Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

Electronics and Communication Engineering
IVth Semester
EC5404 & Digital Signal Processing
(Regulation2019)

Time: 3hrs

Max.Marks: 100

CO1	Ability to apply the concepts of discrete Fourier transform
CO2	Ability to design and analyze IIR filter
CO3	Ability to design and analyze FIR filter
CO4	Ability to analyze performance degradation of digital signal processing systems due to finite precision
CO5	Ability to analyze the architectural details of fixed and floating digital signal processor

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Prove the time shift property of N-point DFT.	2	1	3
2	Compare radix-2 DIT and DIF FFT algorithms	2	1	2
3	Convert analog filter transfer function $H(s) = \frac{2}{(s+2)}$ into digital filter transfer function using impulse invariant method with T=0.1s.	2	2	3
4	What is Prewarping? Why is it employed?	2	2	2
5	What are the condition to be satisfied for constant phase delay in linear phase FIR filter?	2	3	2
6	The frequency response of a digital filter is, $H(e^{j\omega}) = (0.7 + 0.6cos\omega - 0.9cos2\omega)e^{-j7.5\omega}$. Determine the phase delay and group delay.	2	3	3
7	Draw the product quantization noise model of second order IIR system.	2	4	3
8	How the digital filter is affected by quantization of filter coefficients?	2	4	2
9	What is interpolator? Draw the symbolic representation of an interpolator.	2	5	2
10	What is meant by limit cycle oscillation in digital filter?	2	5	2

PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	An eight point sequence is given by $x(n) = \{2,1,2,1,1,2,1,2\}$. Compute 8-point DFT of x(n) by radix-2 DIT-FFT.	13	1	3
	OR			
11 (b)	Derive and draw the butterfly structure for DIF Radix-2 FFT algorithm at N=8.	13	1	3

12 (a)	Design a digital Chebyshev type-I low pass filter to satisfy the following constraints using Bilinear transformation. $0.8 \leq \left\|H(e^{j\omega})\right\| \leq 1 \quad \text{for} \quad 0 \leq \omega \leq 0.2\pi$ $\left\|H(e^{j\omega})\right\| \leq 0.2 \quad \text{for} \quad 0.6\pi \leq \omega \leq \pi$	**13**	2	3
	OR			
12 (b)	For the analog transfer function, $H(s) = \frac{2}{s^2+3s+2}$, Determine H(Z) using impulse invariant transformation if a) T=1 Second b) T=0.1 Second.	**13**	2	3
13 (a)	Design and Evaluate the frequency response of linear phase FIR filter with symmetric impulse response N is odd with centre of symmetry at (N-1)/2.	**13**	3	5
	OR			
13 (b)	Determine the co-efficients of linear phase FIR filter of length N=15 which has a symmetric unit sample response and a frequency response that satisfy the condition by using frequency sampling method. $H\left[\frac{2\pi K}{15}\right] = \begin{Bmatrix} 1, for\ k = 0,1,2,3 \\ 0.4, for\ k = 4 \\ 0, for\ k = 5,6,7 \end{Bmatrix}$	**13**	3	5
14 (a)	Find the output round-off noise power by product quantization for the given system with the transfer function $H(Z) = H_1(z).H_2(z)$ where $H_1 = \frac{1}{1-0.3z^{-1}}$; $H_2 = \frac{1}{1-0.2z^{-1}}$.	**13**	4	4
	OR			
14 (b)	A digital system is described by y(n)=0.95 y(n-1)+x(n). Find the dead band of the filter. Assume 5 bit sign magnitude representation (including sign bit).	**13**	4	4
15 (a)	Derive the frequency domain characteristics of down sampling and upsampling. With neat sketch explain their frequency domain effects andsuggest a suitable solutions.	**13**	5	2
	OR			
15 (b)	Explain the concept of subband coding in speech signal processing. Describe the basic principles of subband analysis and synthesis and how they are utilized to achieve compression and efficient transmission of speech signals.	**13**	5	2

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Design an ideal Band Pass Filter with a frequency response $H_d(e^{j\omega}) = e^{-j\omega\alpha}, \quad \omega_{c1} \leq \lvert\omega\rvert \leq \omega_{c2}$ $-\omega_{c2} \leq \lvert\omega\rvert \leq -\omega_{c1}$ $= 0 \ , \quad else$ where $\omega_{c1} = 1\ and\ \omega_{c2} = 2$. Find the values of h(n) for N=7, using hamming window technique. Find the H(Z).	**15**	3	5