U.S.N.										

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

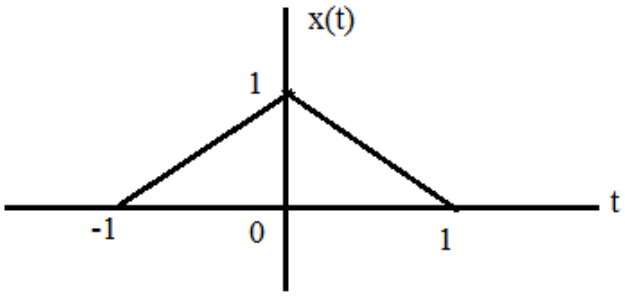
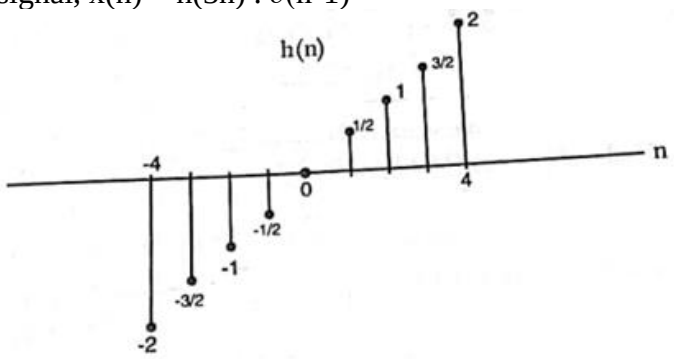
Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 23EI4PCSAS **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, ... draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		MODULE - I	CO	PO	Marks
1	a)	For the continuous-time signal x(t) shown in fig1a. sketch the signal y(t) =x(3t) +x(3t+2)  **Fig1a**	CO1	PO3	**06**
	b)	Determine the odd and even components of the signal, x(t) = cos(t) +sin(t) +sin(t)cos(t)	CO1	PO3	**05**
	c)	Determine whether each of the following signals is periodic. If a signal is periodic, determine its fundamental period. i)x(n) =5cos(0.2πn) ii)x(n) = sin(2n) iii)x(t) = $\cos(\frac{\pi}{3}t) + \sin(\frac{\pi}{4}t)$	CO1	PO3	**09**
		OR			
2	a)	A discrete-time sequence h(n) is shown in Fig 2a. Sketch the signal, x(n) = h(3n) . ∂(n-1)  **Fig2a**	CO1	PO3	**06**

		b)	A discrete-time signal x(n) is described by $x(n) = \begin{cases} 1, & n = 1, 2, 3 \\ -1, & n = -1, -2, -3 \\ 0 & n = 0, \lvert n \rvert > 3 \end{cases}$ Find y(n) = x(2n +2).	*CO1*	*PO3*	**06**
		c)	Determine the average power and the energy of the following sequences. i.$x_1(n) = nu(n)$ ii.$x_2(n) = A_0 e^{j\Omega_0 n}$	*CO1*	*PO3*	**08**
			MODULE - II			
	3	a)	For the following system, T{x(n)} = x(n) + u(n+1) determine whether the system is i. Linear ii.Time-invariant iii. Memoryless iv. Causal v. Stable	*CO2*	*PO2*	**10**
		b)	Find the overall operator of a system whose output signal y(n) is given by $y(n) = \frac{1}{3}[x(n+1) + x(n) + x(n-1)]$ Also draw the block diagram representation.	*CO2*	*PO3*	**05**
		c)	Determine whether the following systems invertible. If it is invertible construct the inverse system. If it is not, find two input signals that give the same output. i. y(t) = x(t-2) ii. y(n) =nx[n]	*CO2*	*PO3*	**05**
			MODULE - III			
	4	a)	An LTI system is characterized by an impulse response $h(n) = \left(\frac{3}{4}\right)^n u(n)$. Find the step response of the system.	*CO3*	*PO3*	**06**
		b)	Convolute the two continuous-time signals $x_1(t)$ and $x_2(t)$ given below. $x_1(t) = \cos\pi t[u(t+1) - u(t-3)]$ $x_2(t) = u(t)$	*CO3*	*PO3*	**08**
		c)	Find the natural response for the system described by the differential equation, $5\frac{dy(t)}{dx} + 10y(t) = 2x(t) \quad : y(0) = 3$	*CO3*	*PO3*	**06**
			OR			
	5	a)	Evaluate the step response of an LTI system represented by the impulse response, $h(n) = (½)^n u(n)$	*CO3*	*PO3*	**06**
		b)	Solve the differential equation $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{d}{dt}x(t)$ The initial conditions are y(0) = 0 and y'(0) =1. The forcing equation $x(t) = e^{-2t}u(t)$.	*CO3*	*PO3*	**08**
		c)	Compute the convolution sum of the two sequences, $x_1(n)$ and $x_2(n)$, given below. $x_1(n) = (1, 2, 3)$ and $x2(n) = (1, 2, 3, 4)$	*CO3*	*PO3*	**06**

			MODULE - IV			
	6	a)	State and prove the following properties of discrete time Fourier series. i) Linearity property ii) Frequency shift	*CO3*	*PO1*	**08**
		b)	Determine the DTFS representation of $x(n) = \cos(n\frac{\pi}{3})$	*CO3*	*PO2*	**06**
		c)	Find the frequency and impulse response of the system described by the differential equation $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$	*CO3*	*PO2*	**06**
			MODULE - V			
	7	a)	Find the Z-transform of the following discrete-time signals. Also include the ROC for each: i. $x(n) = 2^n u(n) + 3(½)^n u(n)$ ii. $x(n) = -a^n u(-n-1)$ iii. $x(n) = 2\partial(n-3) - 2\partial(n+3)$	*CO2*	*PO2*	**09**
		b)	Determine the inverse Z-transform of X(z) using partial fraction expansion approach. $X(z) = \frac{z+1}{3z^2 - 4z + 1}$ ROC: $\|z\| > 1$	*CO2*	*PO2*	**05**
		c)	A causal system has input x(n) and output y(n). Find the impulse response of the system if, $x(n) = \partial(n) + \frac{1}{4}\partial(n-1) - \frac{1}{8}\partial(n-2)$ $y(n) = \partial(n) - \frac{3}{4}\partial(n-1)$	*CO2*	*PO3*	**06**

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