Reg. No.: 21BEC1851

Name :

VIT

Vellore Institute of Technology

Continuous Assessment Test II

Programme	: B.Tech	Semester	:	Winter 2023-24
Course	:	Code	:	BECE308L
		Class Nbr	:	CH2023240500862 CH2023240500856 CH2023240502609 CH2023240502611 CH2023240502607
	Optical Fiber Communications			
Faculty	: Dr.Sivasubramanian A Dr.Brintha Therese A Dr. Sangeetha RG Dr.Ilavarasan T Dr.Selvendran S	Slot	:	C1
Time	: 90 Minutes	Max. Marks	:	50

Answer ALL the questions

Constants: $h = 6.625 \times 10^{-34}$ J.s, $c = 3 \times 10^{8}$ m/s, $q = 1.6 \times 10^{-19}$ C $k_B = 1.380 \times 10^{-23}$ J/K

Q.No.	Sub. Sec.	Questions (Each subdivision has equal weightage)	Marks
1.		An engineer constructs a LED with the alloy $Ga_{1-x}Al_xAs$ which has a material ratio, x=0.06, & a radiative and ,non-radiative recombination times of 20 ns and 75 ns respectively. The drive current is 30 mA and refractive index is 3.5. Find the following parameters: (i) Peak emission wavelength (ii) Bulk recombination time (iii) Internal Quantum efficiency (iv) Internal power level (v) External power level	[10]
2.		A typical laser is emitting a spectral line centred at 632.8 nm, and λ-λ_0 is 2 nm on a gain curve at its half-power points. The cavity length and its refractive index are 350μm and 3.5 respectively. Calculate the (a) number of longitudinal modes excited (b) wavelength separation between the modes (c) laser threshold gain for uncoated facets whose reflectivity are R_1=R_2=0.32, and absorption loss coefficient of 10cm^{-1}. (d) reduction that occurs in the threshold gain coefficient when the reflectivity of one of the facets is increased to 1. (e) minimum gain, in order for the laser to reach threshold if the cavity length is 0.4 micron, and the reflectivity of both the mirrors is 98%. Assume there are no losses in the cavity other than the mirror transmission losses.	[15]
3.		When 10^{11} photons per second each with an energy of $1.28*10^{-19}$ J are incident on an ideal photodiode, calculate the	[10]

(i) wavelength of the incident radiation
(ii) output photocurrent
(iii) output photocurrent if the device is an APD with a multiplication factor of 18.

4. A *pin* photodiode incorporated in an optical receiver with a modulation index of 0.4, has a quantum efficiency of 50% at a wavelength of 1500 nm. The dark current is 3 nA and *ac* resistance is 5 kΩ. The incident optical power is -30 dBm and receiver bandwidth is 6 MHz. Determine the
(i) primary photocurrent
(ii) mean square quantum noise current **[10]**
(iii) mean square dark noise current
(iv) mean square thermal noise current
(v) SNR.

5. Consider a digital fiber optic link operating at a wavelength of 1550 nm which has an incident optical power of 10 nW. The energy of the incident photon is 23.2 eV. Find the
(i) minimum number of photons required for a BER of 10^{-12} **[5]**
(ii) quantum efficiency and the bit rate of the system.

Total [50]

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