09 JAN 2023

Reg. No.												

Question Paper Code	11596

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

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.	Draw the basic butterfly of DIF-FFT structure.	2,K2,CO1
3.	Write the steps to design an Analog Butterworth Low pass Filter.	2,K1,CO2
4.	Compare IIR and FIR filters.	2,K2,CO2
5.	Define Gibbs phenomenon.	2,K1,CO4
6.	Determine the phase delay and group delay for the frequency response of a digital filter $H(e^{j\omega}) = (0.7 + 0.6\cos\omega + 0.9\cos 2\omega)e^{-j7.5\omega}$	2,K2,CO4
7.	State the advantages of floating point representation.	2,K1,CO5
8.	Describe the quantization errors due to finite word length registers in digital filters.	2,K2,CO5
9.	Write a short note on the MAC unit in Digital Signal Processors.	2,K2,CO6
10.	Name the various addressing modes of DSPs.	2,K1,CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11\. a) Find the response y(n) when x(n) = {1,1,1,2} and h(n) = {1,2,3,2} using DIF-FFT algorithm. *13,K3,CO1*

OR

b) Apply appropriate DFT pair equation to determine the IDFT of X(K) = {12,-1.5+j2.598,-1.5+j0.866,0,-1.5-j0.866,-1.5-j2.598} *13,K3,CO1*

12\. a) Obtain an analog Chebyshev filter transfer function that satisfies the constraints $\frac{1}{\sqrt{2}} \le |H(j\Omega)| \le 1; 0 \le \Omega \le 2$ *13,K3,CO2*

$|H(j\Omega)| < 0.1; \quad \Omega \ge 4$

OR

b) Design a analog Butterworth filter satisfying the constraints *13,K3,CO2*

$$0.8 \le |H(j\Omega)| \le 1.0 ; 0 \le \Omega \le \pi/4$$
$$|H(j\Omega)| \le 0.2 ; \pi/2 \le \Omega \le \pi$$

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

13. a) Design a HPF with the following frequency response of length N=11 using Hanning window. *13,K3,CO*

$$H_d(e^{jw}) = \begin{cases} 1 & \frac{\pi}{4} \le |\omega| \le \pi \\ 0 & |\omega| \le \frac{\pi}{4} \end{cases}$$

OR

b) 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*

$$H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1 \; for \; k = 0,1,2,3 \\ 0.4 \quad for \; k = 4 \\ 0 \; for \; k = 5,6,7 \end{cases}$$

14. a) Consider a second order IIR filter with $H(Z)=\frac{1}{(1-0.5Z^{-1})(1-0.45Z^{-1})}$. Identify the effect on quantization on pole locations of the given system function in direct form and in cascade form. Assume b = 3 bits. *13,K2,CO5*

OR

b) With respect to finite word length effects in digital filters, with examples discuss about

(i) Over flow limit cycle oscillation *7,K2,CO5*

(ii) Signal scaling. *6,K2,CO5*

15. a) Draw the schematic block diagram of the architecture of TMS320C5X Processor and explain the major block diagram of the same. *13,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 square wave. *13,K3,CO6*

PART - C (1 × 15 = 15 Marks)

16. a) Design a Chebyshev filter for the following specifications using impulse invariance method. *15,K3,CO3*

$0.8 \le |H(\omega)| \le 1$ for $0 \le \omega \le 0.2\pi$

$|H(\omega)| \le 0.2$ for $0.6\pi \le \omega \le \pi$

Use suitable structure to realize the filter.

OR

b) Realize the direct form I, direct form II, cascade and parallel structures of the system governed by the difference equation, *15,K3,CO3*

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create **11596**