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: V**

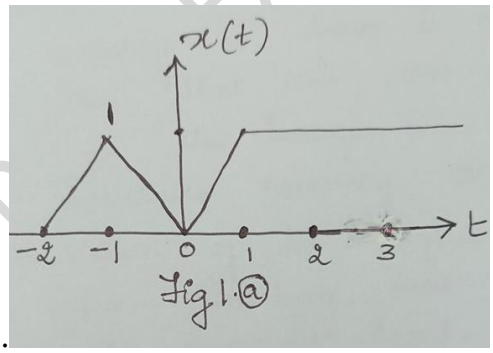
Branch: Medical Electronics Engineering **Duration: 3 hrs.**

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)	Check whether the given signal is energy signal or power signal. i) .x(t) = $e^{2t}\,u(t-2)$ ii) $x[n] = (-0.5)^n u(n)$	CO2	CO 2	**8**
	b)	A signal x (t) is shown in fig 1(a). Find its odd and even parts of the signal x (t). 	CO2	CO2	**6**
	c)	Find the fundamental period of the given signal x(n) = $Cos\left(\frac{\pi}{4}n\right) + Sin\left(\frac{\pi}{8}n\right) - 2Cos\left(\frac{\pi}{2}n\right)$ b) Determine the fundamental period and frequency for the signal x[t] = 2 Cos[40πt] + sin[60πt]	*CO3*	*CO3*	**6**
		OR			
2	a)	An LTI system has impulse response h (n) =u (n)-u (n-4). Find output when input is x (n) =u (n-10)-2u (n+5) +u (n+6). Sketch the output	CO2	CO2	**9**
	b)	Find Forced response of the system given by equation: $y^{11}(t)+3y^{1}(t)+2y(t)=x(t)+x^{1}(t)$, x(t)=5u(t)	CO2	CO2	**6**

		c)	Draw the direct form-I and Direct form-II implementation for the following difference equation. y(n)+1/2 y(n-1)-y(n-3)=3x(n-1)+2x(n-2)	CO2	CO2	**5**
			UNIT - II			
	3	a)	State and prove the following properties of Discrete time Fourier transform i). Periodicity ii). Frequency Shift Property	CO2	CO2	**6**
		b)	Find DTFT of the signal and draw the amplitude spectrum. i). x(n)=(1,2,3,4), origin at 1 , ii)x(n)= $(1/3)^n u(n-5)$	CO3	PO3	**8**
		c)	Using the concept of Fourier representation, obtain frequency response of the system described by the following impulse response. h(t)= $4\boldsymbol{e^{-2t}}$Cos 20t u(t)	CO3	PO3	**6**
			OR			
	4	a)	Mention the properties of ROC.	CO3	PO3	**6**
		b)	Find the Z-transform and sketch the ROC for the following sequence: i).x(n)=$(1/2)^n u(n)+(3/4)^n u(n)$ ii). x(n)=$n(n-1)a^n u(n)$	CO3	PO3	**6**
		c)	Determine x(n) if X(z)=$\frac{\mathbf{1-z^{-1}+z^{-2}}}{(\mathbf{1-1/2z^{-1}})(\mathbf{1-2z^{-1}})(\mathbf{1-z^{-1}})}$ for ROC $\boldsymbol{i}).\ \boldsymbol{\lvert Z\rvert < 1/2}$ ii). $\mathbf{1} < \lvert Z\rvert < \mathbf{2}$	CO3	PO3	**8**
			UNIT - III			
	5	a)	Find DFT of the sequence x (n) = {2, 3, 1, 2} in matrix form. Plot magnitude and phase diagrams.	CO3	PO3	**6**
		b)	State and prove the Parseval's theorem applied for two samples x_1 (n) and x_2 (n) in finding the magnitude of the DFT of the samples.	CO3	PO3	**6**
		c)	The two sequences $x_1(n)$ and $x_2(n)$ are given as follows: $x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$. Find out the sequence $x_3(n)$ which is the circular convolution of the above two sequences, $x_1(n)$ and $x_2(n)$.	CO3	PO3	**8**
			OR			
	6	a)	State and prove the following properties of DFT Circular Time Shift ii) Circular Convolution	*CO3*	*PO3*	**08**

		b)	Determine the circular convolution between x(n)=[2,1,2,1] and h(n)=[1,2,3,4].	*CO3*	*PO3*	**06**
		c)	Compute 4-point DFT of the sequence x(n)=[1,2,3,4]. Sketch magnitude and phase spectrum.	*CO3*	*PO3*	**06**
			UNIT - IV			
	7	a)	Compare and contrast the DIT and DIF algorithms. Calculate the number of multiplications needed in the calculation of DFT using FFT algorithm with 32-point sequence.	CO3	PO3	**10**
		b)	Draw the butterfly line diagram for 8-point FFT calculation and briefly explain. Use decimation-in-time algorithm.	CO3	PO3	**10**
			OR			
	8	a)	Develop decimation in time FFT algorithm to compute DFT. Draw signal flow graph for N=8	CO4	PO4	10
		b)	Determine 8-point DFT of sequence x(n)= {1,1,0,0,-1,-1,0,0} using DIT-FFT method.	CO4	PO4	10
			UNIT - V			
	9	a)	Distinguish between IIR and FIR filters.	CO4	PO4	**4**
		b)	Draw the cascade realization of IIR filter characterized by transfer function H(z)=$\frac{4Z^3+16Z^2+4Z-24}{(2Z^4+1.6Z^3+0.3Z^2+0.1Z)}$	CO4	PO4	**10**
		c)	Apply the bilinear transformation to $H_a(S)=\frac{4}{(S+3)(S+4)}$ with T=0.5s and H(Z)	CO4	PO4	**6**
			OR			
	10	a)	An analog signal contains frequencies up to 10kHz. This signal is sampled at 50kHz.Design the FIR filters having linear phase characteristics and transition band of 5kHz. The filter should provide min 50dB attenuation at the end of transition band.	CO4	PO4	**10**
		b)	A LPF is to be designed with the following desired frequency response $H_d(e^{jw})=\begin{cases} e^{-j2w} & -\pi/4 \le w \le +\pi/4 \\ 0 & +\pi/4 \le \lvert w \rvert \le +\pi \end{cases}$ Determine the filter coefficients h(n), $h_d(n)$ and the frequency response of the filter if w(n) is a rectangular window defined by $w(n)=\begin{cases} 1 & 0 \le \pi \le 4 \\ 0 & \text{otherwise.} \end{cases}$	CO4	PO4	**10**

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