent and multiplication factor. (04 Marks)
- 4 a. Show that the optical power coupled into a step index fiber from an LED with Lambertian distribution is  $P = P_s(NA)^2$  for  $r_s \leq a$  with usual notations. (07 Marks)  
b. What are the principal requirements of good connectors? Explain the different types of connectors. (09 Marks)  
c. A GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index of 1.48. Calculate the optical power loss in dB at the joints when the fiber end and the source are in close physical contact. (04 Marks)

### PART – B

- 5 a. Draw a signal path through a digital link with relevant components and electrical waveforms at every stage. (06 Marks)  
b. Draw and explain the two types of front end amplifiers in optical fiber communication. (06 Marks)  
c. Draw and explain eye pattern and mark the fundamental measurement parameter. (08 Marks)

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

- 6 a. What is link power budget? Explain the link power budget with a relevant diagram. (06 Marks)
- b. Explain subcarrier multiplexing, with neat block diagram. (06 Marks)
- c. What is rise time budget? Explain its significance. Derive an expression for the system rise time budget in terms of transmitter, fiber and receiver rise time. (08 Marks)
- 7 a. Explain the Wavelength Division Multiplexing (WDM) network containing various types of optical amplifiers. (08 Marks)
- b. Explain the optical isolator with a design and operation of a polarization independent isolator mode of three miniature optical components. (06 Marks)
- c. Explain the operation of optical Add/Drop multiplexer, with a relevant diagram. (06 Marks)
- 8 Write short notes on:
- a. EDFA amplifier (07 Marks)
- b. SONET/SDH (07 Marks)
- c. Optical amplifier (06 Marks)

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