U.S.N.										

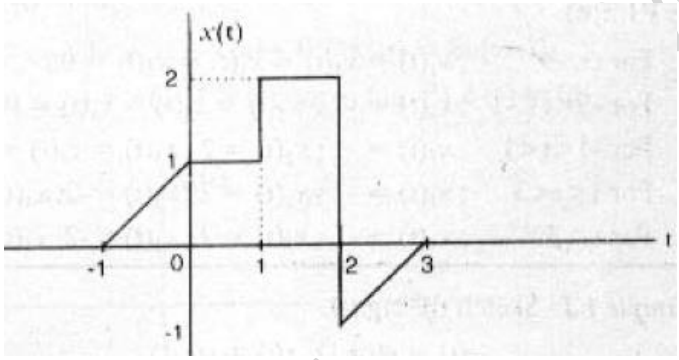
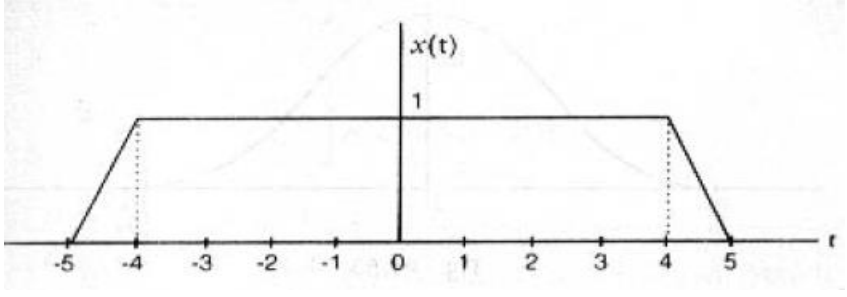
B.M.S. College of Engineering, Bengaluru-560019

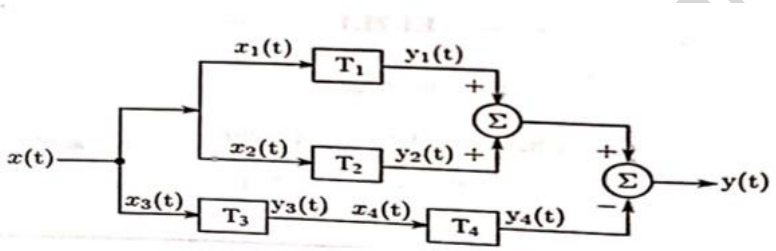
Autonomous Institute Affiliated to VTU

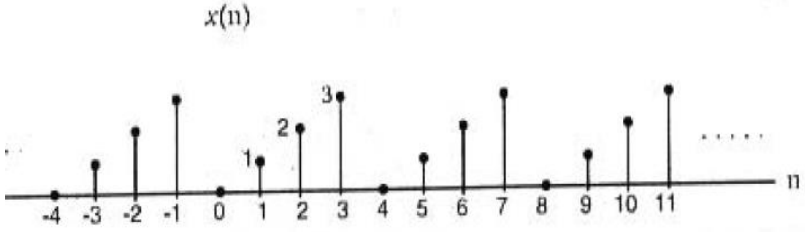
August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Electronics & Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 23EI4PCSAS **Max Marks: 100**
Course: Signals & Systems

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

			MODULE - I	CO	PO	Marks
1	a)	Sketch $y(t) = \{x(t) + x(2-t)\}.u(1-t)$ for the given signal. 		CO1	PO1	**06**
	b)	Determine whether each of the following signal as energy signal or power signal or neither of these two i) $x(t) = e^{-at}u(t)$ $\quad ii) x[n] = 2e^{j3n}$		CO1	PO1	**07**
	c)	Determine whether the following discrete time signals are periodic or not. If periodic find its fundamental period. i) $x(n) = \cos\left(\frac{\pi}{2}n\right) - \sin\left(\frac{\pi}{8}n\right) + 3\cos\left(\frac{\pi}{4}n\right)$ ii) $x(t) = 10\cos(\pi t).\sin(4\pi t)$		CO1	PO1	**07**
			OR			
2	a)	Differentiate the given signal and verify whether the given signal is energy or power signal and determine its value 		CO1	PO1	**06**

