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1005E476

Candidate's Seat No :

M.Sc. (Sem.-II) Examination

410

Electronics Sciences

ELE-410 (OPTOELECTRONICS AND DIGITAL SIGNAL PROCESSING)

Time : 3 Hours] May-2017 [Max. Marks : 70

INSTRUCTION: **Attempt all questions.**

Symbols have their usual meaning.

Q.1(a)	Define photonics devices. Draw the VIS and near VIS electromagnetic spectrum and indicate the energy gap (eV) and relative luminosity function V(λ). Also explain methods of excitation.	(07)
	OR	
Q.1(a)	Draw the basic recombination transitions of excess carriers in semiconductor and classify them. Also discuss emission spectra and show that spectrum width in wavelength of $\Delta\lambda \approx \frac{1.8kT\lambda^2}{hC}$	(07)
Q.1(b)	Explain device structure of LED and choice of materials. Also explain wavelength converters.	(07)
	OR	
Q.1(b)	Write different types of efficiencies and explain Internal quantum and Optical efficiencies.	(07)
Q.2(a)	State the basic process of photo detectors. Discuss basic information about photo detectors.	(07)
	OR	
Q.2(a)	Draw schematic diagram of Photoconductor and show that $\left.\frac{S}{N}\right\|_{POWER} = \frac{i_P^2}{\langle i_{GR}^2 \rangle + \langle i_G^2 \rangle}$.	(07)
Q.2(b)	Discuss frequency response and quantum efficiencies of p-n and p-i-n photodiodes in detail.	(07)
	OR	
Q.2(b)	Write short note on Phototransistor.	(07)
Q.3(a)	**1.** Show that operations of folding and time delaying a signal are not commutative. **2.** Determine power of the unit step sequence.	(07)
	OR	
Q.3(a)	The impulse response of a linear time invariant system is $h(n) = \{1, \underset{\uparrow}{2}, 0, -1\}$. Determine the response of the system $x(n) = \{\underset{\uparrow}{1}, 2, 3, 4\}$.	(07)
Q.3(b)	Determine response of the following system to the input signal $x(n) = \|n\|, \quad -3 \le n \le 3$ $= 0, \quad$ otherwise **(a)** y(n)=x(n) **(b)** y(n)=x(n-1) **(c)** y(n)=1/3[x(n+1)+x(n)+x(n-1)] **(d)** y(n)=Max [x(n+1), x(n), x(n-1)]	(07)
	OR	
Q.3(b)	**1.** Determine the output y(n) of a relaxed linear time-invariant system with impulse response $h(n) = a^n u(n)$, $\|a\| < 1$, when the input is a unit step sequence, that is x(n)=u(n). 2. Determine if the system described by $y(n) = x(n^2)$ is linear or non-linear.	(07)

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Q.4(a)	Obtain Inverse DFT of $x(n)=\{\underset{\uparrow}{2}, 2+2j, -2, 2-2j\}$.	(07)
	OR	
Q.4(a)	1. Obtain value of **X(4)** for sequence $x(n)=\{\underset{\uparrow}{1}, 2, 0, 1, -1, 1, 0, 2\}$. 2. Prove that X(k=N/2)=(-1)^n x(n). Here X(k) is the DFT sequence of x(n).	(07)
Q.4(b)	Consider the sequence x(n) is given by $x(n)=(....5, 6, 7, 0, 1, 2, 3, 4, 5, 6, 7, 0, 1, 2, 3, 4, ...)$. Find its convolution using overlap and add method with the sequence $h(n)=(1, 2, 1)$.	(07)
	OR	
Q.4(b)	1. Obtain the convolution of the sequences $x(n)=(\underset{\uparrow}{1}, 2, 3)$ and $h(n)=(\underset{\uparrow}{2}, 1)$ using Z-transform method. 2. Compute $x[(n-k)_N]$ for **k=3** and **N=5** for periodic sequence $x(n)=\{.....5, 1, 2, 3, 4, 5, \underset{\uparrow}{1}, 2, 3, 4, 5, 1, 2.....\}$.	(07)
Q.5	Write Short Answers:	(14)
1.	State the principle of LASER.	
2.	What is the range of NIR of EM spectrum?	
3.	The emission wavelength of Febry-Perot LASER follows the temperature dependence of the _____, while that of the DFB and DBR LASERs follows the smaller temperature dependence of the _____.	
4.	Semiconductor LASER is also called _____ LASER.	
5.	Which materials are used for the colour converters.	
6.	Radiative transition in indirect semiconductor is a_____ order of process and the transition probability is _____	
7.	Write the applications of LASER.	
8.	Convolution sum is commutative. **(True or False)**	
9.	Plot $\delta(n-5)-2\delta(n+3)$.	
10.	What is the difference between DFT and DTFT?	
11.	Show that $X(k=N-k)=X^*(k)$.	
12.	Find **y(n)** for **n**$\rightarrow\infty$ of given sequence $y(n)=1+a+a^2+a^3+.....+a^n, \lvert a\rvert<1$.	
13.	If x(n)=0 and y(n)=1 then the system is linear **(TRUE / FALSE)**.	
14.	Is the system $y(n)=x(2n)$ causal or non-causal?	