U.S.N.										

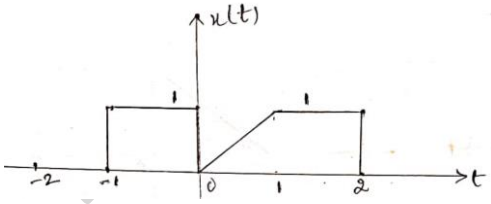
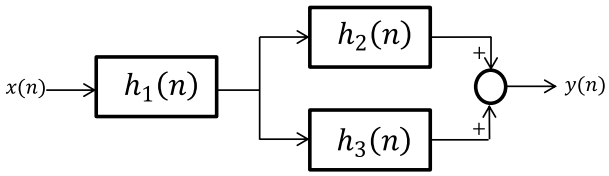
B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main 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.

			CO	PO	Marks
		UNIT-I			
1	a)	Determine whether the following signals are periodic or not. Find the fundamental period if periodic. i) $x(t) = \cos(t) + \sin(\sqrt{2}t)$ ii) $x(n) = cos\left(\frac{\pi n}{12}\right) sin\left(\frac{\pi n}{18}\right)$ iii) $x(n) = (-1)^{n^2}$	CO1	PO1	10
	b)	Investigate the unit ramp signal $r(t)$ is an energy or a power signal.	CO1	PO1	6
	c)	Sketch the even and odd parts of a signal $x(t)$. 	CO1	PO1	4
		UNIT-II			
2	a)	Evaluate the overall impulse response $h(n)$ of a system given below which is an interconnection of three subsystems represented by the impulse responses $h_1(n) = \left(\frac{1}{2}\right)^n u(n+2)$, $h_2(n) = \delta(n)$ and $h_3(n) = u(n-1)$. 	CO1	PO1	6
	b)	Determine whether the system given below is a linear, time invariant, stable, memoryless and causal. $y(t) = \int_{-\infty}^{t} x(\tau)\ d\tau$	CO2	PO2	8

		c)	What is an invertible system? Elaborate schematically. Give any two examples.	**CO2**	***PO2***	**6**
			UNIT-III			
	3	a)	A signal $x(t) = e^{-at}u(t)$ is passed through an LTI system with unit sample response $h(t) = u(t)$, $a > 0$; find the response of the system.	***CO2***	***PO2***	**06**
		b)	Compute the convolution sum of the following two sequences using graphical method. $x(n) = [1,2,3,4]$ for $-1 \leq n \leq 2$, $h(n) = [1,2,3]$ for $0 \leq n \leq 2$.	***CO2***	***PO2***	**08**
		c)	Analyze an LTI system with impulse response $h(n) = a^n\, u(n)$ with $0 < a < 1$ for memoryless causality and stability properties.	***CO2***	***PO2***	**06**
			OR			
	4	a)	Find the response of a discrete time system represented by the difference equation $y(n) - \frac{1}{2}y(n-1) - \frac{1}{2}y(n-2) = \left(\frac{1}{2}\right)^n$ for $n \geq 0$ with initial condition $y(-1) = 1, y(-2) = 0$	***CO2***	***PO2***	**10**
		b)	Determine the natural response for the continuous time system $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y(t) = 2x(t) + \frac{dx}{dt}$ with initial conditions $y(0) = 3$, $\frac{dy}{dt}\mid_{t=0} = -7$.	***CO2***	***PO2***	**06**
		c)	Draw the block diagram representation for an LTI system described as $y(n) + \frac{1}{2}y(n-1) - \frac{1}{3}y(n-3) = x(n) + 2\,x(n-2)$.	**CO1**	***PO1***	**04**
			UNIT-IV			
	5	a)	Find the discrete time Fourier Series coefficients for the sequence $x(n) = 2 + 2cos\left(\frac{\pi n}{4}\right) + cos\left(\frac{\pi n}{2}\right) + \frac{1}{2}cos\left(\frac{3\pi n}{4}\right)$. Also plot magnitude spectrum.	***CO1***	***PO1***	**06**
		b)	One period of the DTFS of a signal $x(n)$ is given by $X(k) = \left(\frac{1}{2}\right)^k$ for $0 \leq k \leq 9$ Find the time domain signal $x(n)$ assuming $N = 10$.	***CO1***	***PO1***	**06**
		c)	Find the DTFT of unit step sequence $u(n)$ using suitable properties.	***CO1***	***PO1***	**08**
			OR			
	6	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	***CO 2***	***PO 2***	**10**

			$h(t) = \frac{1}{RC}\, e^{-\frac{t}{RC}} .u(t)$. Find Frequency response and plot the magnitude and phase response.			
			UNIT-V			
	7	a)	A Causal LTI system described by the difference equation $y(n) = y(n-1) + y(n-2) + x(n-1)$. i) find the system function ii) plot the poles and zeros iii) indicate the ROC iv) find the unit sample response v) Find a stable non-causal unit sample response.	***CO2***	***PO2***	**10**
		b)	Find the response of a system described as with the help of Z transform representation $y(n) + 3y(n-1) = x(n)$ with $x(n) = u(n)$ and $y(-1) = 1$	***CO2***	***PO2***	**10**

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