U.S.N.										

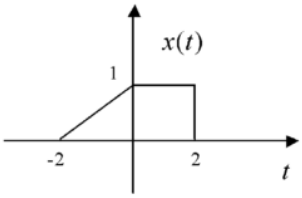
B.M.S. College of Engineering, Bengaluru-560019

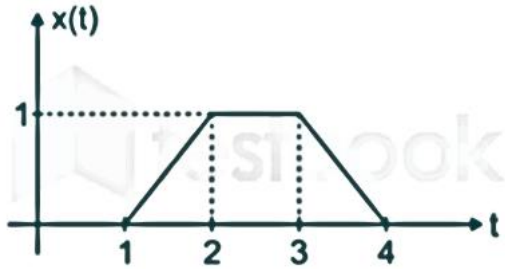
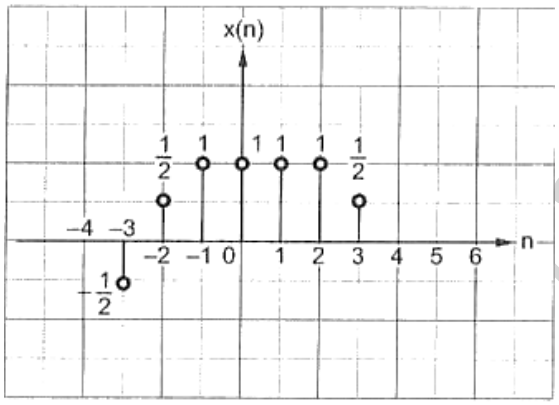
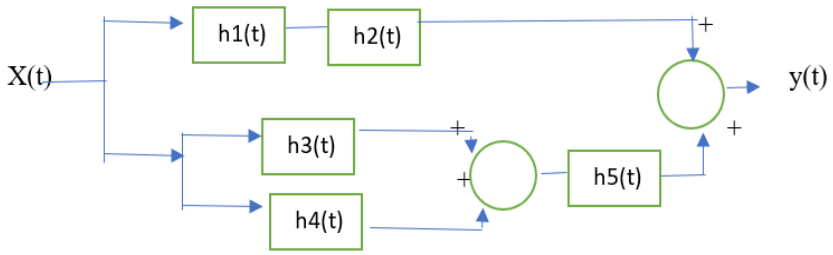
Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: ES Cluster (EEE/ET/ECE/EIE/MD) **Duration: 3 hrs.**
Course Code: 19ES4CCSAS **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.

		UNIT - I	CO	PO	Marks
1	a)	Determine whether the signals are energy or power signal and calculate their energy or power. (i) $x(n) = (\frac{1}{2})^n u(n)$ (ii) $x(t) = rect\left(\frac{t}{T_0}\right)$	CO1	PO1	**6**
	b)	For the signal x(t) shown below, perform the signal operation for the: (i) x(2t) (ii) x(t-2) (iii) x(t+3) 	CO1	PO1	**6**
	c)	Determine whether the following the DT signals are periodic or not. If periodic find its fundament period. (i) Cos(3πn) (ii) Sin(3n) (iii) Sin(π+0.2n) (iv) $Cos(\frac{2\pi n}{5}) + Cos(\frac{2\pi n}{7})$	CO1	PO1	**8**
		OR			
2	a)	Find the even and odd part of the following signals: (i) $x(t) = (1 + t^3)cos^3(t)$ (ii) $x(t) = [\sin(\pi t) + \cos(\pi t)]^2$	CO1	PO1	**6**

		b)	Find whether the signal x(t) given below is energy or power signal and determine its energy or power.  	*CO1*	*PO1*	**6**
		c)	A discrete time signal x(n) is given below  Sketch the following signals: (i) x(n-3) (ii) x(n+3) (iii) x(2n)	*CO2*	*PO1*	**8**
			UNIT - II			
	3	a)	Determine whether the following systems are linear, time invariant, causal, memory and stable: i) y(t)=x(t/2) ii) y(n)=x(2n)	*CO1*	*PO1*	**12**
		b)	Determine the overall impulse response of the LTI system shown below:  	*CO2*	*PO1*	**08**
			OR			
	4	a)	Implement the following LTI system in direct form-I and direct form-II block diagram representation.	*CO2*	*PO2*	**06**

