Reg. No.															

Question Paper Code	13660

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fifth Semester

Electronics and Communication Engineering

(Common to Sixth Semester - Computer and Communication Engineering)

20ECPW501 - DISCRETE TIME SIGNAL PROCESSING WITH LABORATORY

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Compute the circular convolution of the sequences $X_1(n)=\{2,1,2,1\}$ and $X_2(n)=\{1,2,3,4\}$. (a) {14,14,16,16} (b) {16,16,14,14} (c) {2,3,6,4} (d) {14,16,14,16}	1	K1	CO1
2.	_____ required for both DIT & DIF algorithm. (a) Bit reversal (b) Normal (c) Both (d) Only Bit reversal	1	K1	CO1
3.	What is the Butterworth polynomial of order 1? (a) S+1 (b) S-1 (c) S (d) S(S+2)	1	K1	CO2
4.	Which of the following is a disadvantage of Butterworth filters? (a) Sharp transition between passband and stopband (b) Non-linear phase response (c) Unequal ripple in the stopband (d)Unequal ripple in the passband	1	K1	CO2
5.	Digital filters are _____. (a) Highly expensive (b) Consumes very less power (c) Programmable (d) Cannot handle low-frequency signals	1	K1	CO3
6.	In a cascade structure, IIR filters are implemented: (a) in series (b) as a single filter (c) in parallel (d) as feedback loops	1	K1	CO3
7.	FIR filters _____) are non-recursive (b) do not adopt any feedback (c) are recursive (d) use feedback	1	K1	CO4
8.	The well known design techniques of FIR filters are (a) Fourier series method, Window method and Frequency sampling method) Bilinear transformation method) Impulse invariance method (d) Backward difference method	1	K1	CO4
9.	The finite word length effects are due to (a) Quantization of input. (b)Quantization of coefficients. (c) Quantization of Product. (d) All of the above.	1	K1	CO5
10.	DSP adopts _____architecture. VLIW (b) Harvard (c) Von Neumann (d) 64 bit	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Define the twiddle factor of FFT.	2	K1	CO1
12.	Draw the basic butterfly of DIT-FFT structure.	2	K2	CO1
13.	Compare IIR and FIR filters.	2	K2	CO2
14.	Write the properties of the Butterworth filter.	2	K1	CO2
15.	What is the need for prewarping?	2	K1	CO3
16.	Solve H(z) for the IIR filter whose $H(s)=\frac{1}{s+6}$ with T=0.1 sec using Bilinear transformation.	2	K3	CO3

17.	List out the advantages and disadvantages of FIR filters.	2	K1	CO4
18.	Define Gibbs phenomenon.	2	K2	CO4
19.	Define quantization step size.	2	K1	CO5
20.	State the methods used to prevent overflow.	2	K1	CO5
21.	List different types of Digital Signal Processors specified by Texas Instruments.	2	K1	CO6
22.	What is pipelining in Digital Signal Processors?	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Compute the 8 point DFT of the following sequence x(n)={0.5,0.5, 0.5, 0.5, 0, 0, 0 0} using the in place radix-2 DIT FFT algorithm.	11	K2	CO1
		OR			
	b)	Solve the linear convolution of finite duration sequences h(n)={2,1,-1}and x(n)={1,2,3,-1,-2,-3,4,5,6} using Overlap add method and Overlap save method.	11	K3	CO1
24.	a)	Design an analog Butterworth filter that has fp = 10kHz ; fs = 25kHz ; α_p = 0.5dB ; α_s = 22dB.	11	K2	CO2
		OR			
	b)	Design an analog Butterworth filter satisfying the constraints, $0.9 \leq \lvert H(j\Omega) \rvert \leq 1 \quad ; \quad 0 \leq \Omega \leq 0.2\,\pi$ $\lvert H(j\Omega) \rvert \leq 0.2 \quad ; \quad 0.4\pi \leq \Omega \leq \pi$	11	K3	CO2
25.	a)	Realize the direct form I, direct form II, cascade and Parallel structures of the system governed by the difference equation, $$y(n) - \frac{3}{4}y(n-1) + \frac{1}{2}y(n-2) = X(n) + \frac{1}{2}X(n-1)$$	11	K3	CO3
		OR			
	b)	Use bilinear transformation method to design a digital low-pass Butterworth filter satisfying the constraints. $$0.707 \ll \left\lvert H(e^{j\omega}) \right\rvert \ll 1 \;\; ; 0 \leq \omega \leq 0.5\pi$$ $$\left\lvert H(e^{j\omega}) \right\rvert \ll 0.2 \;\; ; 0.75\pi \leq \omega \leq \pi$$ Assume T=1s.Use suitable structure to realize the filter.	11	K3	CO3
26.	a)	Design a lowpass filter with a pass band gain of unity, cut-off frequency of 1000Hz and working at a sampling frequency of 5KHz. The length of the impulse response should be 7. Use a rectangular window technique,	11	K3	CO4
		OR			
	b)	Determine the coefficients of a linear phase FIR filter length N=15 which has a symmetric unit sample response and a frequency response that satisfies the conditions. $$H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1 & ; k = 0,1,2,3 \\ 0.4 & ; k = 4 \\ 0 & ; k = 5,6,7 \end{cases}$$	11	K3	CO4
27.	a)	Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation y(n) = 0.95y(n-1) + x(n); x(n) = 0 and y(n-1) =1 3. Estimate the dead range of the system.	11	K2	CO5
		OR			

	b)	Consider the transfer function where H(z)=$H_1(z)H_2(z)$. $H_1(Z) = \frac{1}{(1-0.5z^{-1})}$ and $H_2(Z) = \frac{1}{(1-0.4z^{-1})}$. Estimate the output round of noise power. Assume b = 3 (excluding sign bit).	*11*	*K2*	*CO5*
28.	a)	Draw the schematic block diagram of the architecture of TMS320C5X Processor and explain the major block diagram of the same.	*11*	*K3*	*CO6*
		OR			
	b) (i)	Explain in detail the various addressing modes of Digital signal process.	*7*	*K2*	*CO6*
	(ii)	Write a program to perform16-bit multiplication.	*4*	*K2*	*CO6*