Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2024
OPEN BOOK EXAMINATION
Sixth Semester

18EIC306T – DISCRETE TIME SIGNAL PROCESSING

(For the candidates admitted from the academic year 2018-2019 to 2020 - 2021)

- 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

(5×20 = 100 Marks)
Answer **FIVE** questions
(Question No. 1 is compulsory)

		Marks	BL	CO	PO
1.a.i.	Using linear convolution method determine the output sequence y(n) $x(n)=1 \quad for \quad n=-2,0,1$ $\quad 2 \quad for \quad n=-1$ $h(n)=\delta(n)-\delta(n-1)+\delta(n-2)-\delta(n-3)$	14	3	1	2
ii.	Verify the same through circular convolution.	4	3	1	2
b.	The representation of unit step signal delayed by 4 samples is ________ (A) u(n+4) (B) u(n–4) (C) u(–n+4) (D) u(–n–4)	1	1	1	1
c.	If $x(n)=\delta(n)+\delta(n+2)-\delta(n+1)$ then the sequence of x(n) is ______ (A) {1, –1, 1, 0} (B) {–1, 1, –1, 1} (C) $\{0,\underset{\uparrow}{1},-1,1\}$ (D) {1, 0, –1, 1}	1	1	1	1
2.a.i.	Design a third order Butterworth digital filter using impulse invariant method.	12	3	2	3
ii.	Realize the Butterworth filter of the above using direct form I.	6	3	2	2
b.	The transformation technique in which there is one to one mapping from s domain to z domain is ________ (A) Approximation of derivatives (B) Impulse invariant method (C) Bilinear transformation method (D) Backward difference for the derivative	1	1	2	1
c.	The correct relation between ω and Ω is (A) Ω=ωT (B) T=Ωω (C) Ω=ωT/2 (D) ω=ΩT	1	1	2	1

3.a.	Design an ideal band reject filter with a desired frequency response $H_d(e^{j\omega}) = 1 \quad for\ \lvert\omega\rvert \le \frac{\pi}{3}\ and\ \lvert\omega\rvert \ge \frac{2\pi}{3}$ $= 0 \quad otherwise$ Determine the value of h(n) for N=11 also show the magnitude response.	18	3	3	3
b.	Identify where the poles of transfer function of normalized low pass Butterworth filter exists. (A) On unit circle (B) Inside unit circle (C) Outside unit circle (D) Imaginary axis	1	1	3	1
c.	Analog filters are characterized by __________ (A) Differential equation (B) Difference equation (C) Quadratic equation (D) State equation	1	1	3	1
4.a.i.	Illustrate any one application of digital signal processing in speech processing.	13	2	4	1
ii.	Summarize the advantages of speech processing.	5	2	4	1
b.	The process of increasing the sampling rate by a factor I is __________ (A) Decimation (B) Quantization (C) Sampling rate (D) Interpolation	1	1	4	1
c.	The instructions executed in DSP processors are __________ (A) Line by line (B) Both parallel and sequential (C) Parallel manner (D) Sequential manner	1	1	4	1
5.a.i.	Model and realize the ARMA model for recursive system.	13	3	5	1
ii.	Outline the advantages of discrete wavelet transform.	5	4	5	1
b.	The autocorrelation function of white noise is __________ (A) Gaussian (B) Delta (C) Non uniform (D) Uniform	1	1	5	1
c.	The interface between an analog and a digital processor is __________ (A) Demodulator (B) D/A converter (C) Modulator (D) A/D converter	1	1	5	1
6.a.	Solve the IDFT of the sequence $x(k) = \{5, 0, 1-j, 0, 1, 0, 1+j, 0\}$ using DIF algorithm.	18	3	1	2
b.	If *x(n)* and *x(k)* are N point DFT pair then X(k+N) is __________ (A) $-x(k)$ (B) $x(k+1)$ (C) $x(k)$ (D) $x(-k)$	1	1	1	1
c.	If x(n) is real and even, then DFT of x(n) is __________ (A) $\sum_{n=0}^{N-1} x(n)\cos\frac{2\pi kn}{N}$ (B) $-j\sum_{n=0}^{N-1} x(n)\sin\frac{2\pi kn}{N}$ (C) $j\sum_{n=0}^{N-1} x(n)\cos\frac{2\pi kn}{N}$ (D) $\sum_{n=0}^{N-1} x(n)\sin\frac{2\pi kn}{N}$	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. The poles of Chebyshev transfer function is ________ (A) Anti-symmetrical on a circle in s plane (B) Symmetrical on an ellipse in s plane (C) Symmetric on a circle in s plane (D) Anti-symmetric on an ellipse in s plane	1	1	2	1
c. In impulse invariant transformation the digital frequency 'ω' is ________ (A) $\omega=\Omega/T$ (B) $\omega=T/\Omega$ (C) $\omega=\Omega T$ (D) $\omega=\tan\Omega T$	1	1	2	1

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