U.S.N.										

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

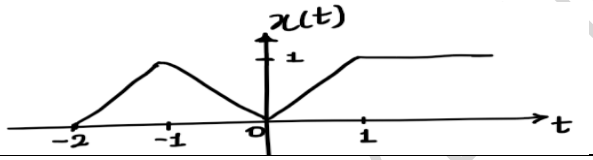
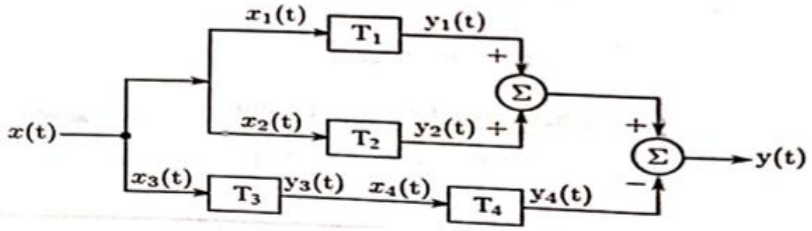
Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 22EC3PCSAS **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)	Sketch the even and odd components of the given signal 	CO 1	PO 1	07
	b)	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) $x(t) = 3cos\sqrt{2}\,t + 4sin5\sqrt{2}\,t$	CO 1	PO 1	06
	c)	Determine whether each of the following signal as energy signal or power signal or neither of these two i) $x(t) = e^{-at}\,u(t)$ $ii) x[n] = 2e^{j3n}$	CO 1	PO 1	07
		UNIT - II			
2	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 $T1: y_1(t) = x_1(t)\,x_1(t-1)$ $T2: y_2(t) = \lvert x_2(t)\rvert$ $T3: y_3(t) = 1 + 2x_3(t)$ $T4: y_4(t) = \cos(x_4(t))$ 	CO 1	PO 1	06
	b)	For the following systems, determine whether the system is Linear, Time-Invariant, Memoryless, Causal and Stable.	CO 2	PO 2	10

			i) $y(t) = x\left(\frac{t}{2}\right)$ ii) $y(n) = n.x(n)$			
		c)	Check whether the given systems is invertible? If invertible then finds its inverse system i) $y(n) = x(1-n)$ ii) $y(t) = x(t-6)$	***CO 2***	***PO 2***	**04**
			UNIT - III			
	3	a)	Design Direct form 1 and Direct form 2 for the given differential equation $$2\frac{dy}{dt} + \frac{1}{3}\int y(t)\,dt + 5\,y(t) = \frac{dx}{dt} + 6x(t)$$	***CO 3***	***PO 3***	**06**
		b)	Determine the total response of the system $y''(t) + 3y'(t) + 2y(t) = 2x(t)\ with\ y(0) = -1\ and$ $y'(0) = 1\ and\ x(t) = cost.u(t)$	***CO 2***	***PO 2***	**08**
		c)	Obtain the discrete time convolution sum for the given signal $y(n) = \beta^n.u(n) * \alpha^n.u(n)\ \ where\ |\beta| < 1\ and\ |\alpha| < 1$	***CO 1***	***PO 1***	**06**
			OR			
	4	a)	Consider an LTI system with unit impulse response $h(t) = e^{-t}.u(t)\ \ and\ input\ x(t) = e^{-3t}\{u(t) - u(t-2)\}$ obtain the convolution output.	***CO 2***	***PO 2***	**10**
		b)	Determine the total response of the system for the given difference equation $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$ $with\ input\ x(n) = \left(\frac{1}{8}\right)^n u(n)$	***CO 2***	***PO 2***	**10**
			UNIT - IV			
	5	a)	Determine the DTFS representation for the signal x(n) and sketch i) magnitude spectrum. ii) Phase Spectrum. iii) power spectrum density. $$x(n) = \cos\left(\frac{6\pi n}{13} + \frac{\pi}{6}\right)$$	***CO 2***	***PO 2***	**10**
		b)	The impulse response of a continuous time LTI system is given by $h(t) = \frac{1}{RC}\,e^{-\frac{t}{RC}}.u(t)$. Find Frequency response and plot the magnitude and phase response.	***CO 2***	***PO 2***	**10**
			OR			
	6	a)	Determine the Nyquist rate for the following signals i) $x_1(t) = Sinc(200t)$ ii) $x_2(t) = Sinc^2(200t)$	***CO 2***	***PO 2***	**06**

		b)	Determine the DTFT of the signal $x(n) = \cos\left(\frac{\pi n}{5}\right) + jsin\left(\frac{\pi n}{5}\right)\ where\ \|n\| \leq 10\ and$ $0\ otherwise$	***CO 2***	***PO 2***	**06**
		c)	Consider the signal, $x(n) = 2 + 2\cos\left(\frac{\pi n}{4}\right) + \cos\left(\frac{\pi n}{2}\right) + \frac{1}{2}\cos\left(\frac{3\pi n}{4}\right)$ i) Determine and sketch the power spectral density ii) Evaluate the power of the signal	***CO 2***	***PO 2***	**08**
			UNIT - V			
	7	a)	Evaluate the given expression and obtain $x(n)$ $X(z) = \frac{-1+5z^{-1}}{1-1.5z^{-1}+0.5z^{-2}}$ with ROC |z| > 1	***CO 1***	***PO 1***	**06**
		b)	A LTI discrete time system is given by the system function, $H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$ specify the ROC of H(z) and determine h(n) for the following Conditions. (i) System is stable. (ii) System is Causal.	***CO 2***	***PO 2***	**06**
		c)	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 $y(-1) = 4,\ y(-2) = 10\ and\ x(n) = \left(\frac{1}{4}\right)^n u(n).$	***CO 1***	***PO1***	**08**

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