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

Course Code: 23EC5PCDSP **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.

REAPPEAR EXAMS 2024-25

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.

			CO	PO	Marks
		UNIT - I			
1	a)	An analog signal is sampled at 10kHz and DFT of 512 samples is computed. Determine the frequency spacing between spectral samples of the DFT. Determine the frequency spacing if 1024 point DFT is calculated.	*CO 3*	*PO 2*	**4**
	b)	Compute the DFT of following finite length sequence of length N. $x(n)=u(n)-u(n-N)$	*CO 3*	*PO 2*	**6**
	c)	Find the DFT of a sequence for (i) N=4 and (ii) N=8 $x(n)=\begin{cases}1;0\le n\le 2\\0;otherwise\end{cases}$	*CO 3*	*PO 2*	**10**
		OR			
2	a)	State circular frequency shift property of DFT	*CO 1*	-	**4**
	b)	The first five points of 8 point DFT X(k) of a real valued sequence are {0.25,0.125-j0.3018,0,0.125-j0.518,0}. Determine the remaining three points.	*CO 3*	*PO 2*	**6**
	c)	Consider a finite duration sequence x(n)={0,1,2,3,4,5} (i) Sketch the sequence s(n) with 6 point DFT $S(k)=W_2^k X(k)$ (ii) Determine the sequence y(n) with 6 point DFT $Y(k)=\mathrm{Re}\{X(k)\}$, The real part of X(k).	*CO 3*	*PO 2*	**10**
		UNIT - II			
3	a)	Consider a FIR filter with impulse response h(n)={3,2,1,1}. If the input is x(n)={1,2,3,3,2,1,-1,-2,-3,5,6,-1,2,0,2,1}.Find the output using overlap add method assuming the length of block as 7.	*CO 3*	*PO 2*	**10**

		b)	Compute 8 point DFT of the sequence $x(n)=\sin\left(\frac{\pi}{2}n\right),0\le n\le 7$ using DIF-FFT.	***CO 3***	***PO 2***	**10**
			OR			
	4	a)	Using overlap save method compute y(n), of a FIR filter with impulse response h(n)={3,2,1} and input x(n)={2,1,-1,-2,-3,5,6,-1,2,0,2,1}. Use only 8 point circular convolution in your approach.	***CO 3***	***PO 2***	**10**
		b)	Compute the IDFT of X(k)={0,2.8284-j2.8284,0,0,0,0,0,2.8284+j2.8284} using inverse Radix-2 DIT-FFT Algorithm	***CO 3***	***PO 2***	**10**
			UNIT - III			
	5	a)	Let $H(s)=\frac{1}{s^2+\sqrt{2}s+1}$ represent the transfer function of a low pass filter with a pass band of 1 rad/sec. Use frequency transformation to find the transfer functions of the following analog filters. (i) A low pass filter with pass band of 10 rad/sec. (ii) A high pass filter with cutoff frequency of 10 rad/sec.	***CO 3***	***PO 2***	**4**
		b)	Design a second order low pass digital butter worth filter with cutoff frequency of 1 kHz and sampling frequency of 10,000samples/sec by Bilinear transformation	***CO 3***	***PO 2***	**10**
		c)	Give a comparison of Impulse invariant method and Bilinear transformation method of digital filter design	***CO 1***	**-**	**6**
			OR			
	6	a)	The system function of an analog filter is given by $H(s)=\frac{1}{(s+1)(s+2)}$ Obtain H(z) using impulse invariant method. Take sampling frequency of 5 samples/sec.	***CO 3***	***PO 2***	**10**
		b)	Obtain direct form-II and parallel form realization of the following function $H(z)=\frac{8z^3-4z^2+11z-2}{(z-0.25)(z^2-z+0.5)}$	***CO 3***	***PO 2***	**10**

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			UNIT - IV			
	7	a)	List the properties of FIR filter	***CO 1***	**-**	**4**
		b)	Design the symmetric FIR low pass filter whose desired frequency response is $H(\omega)=\begin{cases} e^{-j\omega\tau}; \lvert\omega\rvert \le \omega_c \\ 0; otherwise \end{cases}$ The length of the filter should be 7 and cutoff frequency is 1 radians/sample. Use rectangular window.	***CO 3***	***PO 2***	**10**
		c)	Realize a linear phase FIR filter with the following impulse response. Give necessary equations. $h(n)=\delta(n)+\frac{1}{2}\delta(n-1)-\frac{1}{4}\delta(n-2)+\delta(n-4)+\frac{1}{2}\delta(n-3)$	***CO 3***	***PO 2***	**6**
			OR			
	8	a)	Determine the transfer function H(z) of an FIR filter to implement $h(n)=\delta(n)+2\delta(n-1)+\delta(n-2)$ .Use frequency sampling technique. Draw the structure.	***CO 3***	***PO 2***	**10**
		b)	Design a low pass FIR filter using frequency sampling technique having cutoff frequency of $\frac{\pi}{2}$ rad/sample. The filter should have linear phase and length of 17.	***CO 3***	***PO 2***	**10**
			UNIT - V			
	9	a)	Describe noise canceller using adaptive filter with neat block diagram and relevant equations. Also explain LMS Algorithm	***CO 4***	***PO 1***	**10**
		b)	Show the process of sampling rate conversion by a rational factor I/D with neat block diagram and relevant equations.	***CO 4***	***PO 1***	**10**
			OR			
	10	a)	Consider a sequence x(n)={2,4,6,8,0,1,3,5,7,9}. Down sample the sequence by 3 and then up sample by 2. Give the resulting sequence	***CO 4***	***PO 2***	**4**
		b)	Describe the decimation process with block diagram and relevant expressions.	***CO 4***	***PO 1***	**8**
		c)	Describe the Interpolation process with block diagram and relevant expressions.	***CO 4***	***PO1***	**8**

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