U.S.N.										

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

Autonomous Institute Affiliated to VTU

July / August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: ES Cluster **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.

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 waveforms 1. $X_1(t) = u(t)- u(t-3)$ 2. $X_2(t) = u(t+2)- 2u(t) + u(t-2)$ 3. $X_3(t) = r(t+1)-r(t) + r(t-2)$ where u(t) and r(t) stands for unit step and unit ramp signal respectively.	CO1	PO1	**06**
	b)	Determine whether the given signals are periodic. Determine the fundamental period if periodic 1. X(n) = cos [0.125 nπ] 2. X(n) Re {exp (j nπ /12)} +Im {exp (j nπ /18)} 3. X(t)=cos (2t) 4. X(n)= exp (jπn/16) cos [nπ/17].	CO1	PO1	**08**
	c)	Find and sketch the first order derivative of the following signals 1. x(t) = u(t)-u(t-a); a>0 2. y(t)=t[u(t)-u(t-a)] : a>0	CO1	PO1	**06**
		OR			
2	a)	Analyze and sketch dependent and independent signal operation with an examples	CO1	PO2	**10**
	b)	Evaluate & analyze even and odd signals for the following equations: i).$x(t) = (1+t^3)\cos^3(10t)$ ii).$1+t+3t^2+5t^3+9t^4$	CO2	PO2	**04**
	c)	Analyze and Evaluate the average Power or Energy of the following signals after determining whether they are Energy or Power signals. $i).x(n) = e^{j[(\frac{\pi}{3})n+\frac{\pi}{2}]}; ii).x(t) = cos^2 w_0 t, iii).x(t) = Ae^{-\alpha t}u(t), \alpha > 0$	CO2	PO2	**06**
		UNIT - II			
3	a)	a) For the following system illustrate whether the system is Linear, Time invariant, Memory, causal and stable i. $y(n)=g(n)\,x(n)$ ii. $y(t)=x^2(t)$	CO1	PO2	**04**

		b)	Represent following difference equation in Direct Form-I and Direct form- II block diagram representation. Y(n)+0.5y(n-1)-0.25y(n-2) +0.33y(n-3)=x(n)+3x(n-1)+2x(n-2)	*CO3*	*PO2*	**08**
		c)	Draw the direct Form-I and direct form-II realizations for the system described by the following equation. y(n) 5y(n-1)+y(n-2) = 3x(n) - 4x(n-2)	*CO3*	*PO3*	**08**
			UNIT - III			
	4	a)	An LTI system is characterized by h(n)= $(3/4)^n$ u(n). compute the output of the system at time n=5,-5,10, when the input x[n]=u[n]	*CO4*	*PO3*	**06**
		b)	Find the convolution sum y[n] of the following signal $x[n] = \alpha^n[u(n) - u(n-10)]$ $h[n] = \beta^n u[n] \quad 0 < \beta < 1$	*CO4*	*PO3*	**08**
		c)	Show that i) The convolution of an odd and an even function is an odd function ii) The convolution of two odd functions is an even function. iii) The convolution of two even functions is an even function.	*CO4*	*PO3*	**06**
			OR			
	5	a)	Given h(t) = e^{-t}u(t) and x(t) = e^{-3t}{u(t)-u(t-2)}. Determine y(t) using convolution integral. Also plot y(t).	*CO3*	*PO2*	**06**
		b)	State and prove the following properties of the impulse response i) Commutative property ii) Associative property	*CO4*	*PO3*	**08**
		c)	Compute the convolution of x(n) = u (n − 1) and h(n) = a^n u(n − 1)	*CO4*	*PO2*	**06**
			UNIT - IV			
	6	a)	Using Convolution Theorem find inverse Fourier transform of X (jw) = 1/ $(a + jw)^2$	*CO3*	*PO2*	**06**
		b)	The impulse response of the continuous time system is given as $h(t) = \frac{1}{RC} e^{-\frac{t}{RC}} u(t)$ Determine the frequency response and plot the magnitude and phase plots	*CO3*	*PO2*	**07**
		c)	The output of a causal LTI system is related to the input x(t) by the equation $\frac{dy(t)}{dt} + 10y(t) = \int_{-\infty}^{\infty} x(\tau)z(t-\tau)d\tau - x(t).$ Where $z(t) = e^{-t}u(t + 3\delta(t))$ i. Find the frequency response of the system ii. Determine impulse response.	*CO3*	*PO2*	**07**
			UNIT - V			
	7	a)	Find the Z-Transform of i) x[n] = $(-3/4)^n$ u(n) +2$(1/2)^n$ u(n). Specify its ROC. ii) x[n] = sin(πn/4) u(n). Determine its ROC.	*CO5*	*P02*	**08**

		b)	Solve the difference equation y(n)+3y(n-1)=x(n) with x(n)=u(n) and the initial condition y(-1)=1 using Z-Transform method	*CO5*	*P01*	**06**
		c)	Using appropriate properties find the Z Transform of $i)\ x(n) = n2^n \sin\left(\frac{\pi}{2}n\right) u(n)$.Given Z Transform of $\sin\left(\frac{\pi}{2}n\right) u(n) = \frac{z \sin\frac{\pi}{2}}{z^2 - 2z\cos\frac{\pi}{2} + 1}$ $ii) x(n) = nu(n).$	*CO5*	*P01*	**06**

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