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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: VI**

Branch: Electrical and Electronics Engineering | **Duration: 3 hrs.**

Course Code: 23EE6PCSIP / 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 $.i) x(n) = 2u(n), ii)\ x(n) = \left(\frac{1}{3}\right)^n u(n)$	*CO2*	*PO2*	**04**
	b)	Analyze and sketch the following the DT signal operation of : x(n)={1 -1 **2** 3 -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, which results in response y(n), if the input sequence x(n)= [1 1 0.5 0.5] and h(n) = [1 1 0.5 0.25] by graphical method (linear convolution). Verify the response of the system using the designed unit impulse sequence and using short cut method.	*CO3*	*PO3*	**10**
		OR			
2	a)	What is dependent signal operation with examples	*CO1*	*PO1*	**04**
	b)	Explain with examples of following property: static property, causal property & Time-invariant property.	*CO1*	*PO1*	**06**
	c)	If x(n)={1 **2** 0 3};2=origin and output y(n)={1 4 **5** 10 22 P Q R}; 5=Origin, Analyse and evaluate the impulse function of h(n) and also values of PQR.	*CO2*	*PO2*	**10**
		UNIT – II			
3	a)	Analyze and perform the following on the sequence x(n)={1 2 3 1}& h(n) ={1 1 1 } (i) Linear convolution; (ii) Circular convolution; (iii) Linear convolution using circular convolution.	*CO2*	*PO2*	**08**
	b)	Analyze and evaluate the linear convolution of the given sequence:	*CO2*	*PO2*	**12**

			h(n) = {1 2 } & x(n)={1 2 -1 2 3 -2 -3 -1 1 1 2 -1 }, using overlap save and overlap-add method, compare the results.			
			OR			
	4	a)	Evaluate & analyse the z-transform using appropriate property: $\boldsymbol{x(n) = n[\left(\frac{1}{2}\right)^{n} u(n) + \left(\frac{1}{3}\right)^{n} u(n)]}$	*CO2*	*PO2*	**08**
		b)	Analyze and evaluate the linear convolution of the given sequence: h(n) = {1 1 1 } & x(n)={3 -1 0 1 3 2 0 1 2 1 }, using overlap save and overlap-add method, compare the results.	*CO2*	*PO2*	**12**
			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 1 1 1 0 0 0}, using the signal flow graph show all the intermediate results on the signal flow graph.	*CO2*	*PO2*	**12**
		b)	Realize the following system function by IIR structure: i). Direct-Form-II & ii). Cascaded Form: $H(z) = \frac{Y(z)}{X(z)} = \frac{8z^3 - 4z^2 - 11z - 2}{(z-0.25)(z^2 - z + 0.5)}$	*CO1*	*PO1*	**08**
			OR			
	6	a)	Analyze & develop an 8-point DIF-FFT algorithm, draw the signal flow graph. Evaluate the DFT of the following sequence x(n)=n+1 using the signal flow graph show all the intermediate results on the signal flow graph.	*CO2*	*PO2*	**12**
		b)	Realize the following system function by linear phase FIR structure: $i).H(z) = 1 + \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2} + \frac{1}{7}z^{-3} + \frac{1}{3}z^{-4} + \frac{1}{2}z^{-5} + z^{-6}$ $ii).H(z) = 1 + \frac{1}{3}z^{-1} + \frac{1}{4}z^{-2} + \frac{1}{4}z^{-3} + \frac{1}{3}z^{-4} + z^{-5}$	*CO1*	*PO1*	**08**
			UNIT - IV			
	7	a)	Design an analog filter with maximally flat response in the passband and acceptable attenuation of -2dB at 20 rad/sec. The attenuation in the stopband should be more than 10dB beyond 30 rad/sec.	*CO3*	*PO3*	**10**
		b)	Design the Chebyshev filter with specification: A_p=2.5dB; Ω_p=20 rad/sec; A_s =30dB; Ω_s=50 rad/sec.	*CO3*	*PO3*	**10**
			OR			
	8	a)	Design butter-worth filter for the following specifications: $0.8 \leq \lvert H_a(s)\rvert \leq 1$ for $0 \leq F \leq 1000$ Hz; & $\lvert H_a(s)\rvert \leq 0.2$ for $F \geq 5000$ Hz	*CO3*	*PO3*	**10**
		b)	Design an analog butter-worth band-pass filter for the following specifications: -3dB for frequency above 500Hz and below 5KHz -20dB for frequency less 100Hz and greater than 50KHz	*CO3*	*PO3*	**10**

			UNIT - V			
	9	a)	Design a FIR digital high pass filter with the following desired specification using a Hanning window with N=11 $$H(\Omega)_d = \begin{cases} 1 & \frac{\pi}{4} \le \lvert w \rvert \le \pi \\ 0 & otherwise \end{cases}$$	*CO3*	*PO3*	**10**
		b)	Using frequency sampling method, design a band pass filter with the following specification: Sampling frequency: F=80000Hz Cut-off frequency F_{c1}:1000 Hz Cut-off frequency F_{c2}:3000 Hz ; Evaluate the filter co-officients for N=7	*CO3*	*PO3*	**10**
			OR			
	10	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: $$H(w)_d = \begin{cases} e^{\frac{-j(N-1)w}{2}} & 0 \le \lvert w \rvert \le \frac{\pi}{2} \\ 0 & \frac{\pi}{4} \le \lvert w \rvert \le \pi \end{cases}$$	*CO3*	*PO3*	**10**

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