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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE6PCSIP **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)		Analyze and Evaluate the average power or energy of the following signals after determining whether they are Energy or Power signals.$i).x(n)=u(n), ii).x(n)=e^{j[\left(\frac{\pi}{3}\right)n+\frac{\pi}{2}]}$	CO1	PO1	**04**
	b)		Analyze and sketch the following the DT signal operation of : x(n):{1 -1 **2** 0 1 1 4}; **2**=origin **i).**x(-n-2); **ii).**x(-2n-2); **iii)**. x(-n+3)	CO2	PO2	**06**
	c)		Design an LTI system, If x(n) = {[1 **1** 0 2] (**1**=origin} and y(n)={[2 4 **6** 12 16 L M N](**6**=origin)}. Analyses and develop the DT convolution sum of the signal, evaluate L M &N and also verify by tabular Convolution method.	CO2	PO2	**10**
			OR			
2	a)		Determine the even and odd parts of the following signals a. $x(n)=3e^{\frac{j\pi n}{5}}$ b. $x(n)=\{3,-4,2,0,6,3,9,5\}$ $\uparrow$	CO2	PO2	**06**
	b)		Analyze whether the following signals are periodic or not. If periodic, determine the fundamental period of the signal. a. $x(t)=\sin 10\pi t$ b. $x(t)=\sin \pi t\, u(t)$	CO2	PO2	**06**
	c)		Design an LTI system, which results in response y(n), if the input sequence x(n)=[1 1 1] and h(n)=[1 -1 1 3 2] by graphical method(linear convolution). Verify the response of the system using the designed Unit impulse sequence and using short cut method	CO2	PO2	**08**
			UNIT - II			
3	a)		Enumerate the properties of ROC of Z - transforms	CO2	PO2	**04**
	b)		Evaluate & Analyses the z-transform using appropriate property: $\boldsymbol{x(n)=\frac{1}{3}(n^2-n)\left(\frac{1}{2}\right)^{n-1}u(n-1)}$	CO2	PO2	**06**

		c)	A long sequence is filtered through a filter of impulse response h[n] to give the output y[n] for the input x[n]. given h[n] and x[n] as follows, compute y[n] using overlap and add method. x(n) = [1,1,1,1,1,3,1,1,4,2,1,1,3,1,1,1] h(n)= [1, -1]. Use five-point circular convolution	*CO2*	*PO2*	**10**
			OR			
	4	a)	Analyze and evaluate the average Power or Energy of the following signals after determining whether they are Energy or Power signals $a. x(n) = u(n)$ $b. x(n) = e^{j\left[\left(\frac{\pi}{3}\right)n+\frac{\pi}{2}\right]}$ $c. x(n) = (-0.4)^n u(n)$	*CO2*	*PO2*	**10**
		b)	Analyze and sketch the following DT signal operation of: x(n)={1 −1 **2** 0 1 1 4}; **2** = origin i) $x(-n-2)$ ii) $x(-2n-2)$ iii) $2\,x(n)$ iv) $x(-n+3)$ v) $x(n/4)$	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	Develop an 8 point DIT-FFT algorithm, draw the signal flow graph. Evaluate the DFT of the following sequence: x(n)={1 2 4 8 16 32 64 128},using the signal flow graph show all the intermediate results on the signal flow graph.	*CO2*	*PO2*	**10**
		b)	Obtain a) Direct form II b) Cascade realization with two biquadratic section realization for the system described below. $H(Z) = \frac{(z-1)(z^2+5z+6)(z-3)}{(z^2+6z+5)(z^2+6z+8)}$	*CO2*	*PO2*	**10**
			OR			
	6	a)	First five points of 8-point DFT of a real valued sequence is given by X(k) = {0, 2+j2, -j4, 2-j2, 0}. Determine the remaining points. Hence Determine the sequence x(n) using DIF FFT.	*CO2*	*PO2*	**10**
		b)	The transfer function of FIR filter is: $H(z) = (1 + 0.25z^{-1} + z^{-2})(1 + 2z^{-1} + z^{-2})$ Realize the filter using i) direct form ii) linear phase form iii) cascade form structure.	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Design butter-worth filter for the following specifications: $0.8 \le \|Ha(s)\| \le 1$ for $0 \le F \le 1000$ Hz; & $\|Ha(s)\| \le 0.2$ for $F \ge 5000$ Hz	*CO3*	*PO3*	**10**
		b)	Design the Chebyshev filter with specification: Ap=2.5dB;Ωp=20 rad/sec; As =30dB;Ωs=50 rad/sec.	*CO3*	*PO3*	**10**
			OR			
	8	a)	For the analog filter with transfer function	*CO3*	*PO2*	**12**

			$H_a(s) = \frac{4}{(S+2)(S+3)}$ determine the digital IIR transfer function H(Z) using impulse invariance transformation. Given T=2 sec			
		b)	Obtain the digital filter H(z) from analog filter Ha(s) using bilinear transformation. Given the $H_a(s) = \frac{4s}{s^2+0.4s+2}$ and T= 2 sec	*CO3*	*PO2*	**08**
			UNIT - V			
	9	a)	Design a FIR digital filter with the following desired specification using a Hanning window with N=7 $H(\Omega)_d = \begin{cases} e^{-3jw} & \frac{-\pi}{4} \le \lvert w \rvert \le \frac{\pi}{4} \\ 0 & \frac{\pi}{4} \le \lvert w \rvert \le \pi \end{cases}$	*CO3*	*PO3*	**10**
		b)	Design a FIR digital filter with the following desired specification using a frequency sampling method with N=7: $H(w)_d = \begin{cases} e^{-j3w} & 0 \le \lvert w \rvert \le \frac{\pi}{2} \\ 0 & \frac{\pi}{4} \le \lvert w \rvert \le \pi \end{cases}$	*CO3*	*PO3*	**10**
			OR			
	10	a)	Enumerate the advantages and disadvantages of FIR filters.	*CO1*	*PO1*	**08**
		b)	Design a lowpass FIR filter using rectangular window with M=7 and with a cutoff frequency of 1 rad/sec.	*CO3*	*PO3*	**12**

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