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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST - 3 EXAMINATION, May 2019

B.Tech VIIIth Semester (ECE)

Course Code: 11B1WEC834
Course Name: Optical Communication Systems
Course Credits: 03

MAX. MARKS: 35

MAX. TIME: 2 Hrs.

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Marks are indicated in square brackets against each question

1 Answer the following questions briefly: **[5 x 2=10 Marks]** (CO-1, CO-2, CO-3, CO-4)

(i) Differentiate between Regenerative repeater and optical amplifier.

(ii) What are insertion and excess losses?

(iii) How is birefringence and beat length related?

(iv) What is electro-optic effect?

(v) What is cut-off wavelength and what role does it play in optical communication?

2 (a) A p-n photodiode has a quantum efficiency of 50% at a wavelength of 0.90μm. Calculate its (i) responsivity at this wavelength (ii) received optical power if the mean photocurrent is 10^{-6} A and (iii) the corresponding number of received photons at this wavelength. **[4 Marks]** (CO-3, CO-4)

(b) Define quantum efficiency and responsivity of a p-n diode. How are the two related to each other? **[3 Marks]**

(c) What is a semiconductor optical amplifier? What qualities should a DH structure possess to be used as an optical amplifier? **[3 Marks]**

3 (a) With the help of suitable diagram explain the working of longitudinal electro-optic modulator in detail. **[4 Marks]** (CO-4, CO-5)

(b) Differentiate between WDM and DWDM. What are the different types of demultiplexers employed in optical communication systems. Explain. **[3 Marks]**

(c) A SOA has uncoated facet reflectivities of 30% and a single-pass gain of 5 dB. The device has an active region length of 320μm, a mode spacing of 1nm, and appeal gain wavelength of 1.55μm. Calculate the refractive index of the active region and the spectral bandwidth of the amplifier. **[3 Marks]** (CO-6)

4 Calculate the change in the refractive index due to the longitudinal electro-optic effect for a 5-mm long crystal of lithium niobate for an applied voltage of 100V. if the wavelength of light propagating through the crystal is 550nm, calculate the net phase shift between the two polarization components after they emerge from the crystal. Also calculate V_π for the same. (For Lithium niobate, n_0=2.29, n_e = 2.20 and r_{33} = 30.8 x 10^{-12} m/V). **[5 Marks]** (CO-6)

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