		b)	Sketch the even and odd components of the following signals i) $x[n] = u[n] - u[n-4]$ ii) $x(t) = \begin{cases} t & ; \quad 0 \le t \le 1 \\ 2-t & ; 1 \le t \le 2 \end{cases}$	*CO1*	*PO1*	**07**
		c)	Find the fundamental period of the given signal i) x(n) = $Cos\left(\frac{\pi}{4}n\right) + Sin\left(\frac{\pi}{8}n\right) - 2Cos\left(\frac{\pi}{2}n\right)$ ii) $x(t) = 3cos\sqrt{2}\,t + 4sin5\sqrt{2}\,t$	*CO1*	*PO1*	**07**
			MODULE - II			
	3	a)	A system consists of several subsystems connected as shown in below fig. Find the operator T relating x(t) to y(t) for the subsystem operators given by $T1: y_1(t) = x_1(t)\,x_1(t-1)$ $T2: y_2(t) = \lvert x_2(t) \rvert$ $T3: y_3(t) = 1 + 2x_3(t)$ $T4: y_4(t) = \cos(x_4(t))$  	*CO2*	*PO1*	**06**
		b)	For the following systems, determine whether the system is Linear and Time-Invariant? i) $y(t) = t^2.x(t-1)$ ii) $y(n) = n.x^2(n)$	*CO2*	*PO1*	**06**
		c)	For the following systems, determine whether the system is Linear, Time-Invariant, Memoryless, Causal and Stable. i) $y(t) = x\left(\frac{t}{2}\right)$ ii) $y(n) = n.x(n)$	*CO2*	*PO1*	**08**
			MODULE - III			
	4	a)	Evaluate the continuous time convolution integral for the given equation $y(t) = \{u(t+2) - u(t-1)\} * u(-t+2)$	*CO4*	*PO2*	**10**
		b)	Evaluate the total response for the system described by the difference equation $y(n) + 4y(n-1) + 4y(n-2) = 2^n.u(n)$ *with* $y(-1) = 0$ *and* $y(-2) = 1$	*CO4*	*PO2*	**10**
			OR			
	5	a)	Consider the LTI system with input $x(n) = 0.3^n u(n-2)$ and unit impulse response $h(n) = u(n)$. Compute the convolution summation.	*CO4*	*PO2*	**10**
		b)	Obtain the total response of the system given by $y''(t) + y(t) = 3\,x'(t)$ with $y'(0) = -1\,; y(0) = -1$ *and* $x(t) = 2e^{-t}.u(t)$	*CO4*	*PO2*	**10**

			MODULE - IV			
	6	a)	Evaluate the DTFS representation for the signal x(n) shown in the figure below sketch the magnitude and phase spectrum and verify the Parseval's identity.  	*CO3*	*PO2*	**10**
		b)	Consider a discrete time LTI system described by $y(n) - 0.5\,y(n-1) = x(n) + 0.5x(n-1)$ Evaluate the frequency response and impulse response of the system.	*CO3*	*PO2*	**05**
		c)	Determine the Nyquist rate for the following signals: $i)\ x(t) = \cos(150\pi t)\,.\sin(100\pi t)$ $ii)\ x(t) = cos^3(200\pi t)$	*CO3*	*PO2*	**05**
			MODULE - V			
	7	a)	A LTI discrete time system is given by the system function $H(z) = \dfrac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-1}}$ Specify the ROC of H(z) and determine h(n) for the following conditions. Check if system is Stable and Causal.	*CO2*	*PO2*	**06**
		b)	Solve the following difference equation using unilateral Z-transform. $y(n) - 1.5y(n-1) + 0.5y(n-2) = x(n)\ for\ n \geq 0$ with initial conditions $y(-1) = 4,\ y(-2) = 10\ and\ x(n) = \left(\frac{1}{4}\right)^n u(n).$	*CO2*	*PO2*	**08**
		c)	Sketch the direct form 1 and direct form 2 for the given difference equation $y(n) = -0.5y(n-1) + 0.2y(n-2) + 3x(n) + 0.6x(n-2)$	*CO2*	*PO1*	**06**

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