APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Branch: 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. Explain various non-linear effects occur in optical fibers.   6

   b. An optical signal at a specific wavelength has lost 50% of its power after traversing 3 Km of fiber. What is the attenuation in dB/Km of this fiber.   3

2. a. With necessary diagrams explain the design features of an edge emitting LED.   5

   b. A heterojunction LED emitting at peak wavelength of 850 nm has radiative and non radiative recombination times of 25ns and 90ns respectively. If the drive current is 35mA find the internal quantum efficiency and internal power level.   4

3. a. Explain the working of Avalanche Photo Diode.   4

   b. A digital fiber optic link operating at 850nm requires a maximum BER of 10^{-9} Find the minimum incident optical power Pi that must fall on the photodetector having quantum efficiency 1 to achieve this BER at a data rate of 100 Mbps for a simple binary level switching scheme.   5

PART B

4. a. With a block diagram explain briefly a digital transmission link as an optical data link with waveforms at each stage.   4

   b. Make the power budget and calculate the maximum transmission distance for a 1550nm light wave system operating at 100Mb/s and using an Laser for launching 1mW of average power into the fiber. Assume 0.5dB/Km fiber loss, 0.2 dB splice loss every 2 Km, 1 dB connector loss at each end of fiber link, and 100nW receiver sensitivity. Allow 8dB system margin.   5

1

5. a. Explain the noise generation in EDFAs. 4

  b An EDFA produces output power of 27dBm for an input level of 2dBm at 1542nm. Find the amplifier gain and the minimum pump power required. 5

6. a. Explain the gain mechanism in a SOA. 4

  b. Show that the amplifier output saturation power is $P_{out,sat} = \frac{G_0 \ln 2}{G_0 - 2} P_{sat}$ 5

PART C

7. a. What are solitons? 2

  b. Draw and explain the block diagram of soliton communication link. 6

  c. What are the design constraints in soliton communication link? 4

8. a. Draw the block schematic of a synchronous heterodyne receiver and explain. 6

  b. Derive expression for SNR of heterodyne receiver in shot noise limit. 6

9. a. Assume that a 32 channel WDM system has a uniform channel spacing Δv = 100GHz and let the wavelength λ_1 = 1550nm. Calculate the wavelength spacing between first two channels and the last two channels (between 31 & 32). From the result what can be concluded about using an equal wavelength spacing? 6

  b. Explain with diagrams the method of multiplexing/demultiplexing wavelengths using arrayed waveguide grating. 6