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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: Electronics and Telecommunication Engineering **Duration: 3 hrs.**

Course Code: 23ET4PCSSD **Max Marks: 100**

Course: Signals and Systems :Digital

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)		Given the signal $x(n) = n + (-1)^n$. Find its even and odd components	CO2	PO1	**06**
	b)		What is a gold sequence? Give an example on generation of gold sequence	CO1	-	**06**
	c)		Determine whether the following signals are periodic or not periodic. Hence find the fundamental time period (i) $x(n) = \cos\left(\frac{2\pi}{3}n\right)$ (ii) $x(n) = e^{j\left(\frac{\pi}{4}\right)n}$	CO2	PO1	**08**
			OR			
2	a)		A system is defined as $y(n) = \sum_{k=n_0}^{n} x(k)$. Apply necessary equations and test the system for the following. (i) linearity (ii)static/dynamic (iii) causality (iv)time invariance (v)stability	CO4	PO3	**10**
	b)		What is PRBS? Give an example on generation of PRBS	CO1	-	**06**
	c)		Find the energy of the signal x(n)={1,2,3,4}	CO2	PO1	**04**
			UNIT - II			
3	a)		Define Autocorrelation. List its properties	CO1	-	**06**

		b)	Find the output of a LTI system, whose impulse response is h(n)={1,1,1} and the input signal is x(n)={3,-1,0,1,3,2,0,1,2,1} using overlap save method.	*CO2*	*PO1*	**10**
		c)	Find the impulse response of the difference equation given by $y(n)-\beta y(n-1)=x(n)$	*CO2*	*PO1*	**04**
			OR			
	4	a)	Define Cross correlation. List its properties	*CO1*	-	**06**
		b)	Find the output of a LTI system, whose impulse response is h(n)={1,1,1} and the input signal is x(n)={3,-1,0,1,3,2,0,1,2,1} using overlap add method.	*CO2*	*PO1*	**10**
		c)	Find the circular convolution of x(n)={1,2,1} and y(n)={1,2,3,4} using matrix method.	*CO2*	*PO1*	**04**
			UNIT - III			
	5	a)	Describe the process of up sampling with a block diagram	*CO1*	-	**04**
		b)	Find the 8 point DFT of x(n)={0.707,1,0.707,0,-0.707,-1,-0.707,0}. Draw its magnitude and phase spectrum	*CO2*	*PO1*	**10**
		c)	State and prove time shift property of DFT			**06**
			OR			
	6	a)	Describe the process of down sampling with a block diagram	*CO1*	-	**04**
		b)	Find the 4point DFT of x(n)={1,2,0,4} using (i)DIT-FFT Algorithm (ii) DIF-FFT Algorithm	*CO2*	*PO1*	**10**
		c)	State and prove frequency shift property of DFT	*CO1*	-	**06**
			UNIT - IV			
	7	a)	Define Power spectral density (PSD). List the key characteristics of PSD.	*CO1*	-	**06**
		b)	Design a low pass digital filter that will have a -3dB cutoff at 30π rad/sec and an attenuation of 50dB at 45π rad/sec. The filter is required to have a linear phase and the system will use a sampling rate of 100 samples/second.	*CO4*	*PO3*	**08**
		c)	Draw the frequency sampling structure of FIR filters along with relevant expressions	*CO1*	-	**06**
			OR			

	8	a)	Find the impulse response for the following system. Draw the pole-zero plot. $y(n)-0.5y(n-1)=x(n)$	*CO2*	*PO1*	**06**
		b)	With relevant expressions, show the design procedure for FIR filters using frequency sampling technique.	*CO2*	*PO1*	**06**
		c)	With the help of an example impulse response, Draw the linear phase structure of FIR filter for the following cases (i) N is odd, Where N is the length of the filter (ii) N is even, , Where N is the length of the filter	*CO2*	*PO1*	**08**
			UNIT - V			
	9	a)	Show with an example how wavelet transform can be applied for denoising applications	*CO1*	-	**06**
		b)	Design a digital filter equivalent (Apply Bilinear transformation) of a 2^{nd} order Butterworth low-pass filter with a cut-off frequency f_c = 100 Hz and a sampling frequency f_s = 1000 samples/sec. Derive the finite difference equation and draw the realization structure of the filter. Given that the analogue prototype of the frequency-domain transfer function H(s) for a Butterworth filter is $\frac{1}{s^2+\sqrt{2}.s+1}$	*CO4*	*PO3*	**10**
		c)	With relevant expressions, draw the Direct form-I realization of a second order IIR filter.	*CO1*	-	**04**
			OR			
	10	a)	Show with an example how wavelet transform can be applied for compression of data.	*CO1*	-	**06**
		b)	With relevant expressions, show the design procedure of IIR filter using impulse invariant method.	*CO1*	-	**08**
		c)	With relevant expressions, draw the Direct form-II realization of a second order IIR filter.	*CO1*	-	**06**

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