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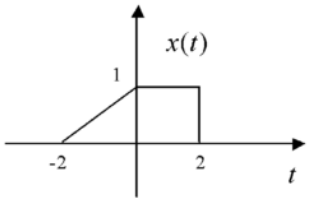
B.M.S. College of Engineering, Bengaluru-560019

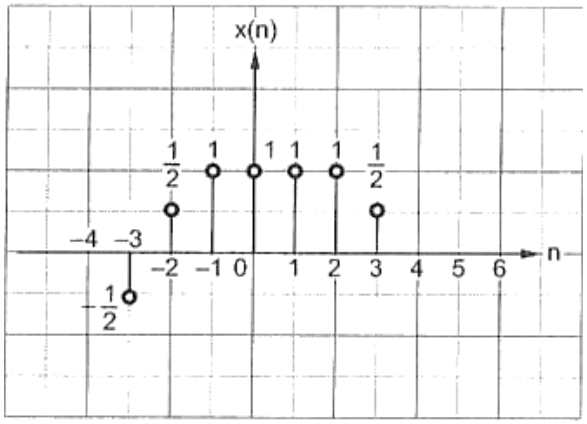
Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 22EI4PCSAS **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) $x(n) = \left(\frac{1}{2}^n\right) u(n)$ (ii) $x(t) = rect\left(\frac{t}{T_0}\right)$	CO1	PO1	**06**
	b)	For the signal x(t) shown in fig.1, find the following (i) x(0.5t) (ii) x(2t) (iii) x(-t+2) (iv) x(t-3) (v) x(-2t)  fig.1	CO1	PO1	**06**
	c)	Determine whether the following discrete time signals are periodic; if periodic, give the period. (i) Cos(3πn) (ii) Sin(3n) (iii) Sin(π+0.2n) (iv) $\text{Cos}(\frac{2\pi n}{5}) + \text{Cos}(\frac{2\pi n}{7})$	CO1	PO1	**08**
		OR			
2	a)	Sketch the even and odd component of the signal $x(t) = e^{\frac{-1}{4}t} u(t)$	CO1	PO1	**06**
	b)	Determine if the following signals are periodic; if periodic, give the period. i) x(t) = cos(4t) + 2sin(8t)	CO1	PO1	**06**

			ii) x(t) = 3cos(4t) + sin(πt) iii) x(t) = cos(3πt) + 2 cos(4π t)			
		c)	A discrete time signal x(n) is as shown in fig.2  fig.2 Sketch the following signals: (i) x(n-3) (ii) x(3-n) (iii) x(n)u(3-n) (iv) x(2n)	*CO1*	*PO1*	**08**
			UNIT - II			
	3	a)	For each of the systems, state whether the system is linear, shift variant and causal (i) y(n)= log[x(n)] (ii) $y(n)=e^{x(n)}$	*CO2*	*PO2*	**06**
		b)	Determine whether the following systems are invertible or not, if it is construct the inverse system. (i) y(t)=10 x(t) (ii) $y(t)=x^2(t)$ (iii) y(t)=log(x(t)) (iv) $y(t) = \int_{-\infty}^{t} x(\tau).d\tau$	*CO2*	*PO2*	**08**
		c)	Find the overall operator of the system whose output signal is given by y(n)=1/3[x(n+1)+x(n)+x(n-1)]. Also, draw the block diagram representation.	*CO2*	*PO2*	**06**
			OR			
	4	a)	Determine whether the following systems are linear or not linear, static or dynamic and stable or unstable system. i) $y(t) = 20x(t) + 6$ ii) $\frac{dy(t)}{dt} + 10y(t) = x(t)$	*CO2*	*PO2*	**08**
		b)	Find whether the following systems are invertible or not. i) $y(t) = x^2(t)$ ii) $y(n) = \log [x(n)]$	*CO2*	*PO2*	**06**

		c)	Determine whether the following systems are time shift variant and causal systems. i) $y(n) = x(2n)$ ii) $y(n) = x(-n+2)$	*CO2*	*PO2*	**06**
			UNIT - III			
	5	a)	The impulse response of the LTI system is h(t)=u(t). Determine the output of the system if the input x(t)= e^{-at} u(t), a>0.	*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.	*CO2*	*PO2*	**10**
		c)	Draw the direct form-I and direct form-II structure for the following structure: $\frac{d^3y(t)}{dt^3}+2\frac{d^2y(t)}{dt^2}+3y(t)=x(t)+3\frac{d^2x(t)}{dt^2}$	*CO3*	*PO2*	**04**
			OR			
	6	a)	The input x(t) and impulse response h(t) of the LTI system are described by x(t)= e^{-3t} u(t) and h(t)=u(t-1). Evaluate the output.	*CO3*	*PO2*	**06**
		b)	A LTI system has the impulse response given by $h(n)=u(n)-u(n-10)$. Determine the output of the system when the input is $x(n)=u(n-2)-u(n-7)$ using the convolution sum. Show the details of your computation. Sketch all the sequence.	*CO3*	*PO2*	**08**
		c)	A difference equation of discrete time system is given below: $y(n)-\frac{3}{4}y(n-1)+\frac{1}{8}y(n-2)=x(n)+\frac{1}{2}x(n-1)$. Draw direct form-I and direct form-II structure.	*CO3*	*PO2*	**06**
			UNIT - IV			
	7	a)	Specify the Nyquist rate for each of the following signals (i) $X_1(t)=Sinc(200t)$ (ii) $X_2(t)=Sinc^2(220t)$	*CO4*	*PO2*	**04**
		b)	Evaluate the DTFT of the signal (i) $x(n)=\left(\frac{1}{2}^n\right)u(n-4)$ (ii) $x(n)=-a^n u(-n-1)$	*CO4*	*PO2*	**08**
		c)	The impulse response of a continuous time LTI system is given by $h(t)=\frac{1}{RC}e^{\frac{-t}{RC}}u(t)$. Find the frequency response and plot the magnitude and phase response.	*CO4*	*PO2*	**08**
			OR			

	8	a)	Find the FT of the following signals: i) $x(t) = cosw_o t$ ii) $x(t) = e^{-a\|t\|}$			**06**
		b)	Obtain the FT of the signal e^{-at}u(t) and plot its magnitude and phase plot.			**08**
		c)	State and prove the following properties of DTFT: i) Frequency shift ii) Time reversal			**06**
			UNIT - V			
	9	a)	Find the Z-transform of $x(n) = \left[3\left(\frac{4}{5}\right)^n - \left(\frac{2}{3}\right)^{2n}\right]u(n)$. Also, find the ROC.	*CO4*	*PO2*	**06**
		b)	Find the inverse Z-transform of $X(z) = \frac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1}$	*CO4*	*PO2*	**06**
		c)	Solve the following difference equation using unilateral Z-transform. $y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n)$; for n≥0 With initial conditions y(-1)=4; y(-2)=10 and $x(n) = \left(\frac{1}{4}\right)^n u(n)$	*CO4*	*PO2*	**08**
			OR			
	10	a)	Given that $y(-1) = 5\ and\ y(-2) = 0$, solve the difference equation $y(n) - 3y(n-1) - 4y(n-2) = 0,\ n \geq 0$	*CO4*	*PO2*	**10**
		b)	Find the Z-transform of $x(n) = a^n u(n) + b^n u(-n-1)$	*CO4*	*PO2*	**05**
		c)	Determine the inverse Z-transform of $X(z) = \frac{1}{1-az^{-1}}$ ROC:$\|z\| > \|a\|$	*CO4*	*PO2*	**05**

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