Reg. No.												

Question Paper Code	12845

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Sixth Semester

Computer and Communication Engineering

(Common to Fifth Semester Electronics and Communication Engineering)

20ECPW501 - DISCRETE TIME SIGNAL PROCESSING WITH LABORATORY

Regulations - 2020

Duration: 3 Hours **Max. Marks: 100**

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	State the properties of DFT.	2	K1	CO1
2.	Define twiddle factor of FFT.	2	K1	CO1
3.	Compare Butterworth with Chebyshev filters.	2	K2	CO2
4.	Determine the order and the poles of low pass Butterworth filter that has a 3dB attenuation at 500Hz and an attenuation of 40dB at 1000Hz.	2	K2	CO2
5.	Write the bilinear transform equation between s-plane and z-plane.	2	K1	CO3
6.	What is the need for prewarping?	2	K1	CO3
7.	Define Gibbs phenomenon.	2	K1	CO4
8.	List the different realization methods for realizing FIR systems.	2	K2	CO4
9.	Describe the quantization errors due to finite word length registers in digital filters.	2	K2	CO5
10.	Interpret why rounding is preferred to truncation in realizing digital filter.	2	K2	CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	Compute the eight point DFT of the sequence $x(n) = \begin{Bmatrix} 1, 0 \le n \le 7 \\ 0, otherwise \end{Bmatrix}$ using DIT algorithms.	13	K2	CO1
		OR			
	b)	Using overlap-add 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}. Prove that the output response is the same when using the overlap-save method.	13	K2	CO1
12.	a)	Construct an analog Butterworth filter satisfying the constraints $0.8 \le \lvert H(\omega) \rvert \le 1.0 \; ; \; 0 \le \omega \le \pi/4$ $\lvert H(\omega) \rvert \le 0.2 \; ; \; \pi/2 \le \omega \le \pi$	13	K3	CO2
		OR			

b) i) Explain the Analog Low pass Chebyshev Filter types and its characteristics with the necessary sketch and equations. 8 K2 CO2

ii) Design a Chebyshev filter for the following specifications Ωp=1rad/sec; Ωs=20rad/sec; α_p=1dB; α_s =25dB. 5 K2 CO2

13. a) Design a digital Butterworth filter satisfying the constraints 13 K3 CO3

$0.8 \le |H(\omega)| \le 1.0$; $0 \le \omega \le \pi/4$

$|H(\omega)| \le 0.2$; $\pi/2 \le \omega \le \pi$

With T=1sec and use impulse invariant transformation.

OR

b) A desired LPF with the following specification is 13 K3 CO3

$0.9 \le |H(e^{j\omega})| \le 1$, for $0 \le \omega \le 0.25\pi$

$|H(e^{j\omega})| \le 0.24$, for $0.5\pi \le \omega \le \pi$.

Design a Chebyshev digital filter using Impulse invariant transformation. Use suitable structure to realize the filter.

14. a) Determine the coefficients of a linear phase FIR filter length M=15 which has a symmetric unit sample response and a frequency response that satisfies the conditions. 13 K3 CO4

$$H\left(\frac{2\pi k}{15}\right)=\begin{cases}1, for k = 0,1,2,3\\ 0, for k = 4,5,6,7\end{cases}$$

OR

b) i) Sketch the linear phase realization of the system function 6 K3 CO4

$$H(Z)=\frac{1}{2}+\frac{1}{3}z^{-1}+z^{-2}+\frac{1}{4}z^{-3}+z^{-4}+\frac{1}{3}z^{-5}+\frac{1}{2}z^{-6}$$

ii) Explain the principle and procedure for designing FIR filter using rectangular window. 7 K3 CO4

15. a) Consider the transfer function where $H(z) = H_1(z)\, H_2(z)$. 13 K2 CO5

$H_1(z) = \frac{1}{(1-0.5z^{-1})}$ and $H_2(z) = \frac{1}{(1-0.4Z^{-1})}$. Estimate the output round off noise power. Assume b = 3.

OR

b) Explain the characteristics of a limit cycle oscillation with respect to the system described by the equation y(n) = 0.95 y(n - 1)+ x(n), when the product is quantized to 5-bits by rounding (including the sign bit). The system is excited by an input x(n) = 0.75 for n = 0 and x(n) = 0; otherwise. Also, determine the dead band of the filter. 13 K2 CO5

PART - C (1 × 15 = 15 Marks)

16. a) Draw the schematic block diagram of the architecture of TMS320C3X Processor and explain the major block diagram of the same. 15 K3 CO6

OR

b) Explain how the instruction sets of TMS320C5X processors are classified. Use appropriate instruction sets to write a program to generate a saw tooth wave. 15 K3 CO6