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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Electronics and Communication

Microwave and TV Engineering

01 EC 6211 : Optical Communication Systems

Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

PART A

1. a. Discuss the concept of Fiber modes. What is the significance of V parameter? 5

   b. A single mode fiber with core index n1 = 1.45 has an index step n1 − n2 = 0.005. Find the numerical aperture and calculate the core radius if the fiber has a cut off wavelength of 1μm. 4

2. a. Explain the working principle of semiconductor lasers. 6

   b. Define the terms slope efficiency, RIN and MPN. 3

3 a. An InGaAs PIN diode operating at a wavelength of 1300nm has dark current of 4nA, quantum efficiency is 75%, load resistance of 1K Ω. If incident optical power is 400nW and receiver bandwidth is 200MHz, calculate SNR. (Boltzmann Constant = 1.38×10^{-23} J/K). 9

PART B

4. a. Prove that the rise time Tr and the 3dB bandwidth Δf of a RC circuit are related by Tr Δf = 0.35. 4

   b. Make the rise-time budget for a 0.85μm, 10-km fiber link designed to operate at 50 Mb/s. The LED transmitter and the Si pin receiver have rise times of 10 and 15 ns, respectively. The graded-index fiber has a core index of 1.46, Δ = 0.01, and D = 80 ps/(km-nm). The LED spectral width is 50 nm. Can the system be designed to operate with the NRZ format? 5

5.	a.	Explain the gain mechanism in EDFAs. Discuss how EDFAs can be used to provide gain in L band.	9
6.	a.	Show that an ideal optical amplifier has a noise figure of 3dB.	4
	b.	Explain how stimulated scattering can provide gain in optical amplifiers.	5

PART C

7.	a.	Justify the existence of solitons in optical fibers.	3
	b.	What is the need of periodic amplification in soliton systems?	3
	c.	Explain lumped and distributed amplification schemes in soliton systems.	6
8.	a.	Draw the block schematic of a synchronous heterodyne receiver and explain.	6
	b.	Prove that SNR of heterodyne receiver is 3dB low that of homodyne receiver..	6
9.	a.	Explain how an arrayed waveguide structure can function as both multiplexer and de- multiplexer..	6
	b.	Explain with diagrams the method of multiplexing four wavelengths using Fiber Bragg grating and circulator.	6