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B.E / B.TECH (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2013

ELECTRONICS AND COMMUNICATION ENGINEERING

SEVENTH SEMESTER

EC 9402 – OPTICAL COMMUNICATION

(REGULATION – 2008)

Time: 3 hours **Max.Marks: 100**

Answer ALL Questions

Part A – (10 x 2 = 20 Marks)

1. An optical fiber with a relative refractive index difference of 1.5% and core refractive index of 1.48, is operating at a wavelength of 0.85 μm. Find the maximum core diameter so that it is suitable for single mode transmission.

2. An optical fiber link feeds -30 dBm signal to the detector. If the fiber length is 10 Km and has an attenuation constant of 2 dB/km, find the power launched to the fiber in Watts.

3. What is the significance of the unit for dispersion?

4. State the difference between Dispersion shifted and Dispersion flattened fibers.

5. Determine the gain threshold for a laser diode having L = 500μm, $R_1 = R_2 = 0.32$ and $\alpha = 20\ cm^{-1}$.

6. How do you provide wavelength tuning in a Laser diode ?

7. Calculate the circuit bandwidth of a PIN photo diode receiver having photo diode capacitance as 3 pF with a load resistance of 1 KΩ. The amplifier capacitance and input resistance are 4 pF and 1 MΩ respectively.

8. Find the average number of photons required to provide a maximum BER of 10^{-9}, in a digital optical link operating under quantum limit detection.

9. What is the need for WDM in optical communication?

10. Obtain the basic data rate in SONET.

Part – B (5 x 16 = 80 Marks)

11(i) Explain about light transmission in Step Index optical fibers. (8)

(ii) Discuss any one recent technique for fabrication of optical glass fibers. (8)

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12.a.(i) Derive the expression for pulse spreading due to intramodal dispersion. (8)

(ii) An optical fiber has a material dispersion of 110 ps/ nm-km at a wavelength of 850 nm. Find the rms pulse broadening due to an optical source of spectral width 40 nm. If the optical source's spectral width is reduced by 50%, what happens to the system bandwidth? (4)

(ii) Explain about profile dispersion. (4)

(Or)

b.(i) Define Beat length and explain the need for polarization maintaining fibers. (4)

(ii) What are the different schemes of implementing polarization maintaining fibers? (4)

(ii) Explain the important non linear effects in optical fibers and their underlying fundamental principles. (8)

13.a.(i) From the first principles, derive the expression for Internal Quantum Efficiency in Light Emitting Diodes. (8)

(ii) A DH LED operating at a wavelength of 1310 nm has radiative and non radiative recombination times of 30 ns and 100 ns, respectively. If the drive current is 50 mA, find the bulk recombination time, internal quantum efficiency and the internal power level. Also find the amount of power emitted in to the air medium, if the refractive index of LED material is 3.5. (5)

(iii)Explain the difference between electrical and optical bandwidths. (3)

(Or)

b.(i) Discuss in detail about the laser diode structures for confining optical waves in the lateral direction. (8)

(ii) With relevant diagrams, explain any two techniques for obtaining single mode emission from semiconductor lasers. Also draw the emission spectrum. (8)

14.a.(i). Compare the performance of Silicon and Germanium for PIN photo diodes. (4)
(ii) Discuss the various factors affecting the bandwidth of a PIN photo diode. (4)

(iii) A PIN photo diode has the following parameters at a wavelength of 1310 nm: I_D = 4 nA, η = 0.90, R_L =1000 Ω. If the incident optical power is – 35 dBm and the receiver has a bandwidth of 50 MHz. Assume negligible surface leakage current and Find the various noise terms and the resulting SNR in db. If the receiver bandwidth is doubled what is its effect on SNR? (8)

(Or)