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B.E / B.Tech (Part Time) DEGREE END SEMESTER EXAMINATIONS, April - May 2014

ELECTRONICS AND COMMUNICATION ENGINEERING

VI SEMESTER

PT EC 9402 / PTEC 473 - OPTICAL COMMUNICATION
(REGULATIONS 2009 / 2005)

Time: 3hour **Max Marks: 100**

Answer ALL Questions
Part A - (2 x 10 = 20 Marks)

1. What is the need for cladding in an optical fiber?

2. When the mean optical power launched in an 8 km fiber is 120 μW, the mean optical power received at the fiber output is 3 μW.Find the fiber loss in dB/km.

3. A 6km long optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative index difference of 1%. Determine the rms pulse broadening due to intermodal dispersion on the link.

4. What is the underlying principle of fiber stimulated scattering?

5. Calculate the threshold current density of a laser diode with $\beta = 21 \times 10^{-3}$ A cm^{-3}, loss coefficient $\alpha = 10$ / cm, L = 250 μm and reflectivity = 0.32.

6. What are the requirements for a free space laser transmitter?

7. A photo diode has a quantum efficiency of 65% when photons of energy 1.5×10^{-19}j are incident upon it. Find the responsivity of the detector.

8. What do you understand by rise time budget in link design?

9. Define excess loss in an optical fiber coupler.

10. Give the principle of $\Delta\beta$ optical switch.

Part B - (16 x 5 = 80 Marks)

11.(i) Outline the fiber fabrication procedure by MCVD technique. (8)

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(ii) Explain the factor responsible for attenuation of signals in an optical fiber link. (8)

12.a.(i) Discuss the waveguide dispersion with relevant mathematical treatment. (8)

(ii) Explain the dispersion mechanism leading to signal distortion in multi mode glass fibers. (8)

(Or)

b.(i) Explain the scheme for realizing Dispersion shifted fibers. (8)

(ii) Describe any two schemes of compensating dispersion in optical fiber links. (8)

13(a)(i) Explain the construction of double hetrostructure (DH) laser diode (6)

(ii) Derive an expression for threshold current density in a DH laser diode. (6)

(iii)Compare the characteristics of LED and Laser diode for optical communication applications. (4)

(Or)

(b)(i)Discuss any two scheme of longitudinal mode control in Laser diodes. (8)

(ii) Write a note on noise in laser diodes. (4)

(iii) Distinguish the features of direct and external modulation for optical communications. (4)

14(a)(i) Explain in detail with relevant circuit diagrams the different types of optical pre amplifiers. (10)

(ii) A high-input-impedance amplifier which is employed in an optical fiber receiver has an effective input resistance of 4 MΩ which is matched to a detector bias resistor of the same value. Determine the following.

(a) maximum bandwidth that may be obtained without equalization if the total capacitance C_T is 6 pF.

(b) The mean square thermal noise current per unit bandwidth generated by this high-input-impedance amplifier configuration when it is operating at a temperature of 300 K.

(c) Compare the values calculated in (a) and (b) with those obtained when the high-input-impedance amplifier is replaced by a trans impedance amplifier with a 100 KΩ

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feedback resistor and an open loop gain of 400. It may be assumed that $R_f << R_{TL}$, and that the total capacitance remains 6 pF. (6)

(Or)

b.(i) Outline the power budget based optical link design with an example. (10)

(ii) Derive an expression for the photo current in the case of a homodyne and heterodyne optical receiver systems. (6)

15.a.(i) Discuss the structure and characteristics of fiber fused biconical taper coupler. (8)

(ii) Brief about any two implementation schemes of WDM optical filters. (8)

(Or)

b.(i) Enumerate the theory and operation of SOA. (8)

(ii) Distinguish the features of EDFA and SOA. (4)

(iii) How optical switches can be realized in SOA? (4)