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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

ECE
Semester IV
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	Calculate DFT for the sequence x(n)={1,1, 0,0}.	2	1	2
2	State Parseval's theorem in DFT.	2	1	1
3	Enumerate the characteristics of Butterworth Filter.	2	2	1
4	Convert the given analog transfer function $H(s) = \frac{1}{s+a}$ into digital by impulse invariant method.	2	2	2
5	Compare FIR and IIR Filters.	2	3	1
6	Mention the necessary and sufficient condition for the linear phase characteristic of an FIR filter.	2	3	1
7	How the digital filter is affected by quantization of filter coefficients?	2	4	2
8	Why rounding is preferred over truncation in realizing digital filter.	2	4	2
9	Mention the applications of Multi Rate Signal Processing.	2	5	1
10	State sampling theorem.	2	5	1

PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	Using radix 2 DIT-FFT algorithm ,determine DFT of the given sequence for N=8 x(n)=n for 0<n<7	13	1	3
	OR			
11 (b)	Perform the circular convolution of the following sequences $x(n) = \{1, 1, 2, 1\}$, $h(n) = \{1, 0, 4, 3\}$ using DFT and IDFT method.	13	1	3
12 (a)	Design and realize analog lowpass IIR Chebyshev filter with the following specifications: α_P= 16 dB, α_S= 7 dB, Ω_P= 20π rad/s, Ω_S= 100π rad/s	13	2	4
	OR			

12 (b)	Design a digital Butterworth lowpass filter using the bilinear transformation for the following specifications: $0.8 \leq \lvert H(e^{j\omega})\rvert \leq 1; \quad 0 \leq \omega \leq 0.2\pi$ $\lvert H(e^{j\omega})\rvert \leq 0.2; \quad 0.6\pi \leq \omega \leq \pi$	**13**	2	4
13 (a)	Determine the filter coefficients for an FIR filter approximating the ideal frequency response having N=7 using Hamming window. $H_d(\omega) = \begin{cases} e^{-j\alpha\omega}; & for \quad \lvert\omega\rvert \leq \frac{\pi}{6} \\ 0; & \frac{\pi}{6} \lvert\omega\rvert \leq \pi \end{cases}$	**13**	3	4
	OR			
13 (b)	Obtain the direct form II, cascade and parallel form realization for the system y(n) = -0.1y(n-1) + 0.2 y(n-2) + 3 x(n) + 3.6 x(n-1) + 0.6 x(n-2)	**13**	3	4
14 (a)	For the second order IIR filter, the system function is, $H(Z) = \frac{1}{(1-0.5z^{-1})(1-0.45z^{-1})}$ Explain the effect of shift in pole location with 3-bit coefficient representation in direct and cascade forms.	**13**	4	3
	OR			
14 (b)	Explain the characteristics of a limit oscillation with respect to the system described by the difference equation y(n) = x(n) $+\frac{3}{4}$ y(n-1), where input x(n) = $\frac{15}{16}$ δ(n). Determine the deadband of the filter.	**13**	4	3
15 (a)	Derive and draw the spectrum of a down sampler used in decimator.	**13**	5	2
	OR			
15 (b)	Explain the polyphase structure of decimator and interpolator.	**13**	5	2

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	A cascaded realization of the two first order digital filter is shown below. The system functions of the individual sections are $H_1(z) = \frac{1}{1-0.5z^{-1}}$ and $H_2(z) = \frac{1}{1-0.5z^{-1}}$. Draw the product quantization noise model of the system and determine the overall output noise power if b=3 bits (excluding sign bit).	**15**	4	5