U.S.N.										

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

Autonomous Institute Affiliated to VTU

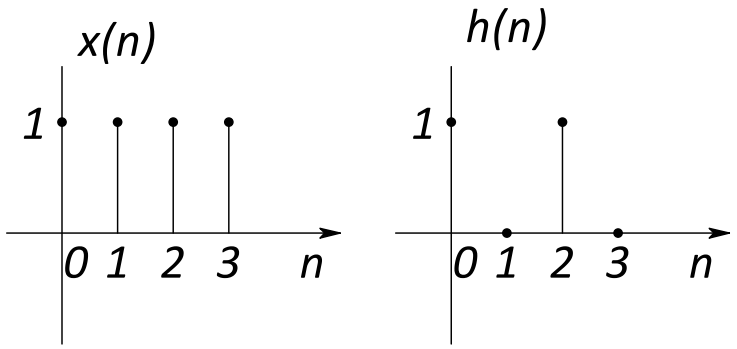
September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: ES CLUSTER (EEE/ECE) **Duration: 3 hrs.**
Course Code: 19ES5CCDSP **Max Marks: 100**
Course: Digital 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)	Describe the process of frequency domain sampling and the reconstruction of discrete time signal.	CO1	PO1	06
	b)	State and prove: i) Linearity property ii) Periodicity and iii) Circular shift in time domain.	CO2	PO2	08
	c)	Given $\boldsymbol{x(n)} = \{\mathbf{1, 2, 3, 4}\}$ and $\boldsymbol{h(n)} = \{\mathbf{1, -1, 1}\}$ find circular Convolution $\boldsymbol{x(n)} \circledast \boldsymbol{h(n)}$.	CO2	PO2	06
		OR			
2	a)	Solve the given sequences for, i)$\boldsymbol{x(n)} = \{\mathbf{2}, \underset{\uparrow}{\mathbf{3}}, \mathbf{5, 8}\}$ Linear shift $\boldsymbol{x(n-2)}$ =? ii) $\boldsymbol{x(n)} = \{\mathbf{5, 2, 8, 9}\}$ Circular shift $\boldsymbol{x(n-2)_4}$ =?	CO2	PO2	04
	b)	State and prove the following properties of DFT. i) Time reversal ii) Circular convolution iii) Frequency shifting.	CO3	PO3	08
	c)	Compute the 4-point DFT of the sequence $\boldsymbol{x(n)} = \{\mathbf{0, 1, 2, 3}\}$ and verify the result with IDFT method using formula method.	CO2	PO2	08
		UNIT - II			
3	a)	What are the differences and similarities between DIT and DIF FFT algorithm?	CO1	PO1	04
	b)	Draw and explain the basic butterfly diagram or signal flow graph of DIF-FFT radix-2.	CO3	PO3	06
	c)	Find 8-point $\boldsymbol{x(n)} = \{\mathbf{1, 1, 1, 1, 0, 0, 0, 0}\}$ using Radix-2 DIT FFT algorithm.	CO3	PO3	10
		UNIT - III			
4	a)	In direct computation of N-point DFT, how many i) complex additions, ii) Complex multiplications iii) Trigonometric functions are required to calculate. Also mention importance of FFT algorithms.	CO3	PO3	10

		b)	Verify the 4-point circular convolution of $\boldsymbol{x(n)}$ **and** $\boldsymbol{h(n)}$ given in Fig. 4 b) using Radix -2 DIF FFT algorithm.  Fig.4 b)	**CO4**	**PO4**	**10**
			OR			
	5	a)	Obtain the cascade form realization for the system given by $$H(z) = \frac{1 + \frac{1}{2} z^{-1}}{\left(1 - \frac{1}{5} z^{-1}\right)\left(1 - \frac{3}{4} z^{-1} + \frac{1}{8} z^{-2}\right)}$$	**CO4**	**PO3**	**08**
		b)	Design a low pass Butterworth filter using Bilinear Transformation which satisfies the following constraints: $\mathbf{0.8 \leq \left\lvert H(e^{j\omega}) \right\rvert \leq 1}$ $\quad \mathbf{0 \leq \omega \leq 0.2\pi}$ $\mathbf{\left\lvert H(e^{j\omega}) \right\rvert \leq 0.2}$ $\quad \mathbf{0.6 \leq \omega \leq \pi}$	**CO4**	**PO3**	**12**
			UNIT - IV			
	6	a)	What are the different types of windows based on Finite Impulse Response (FIR)? And list advantage of FIR filters.	**CO4**	**PO3**	**04**
		b)	Calculate Hamming window coefficient for M=7.	**CO4**	**PO3**	**06**
		c)	Design a FIR, Low Pass Filter (LPF) using Rectangular window technique at a cut-off frequency **1rad/second** with an order **N=5**.	**CO4**	**PO3**	**10**
			UNIT - V			
	7	a)	What are the limitations of linear filtering? How to overcome these limitations.	**CO5**	**PO2**	**06**
		b)	Explain the working principle of Adaptive filters.	**CO5**	**PO1**	**06**
		c)	With a neat block diagram explain two stage interpolator and decimator, representing multistage implementation of sampling rate conversion.	**CO5**	**PO2**	**08**

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