U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

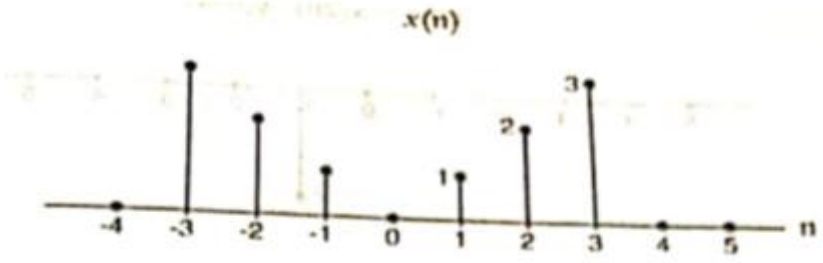
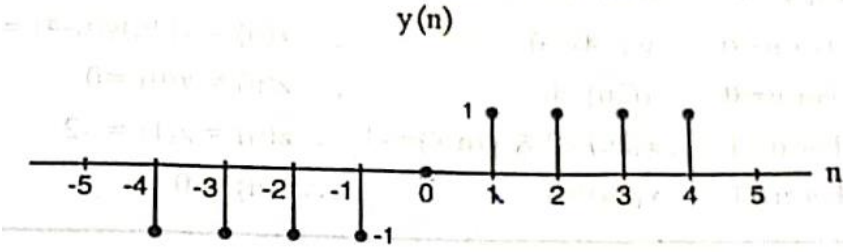
Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Electrical and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 22EI4PCSAS **Max Marks: 100**
Course: Signals and Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Find the even and odd components of the signal, $x(t)=\cos(t)+\sin(t)+\sin(t)\cos(t)$	CO1	PO1	**06**
	b)	Determine whether the continuous time signal $x(t)=[\cos(2\pi t)]^2$ is periodic or not. If periodic, find the fundamental period T.	CO1	PO1	**06**
	c)	Sketch the waveform for the following signals: i) $x(t) = u(t) - u(t-2)$ ii) $x(t) = u(t+1) - 2u(t)+u(t-1)$	CO1	PO1	**08**
		OR			
2	a)	For the discrete signals x(n) and y(n) are shown in Fig 2a and Fig 2b respectively. Sketch the signal z(n) = x(2n) y(n-4).  Fig 2a  Fig 2b	CO1	PO1	**06**

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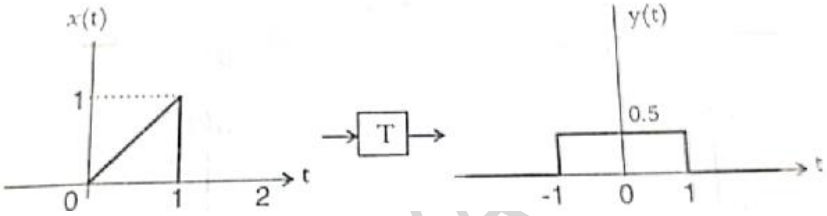
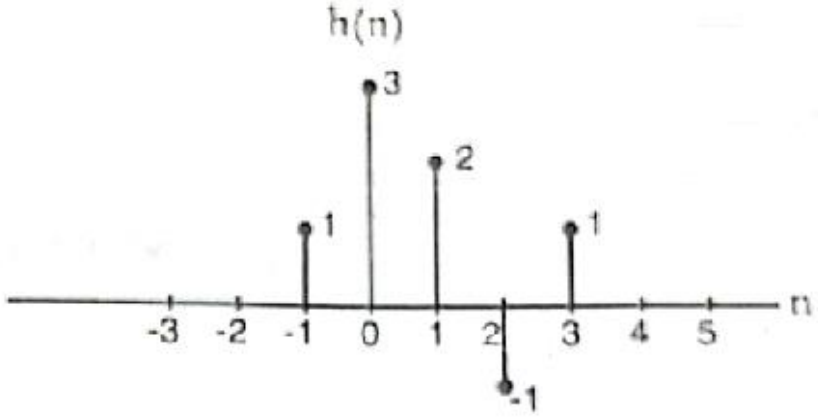
		b)	Determine the average power of the sinusoidal signal $x(t) = A\cos(\omega t + \phi)$	*CO1*	*PO1*	**06**
		c)	Distinguish between i) periodic and non-periodic signals **ii)** Deterministic and Random signals	*CO1*	*PO1*	**08**
			UNIT - II			
	3	a)	Find the overall operator of a system whose output signal y(n) is given by $y(n) = \frac{1}{3}[x(n) + x(n-1) + x(n-2)]$. Also draw the block diagram representation.	*CO2*	*PO2*	**06**
		b)	For the following system, determine whether the system is Linear ,time-invariant ,memory less, causal and stable. i) $y_1(n) = n\,x(n)$ ii) $y_2(n) = x(2n)$	*CO2*	*PO1*	**10**
		c)	A system 'T" has its input-output pairs given in Fig. 3c. Determine whether the system could be memoryless and causal.  **Fig. 3c**	*CO2*	*PO2*	**04**
			UNIT - III			
	4	a)	A discrete –time LTI system has impulse response h(n) as shown in Fig 4a. Using linearity and time invariance property , determine the system output y(n) if the input x(n) is, x(n) = u(n) –u(n-3)  **Fig 4a**	*CO3*	*PO2*	**10**
		b)	Determine the forced response for the system given by, $5\frac{dy(t)}{dt} + 10y(t) = 2x(t)$ with input $x(t) = e^{-t}\,u(t)$	*CO2*	*PO2*	**10**
			OR			
	5	a)	Consider a continuous –time LTI system with unit impulse response, h(t) =u(t) and input $x(t) = e^{-at}\,u(t)$; a>0	*CO3*	*PO2*	**10**

			Find the output y(t) of the system.			
		b)	By converting the differential equation to integral equation, draw direct form I and direct form II implementation for the given system: $\frac{dy(t)}{dx}$ +5y(t) = 3x(t).	*CO3*	*PO2*	**10**
			UNIT - IV			
	6	a)	Compute the DTFT of the signal, i. $x(n) = (-1)^n u(n)$ ii. $x(n) = \left(\frac{1}{2}\right)^n u(n-4)$	*CO4*	*PO2*	**08**
		b)	Obtain the frequency response of a continuous-time LTI system whose impulse response is given by h(t) = $\mathbf{e}^{-\lvert t \rvert}$	*CO4*	*PO2*	**06**
		c)	Specify the Nyquist rate for each of the following signals: i)$x_1(t) = \text{sinc}(200t)$ ii)$x_2(t) = \text{sinc}^2(200t)$	*CO4*	*PO2*	**06**
			UNIT - V			
	7	a)	Design a causal discrete-time LTI system with a property that if the input is x(n) = (½)^n u(n) - ¼ (½)$^{n-1}$ u(n-1), then the output is y(n) = $(\frac{1}{3})^n$ u(n). Determine the impulse response h(n) and the system function H(z) of the system that satisfies this condition.	*CO4*	*PO3*	**10**
		b)	Find the unilateral Z-transform for the following signals: i) $x(n) = \alpha^n u(n)$ ii) y(n) = x(n-2) , where $x(n)=\alpha^n$	*CO4*	*PO2*	**10**

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