U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**

Branch: Medical Electronics Engineering **Duration: 3 hrs.**

Course Code: 23MD5PCSGP / 22MD5PCSGP **Max Marks: 100**

Course: Signal Processing

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)	Define Signal. Explain the of Digital signal Processing steps with neat block diagram.	*CO1*	*PO1*	**08**
	b)	Consider the analog signal ***Xa(t)=3cos100π t*** i.Determine the minimum sampling rate required to avoid aliasing ii.Suppose that the signal is sampled at the rate of *Fs= 200 Hz*. What is the discrete-time signal obtained after sampling? iii.Suppose that the signal is sampled at the rate of Fs= *75 Hz*. What is the discrete time signal obtained after sampling? What is the Frequency 0< *F< Fs /2 of* a sinusoid that yields samples identical to those obtained in part(iii)?.	*CO2*	*PO2*	**08**
	c)	Differentiate between i) Deterministic Versus Random signals ii) Continuous -time versus Discrete time signal	CO2	PO2	**04**
		OR			
2	a)	A Continous-time signal x(t) is shown in the below figure. Sketch and label each of the following signals I. x(t-2) II. x(2t) III. x(t/2) IV. x(-t)	CO2	PO2	**08**
	b)	Compute the convolution of two sequence $x_1(n)$ and $x_2(n)$, given below $x_1(n)$ ={1,2,3} and $x_2(n)$ = {1,2,3,4}	CO3	PO3	**06**
	c)	Explain the following Properties of systems I. Causality II. Invertibility	CO2	PO2	**06**

			UNIT - II			
	3	a)	Find the Complex Fourier Coefficient for x(t) given below x(t) =cos ($\frac{2\pi}{3}$ t) + 2cos ($\frac{5\pi}{3}$ t)	*CO3*	*PO3*	**06**
		b)	Find the Complex Fourier Coefficient, the power spectrum and the total power for x(t) defined below x(t) = 5 sin(5t) + 7 cos(6t) + 3 Also, find the total power I. If x(t) were a voltage across 10,000 ohms II.If x(t) were a current through 0.01 ohm	*CO3*	*PO3*	**08**
	3	c)	Find the Z-transform of $x(n) = \alpha^{-n}u(-n-1)$	CO3	PO3	**06**
			OR			
	4	a)	Find the inverse Z-transforms of $\mathbf{X(z)=} \frac{(2+3z^{-2}+2z^{-3})}{z^2+4z+3}$	*CO3*	*PO3*	**08**
		b)	Find the Fourier transform of the function $x(t) = te^{-2t}u(t)$	CO3	PO3	**08**
		c)	Explain the Frequency shift property of Fourier transform.	*CO3*	*PO3*	**04**
			UNIT - III			
	5	a)	Perform the circular convolution of the following two sequences x_1 (n) = {2,1,2,1} ↑ x_2 (n) = {1,2,3,4} ↑	CO3	PO3	**10**
		b)	Compute the DFT of the four-point sequence X(n)={0 1 2 3}	CO2	PO2	**10**
			OR			
	6	a)	Determine DFT of sequence x(n)=$\frac{1}{3}$ for 0 ≤ n≤ 2 for N=4. Plot magnitude and Phase spectrum	CO2	PO2	**10**
		b)	Define DFT and Explain the three main properties of DFT.	CO2	PO2	**10**
			UNIT - IV			
	7	a)	Develop an 8 point DIT-FFT algorithm and Draw a signal flow graph. Determine the DFT of the sequence X(n)={1,1,1,1,0,0,0,0}	*CO3*	*PO3*	**10**
		b)	Prove the following: I. Periodicity property of W_N: $W_N^{k+N} = W_N^k$ II. Symmetry Property of W_N: $W_N^{k+N/2} = - W_N^k$	*CO3*	*PO3*	**10**

			OR			
	8	a)	Obtain the 8-point DFT of the following sequence using Radix-2 DIF-FFT algorithm., Show all the results along signal flow graph X(n)={2,1,2,1}	*CO3*	*PO3*	**10**
		b)	Calculate the IDFT of X(k) by inverse Radix-2 DIT-FFT algorithm. X(k)={0,28284-j28284,0,0,0,0,0,28284+j28284}	CO3	PO3	**10**
			UNIT - V			
	9	a)	Realize the following system function in cascade form $H(Z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$	*CO3*	*PO3*	**10**
		b)	Derive an expression for a system function, if the unit sample response h(n) is obtained using Frequency sampling technique.	*CO3*	*PO3*	**10**
			OR			
	10	a)	Design an FIR linear phase filter using kaiser window to meet the following specifications $0.99 \leq \lvert H(e^{jw}) \rvert \leq 1.01, \quad 0 \leq \lvert\omega\rvert \leq 0.19\pi$ $\lvert H(e^{jw}) \rvert \leq 0.01, \quad 0.21\pi \leq \lvert\omega\rvert \leq \pi$	*CO3*	*PO3*	**10**
		b)	Design a second order lowpass butterworth filter with cutoff frequency of 1kHz and sampling frequency of 10^4 samples/sec by bilinear transform	*CO3*	*PO3*	**10**

****