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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B.Tech / B. Arch (Full Time) – ARREAR EXAMINATIONS, NOV / DEC 2024

ELECTRONICS AND COMMUNICATION ENGINEERING.

Semester IV

EC5404 - DIGITAL SIGNAL PROCESSING

(Regulation 2019)

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	Find the DFT of unit impulse sequence.	2	1	L3
2	Calculate the number of complex multiplications and additions required to compute 128 point DFT by computing DFT directly and by using FFT.	2	1	L3
3	Compare Butterworth and Chebyshev approximation.	2	2	L2
4	Why prewarping is needed in designing IIR filter using bilinear transformation?	2	2	L2
5	What is meant by Gibb's phenomenon?	2	3	L1
6	Distinguish between FIR and IIR filters.	2	3	L1
7	Mention the three formats of representing a fixed point number with example.	2	4	L2
8	Define perturbation error.	2	4	L1
9	What is Decimation? Why is it needed?	2	5	L2
10	Define sampling rate conversion.	2	5	L1

PART- B (5x13=65Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	Determine the response of LTI system when input sequence x(n) = {– 1, 1, 2, 1} and impulse response h(n) = {– 1, 1, – 1, 1} by using radix-2 DIT-FFT.	13	1	L3
	OR			
11 (b)	Consider x(n) = (n+1), 0 ≤ n ≤ 9, and h(n) = [1, 0, -1]. Implement overlap save method to compute y(n) = x(n) * h(n).	13	1	L3
12 (a)	Design an analog Butterworth filter that has a –2dB passband attenuation at a frequency of 20 rad/sec and atleast –10dB stopband attenuation at 30 rad/sec.	13	2	L3
	OR			

12 (b)	Using Bilinear transformation, design a digital lowpass filter with the following specifications: (i) Monotonic passband and stopband (ii) -3.01 dB cutoff frequency of 0.5π rad (iii) Magnitude down atleast 15 dB at 0.75π rad	13	2	L3
13 (a)	Design a linear phase filter for the given specifications using Hamming window with N=7. $H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -\frac{3\pi}{4} \le \omega \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} \le \lvert\omega\rvert \le \pi \end{cases}$	13	3	L3
	OR			
13 (b)	Design and realize a 15-tap linear phase FIR filter which has a symmetric sample response and a frequency response that satisfies the condition, $H(2\pi k/15) = \begin{cases} 1 & ; k = 0,1,2,3 \\ 0.4 & ; k = 4 \\ 0 & ; k = 5,6,7 \end{cases}$	13	3	L3
14 (a)	Consider two 1st order LPF with the following system functions connected in cascade, $H_1(z) = \frac{1}{1-0.9z^{-1}}$ and $H_2(z) = \frac{1}{1-0.8z^{-1}}$. Analyze and Compute the overall output noise power.	13	4	L4
	OR			
14 (b)	Analyze and Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation, y(n) = ay(n-1) + x(n), where $x(n) = \begin{cases} 0.875 & ; n = 0 \\ 0 & ; n \neq 0 \end{cases}$ Assume a = $\frac{1}{2}$ and 3 bits excluding sign bit.	13	4	L4
15 (a)	Explain in detail about Polyphase Decomposition of FIR filter.	13	5	L2
	OR			
15 (b)	Explain in detail about various applications of Multirate signal processing.	13	5	L2

PART- C (1x15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	A system is represented by transfer function $H(z)$ given by, $H(z) = 3 + \frac{4z}{z-\frac{1}{2}} - \frac{2}{z-\frac{1}{4}}$ (i) Does this H(z) represent a FIR or IIR? Why? (ii) Give a difference equation realization of this system using direct form I. (iii) Create a block diagram for the direct form II realization, and give the governing equations for implementation.	15	2	L6