Reg. No.															

B.Tech. DEGREE EXAMINATION, MAY 2023

OPEN BOOK EXAMINATION

Sixth Semester

18EIC306T – DISCRETE TIME SIGNAL PROCESSING

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

- Specific approved THREE text books (Printed or photocopy) recommended for the course
- Handwritten class notes (certified by the faculty handling the course / head of the department)

Time: 3 Hours | Max. Marks: 100

Answer **FIVE** questions

(Question No 7 is compulsory)

		Marks	BL	CO	PO
1.a.i.	Calculate the 8 point DFT of the sequence $x(n)=\begin{cases}1, & -3\le n\le 3\\ 0 & otherwise\end{cases}$.	14	3	1	2
	ii. Also show the graphical representation of *x(n)*.	4	3	1	2
	b. IDFT of $y(k)=\{1,0,1,0\}$ is _____ (A) $y(n)=\{0,0.5,0,0.5\}$ (B) $y(n)=\{0.5,0,0.5,0\}$ (C) $y(n)=\{0.5,0.5,0,0\}$ (D) $y(n)=\{0,0,0.5,0.5\}$	1	2	1	1
	c. The difference in the number of complex multipliers required for 16-point DFT and 16 point radix 2 FFT is _____ (A) 30 (B) 63 (C) 224 (D) 256	1	2	1	1
2.a.i.	Analyze a digital Butterworth filter satisfying the constraints $0.707 \le \lvert H(e^{jw})\rvert \le 1 \quad for \ \ 0\le\omega\le\pi/2$ $\lvert H(e^{jw})\rvert 0.2 \quad for \ \ \frac{3\pi}{4}\le\omega\le\pi$ with T=1 sec using bilinear transformation.	12	4	2	3
	ii. Realize the filter in direct form II.	6	3	2	3
	b. The value of Chebyshev polynomial of degree 0 is _____ (A) 1 (B) 0 (C) –1 (D) 2	1	1	2	1
	c. The order of low pass Butterworth filter that has a –3 dB bandwidth of 500 Hz and an attenuation of 40 dB at 1000 Hz is _____ (A) 4 (B) 5 (C) 6 (D) 7	1	2	2	1

3.a.	Design an ideal high pass filter with a frequency response $H_d\left(e^{jw}\right)=1 \quad for \quad \frac{\pi}{4}\le\omega\le\pi$ $0 \quad for \quad \lvert\omega\rvert\le\frac{\pi}{4}$ Calculate the values of h(n) for N=11 using Hamming window. Also plot the frequency response.	18	5	2	3
b.	Choose the condition which is not suitable either as low pass or a high pass filter. (A) h(n) symmetric and m odd (B) h(n) symmetric and m even (C) h(n) antisymmetric and m odd (D) h(n) antisymmetric and m even	1	1	3	1
c.	The window technique whose main lobe width of $\frac{12\pi}{N}$ is _____ (A) Hamming window (B) Blackmann window (C) Kaiser window (D) Rectangular window	1	1	3	1
4.a.i.	Illustrate any one application of digital signal processing in image processing.	13	4	4	1
ii.	Summarize the benefits of using DSP, in image data processing.	5	5	4	1
b.	The process of converting a signal from a given rate to a differentiate is _____ (A) Sampling (B) Normalizing (C) Sampling rate conversion (D) Holding	1	1	4	1
c.	The process of increasing the sampling rate by a factor I is _____ (A) Sampling rate (B) Interpolation (C) Decimation (D) Quantization	1	1	4	1
5.a.i.	Model and realize the auto regressive moving average model for recursive system.	13	3	5	1
ii.	Outline the advantages of discrete wavelet transform.	5	4	5	1
b.	Consider a random process $x(t)=\sqrt{2}\sin(2\pi t+\phi)$, where the random phase ϕ is uniformly distributed in the interval $(0,2\pi)$, the auto correlation R[t1,t2] is _____ (A) $\cos(2\pi(t_1+t_2))$ (B) $\sin(2\pi(t_1-t_2))$ (C) $\sin(2\pi(t_1+t_2))$ (D) $\cos(2\pi(t_1-t_2))$	1	1	5	1
c.	FWT stands for _____ (A) Fast wavelet transformation (B) Fast wavelet transform (C) Fourier wavelet transform (D) Fourier wavelet transformation	1	1	5	1

6.a.i.	Determine the circular convolution of the two sequences $x_1(n)=\{1,2,2,1\}$ and $x_2(n)=\{1,2,3,1\}$ using the following method. (1) Concentric circle method (2) Matrix method	10 4	3	1	2
ii.	Calculate the difference in the number of complex multiplication required for 16 point DFT and 16 point radix 2 FFT.	4	3	1	2
b.	Wavelet series equation is the sum of _____ (A) Scaling coefficient (B) Detail coefficient (C) Span coefficient (D) Both scaling and detail coefficient	1	1	1	1
c.	In quantization, if 'R' is the range, then quantization step size 'q' is _____ (A) R/2b (B) R/2(b–1) (C) R/2(b–1) (D) R/2(b+1)	1	1	1	1
7.a.i.	Determine the direct form and cascade form realization for the system function $H(z)=1+\frac{1}{3}z^{-1}+\frac{1}{4}z^{-2}+\frac{1}{4}z^{-3}+\frac{1}{3}z^{-4}+z^{-5}$.	14	3	2	3
ii.	Compare Hamming and Hanning window.	4	5	2	2
b.	A digital signal processing system is described by the expression $y(n)=2x(n)+x(n-1)+2y(n-1)$ is _____. (A) Stable FIR filter (B) Stable IIR filter (C) Unstable FIR filter (D) Unstable IIR filter	1	1	2	1
c.	The value of Chebyshev polynomial of degree 5 is _____ (A) $16x^5+20x^3-5x$ (B) $16x^5+20x^3+5x$ (C) $16x^5-20x^3+5x$ (D) $16x^5-20x^3-5x$	1	1	2	1

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