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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015
Electronics and Communication 7 E
(Microwave and TV Engineering)
01 EC 6211 : Optical Communication Systems

Max Marks: 60   Duration: 3 Hours

(Answer any Two from Each Module)

Part- A

1. (a) Explain Group Velocity Dispersion occur in SM fibers.

   (b) A single mode fiber with core index $n_1 = 1.45$ has an index step $n_1 - n_2 = 0.005$. Find the numerical aperture and calculate the core radius if the fiber has a cut off wavelength of $1\mu m$.

   (5+4=9 Marks)

2. (a) With neat sketches explain the structure and operation of a VCSEL.

   (b) The threshold current of a semiconductor laser doubles when the operating temperature is increased by $50^0 C$. What is the characteristic temperature of the laser.

   (6+3=9 Marks)

3. (a) Explain the operation of Avalanch Photo Diode.

   (b) Photons at a rate of $10^{10}/s$ are incident on an APD with responsivity of $6 A/W$. Calculate the quantum efficiency and the photocurrent at the operating wavelength of $1.5\mu m$ for an APD gain of 10.

   (5+4=9 Marks)

Part- B

4. (a) Explain how looses and dispersion affect the long haul lightwave systems.

   (b) Make the power budget and calculate the maximum transmission distance for a $1550nm$ light wave system operating at 1Gb/s and using an Laser for launching $1mW$ of average power into the fiber. Assume 1dB/Km fiber loss, 0.2 dB splice loss every 2 Km, 1 dB connector loss at each end of fiber link, and $-30dBm$ receiver sensitivity. Allow 6dB system margin.

   (4+5=9 Marks)

5. (a) Explain the operation of EDFA.

    (b) An EDFA having gain of 20dB operating at pump wavelegth 980nm with pump power 30mW. If the signal wavelength is 1550nm find the maximum input power that can be fed to the amplifier and the corresponding output power obtained.

    (5+4=9 Marks)

6. (a) Explain the Raman Amplifier

    (b) Discuss the various precompensation schemes for dispersion management.

    (4+5=9 Marks)

Part- C

7. (a) Briefly explain fiber solitons. Differentiate between bright and dark solitons.

    (b) A 10GBps soliton system is operating at 1.55μm using fibers with $D = 2ps/(km - nm)$. the effective core area of the fiber is 50μm^2. Calculate the peak power and the pulse energy required for fundamental solitons of 30 ps width(FWHM). Use $n_2 = 2.6 \times 10^{-20} m^2/W$.

    (6+6=12 Marks)

8. Draw the block schematic of coherent optical receiver and explain. Prove that sensitivity of coherent optical receiver can be enhanced locally by increasing local oscillator power.

    (12 Marks)

9. (a) Estimate the capacity of a WDM system operating over the spectral region from 1.3 to 1.6 μm using 40Gb/s channels spaced apart by 50GHz.

    (b) Write short notes on AWG and Add-Drop multiplexer.

    (6+6=12 Marks)