			$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 5y(t) = 5x(t) + 3\frac{dx(t)}{dt} + 2\frac{d^2x(t)}{dt^2}$			
		b)	Fine the total response of the system described by the equation $4y(n) + 4y(n+1) + y(n+2) = x(n)$ with an input $x(n) = 4^n u(n)$. Initial condition being y(-1)=0,y(-2)=1.	*CO2*	*PO2*	**08**
		c)	For each of the systems, state whether the system is linear, stable and causal (i) $y(n) = \log[x(n)]$ (ii) $y(n) = e^{x(n)}$	*CO2*	*PO2*	**06**
			UNIT-III			
	5	a)	The input x(t) and impulse response h(t) of the LTI system are described by: x(t)= e^{-3t} u(t); h(t)=u(t-1). Evaluate the output.	*CO2*	*PO2*	**10**
		b)	Evaluate the natural response, forced response and total response for a system described by the following differential equation with input x(t)= $2e^{-t}u(t)$. $y''(t) + 5y'(t) + 6y(t) = x(t);\ y(0) = 0; y'(0) = 1$	*CO3*	*PO2*	**10**
			OR			
	6	a)	Consider x(n)={1,1,1,1,1} and h(n)={1,1,1,2,2,2}. Compute y(n)=x(n)*h(n)\ using tabular Column method	*CO3*	*PO2*	**06**
		b)	Fine the total response of the system described by the equation $4y(n) + 4y(n+1) + y(n+2) = x(n)$ with an input $x(n) = 4^n u(n)$. Initial condition being y(-1)=0,y(-2)=1.	*CO3*	*PO2*	**08**
		c)	A difference equation of discrete time system is given below: $y(n) - 0.2y(n-1) + 0.6y(n-2) = x(n) + 0.4x(n-1)$. Draw direct form-I and direct form-II structure.	*CO1*	*PO1*	**06**
			UNIT - IV			
	7	a)	State only the property of DTFT : convolution & Modulation	*CO1*	-	**04**
		b)	The impulse response of continuous time system is given by: $h(t) = \frac{1}{RC}e^{\frac{-t}{RC}}u(t)$. Determine the frequency response and plot its magnitude and phase response.	*CO2*	*PO1*	**10**
		c)	Evaluate and analyse the FT representation for the signal x(t) and plot the magnitude and phase spectrum of x(t).$x(t) = e^{-a\|t\|}; a > 0$	*CO3*	*PO2*	***06***
			OR			
	8	a)	Evaluate the DTFT of the signal i) $x(n) = \left(\frac{1}{2}^n\right)u(n-4)$ ii) $x(n) = -a^n u(-n-1)$	*CO3*	*PO2*	***08***
		b)	The differential equation of the system is given as $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$. Determine the impulse response of the system.	*CO3*	*PO2*	***06***

		c)	Determine the DTFS representation of $x(n) = cos\left(\frac{n\pi}{3}\right)$ and plot its spectrum.	*CO3*	*PO2*	***06***
			UNIT - V			
	9	a)	Solve the following difference equation using unilateral Z-transform: y(n)+y(n-2)=δ(n); $n \geq 0$ y(-2)=0; y(-1)=1	*CO2*	*PO1*	**08**
		b)	Find the Z-transform of the following sequences: i) $x(n) = u(n+2)$ ii) $x(n) = u(-n)$ iii) $x(n) = n\,u(n)$	*CO2*	*PO1*	**12**
			OR			
	10	a)	Find the Z-transform and ROC of the following sequences: i) $x(n) = a^n \sin(\Omega_o n)\ u(n)$ ii) $x(n) = n\,a^n\,u(n)$	*CO2*	*PO1*	**10**
		b)	Determine the inverse Z-transform of $X(z) = \frac{z(z^2-4z+5)}{(z-3)(z-2)(z-1)}$ for the following ROC of i) $2 < \|z\| < 3$ ii) $\|z\| > 3$ iii) $\|z\| < 1$	*CO3*	*PO2*	**10**

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