Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Sixth Semester – Regular/Supplementary) Examinations, April 2025

21BCSPE36011/22BCSPE36011 – Introduction to Digital Signal Processing

(CSE)

Time: 3 hrs Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	Plot the signal $\boldsymbol{x(n) = \{4, 3, 2, 1, -2\}}$	CO1	K1
b.	Differentiate between symmetric and anti-symmetric signals?	CO1	K2
c.	What do you mean by RoC in z-transform? State its significance.	CO3	K1
d.	Write any 2 properties of cross correlation.	CO2	K2
e.	Find the z-transform of unit step function.	CO4	K3

PART – B **(15 x 4 = 60 Marks)**

	Answer ***all*** the questions	Marks	CO #	Blooms Level
2. a.	Given a discrete time signal $\boldsymbol{x(n) = \{2, 3, 5, 7, 9\}}$. Determine $\boldsymbol{x_1(n) = x(n-2)}$, $\boldsymbol{x_2(n) = x(n+3)}$, $\boldsymbol{x_3(n) = x(2n-1)}$, $\boldsymbol{x_4(n) = 2x(n+1)}$.	8	CO1	K3
b.	Given a discrete time signal $\boldsymbol{x(n) = \{1, 2, 3, 4, 5\}}$. Determine its even and odd parts.	7	CO1	K2
	(OR)			
c.	Determine whether the unit step signal is (i) Energy signal or Power Signal. (ii) Causal or not	8	CO1	K3
d.	What is the condition of periodicity for a discrete time signal? Determine whether the signal $\boldsymbol{x(n) = \cos\left(\frac{\pi}{8}n^2\right)}$ is periodic or not. If periodic determine the fundamental period.	7	CO1	K2
3.a.	Determine the response of the discrete time system governed by the difference equation : $\boldsymbol{y(n) = -0.5y(n-1) + x(n)}$ when the input is unit step with initial conditions $\boldsymbol{y(-1) = \frac{1}{3}}$.	8	CO2	K3
b.	Represent the given discrete time system using block diagram: $\boldsymbol{y(n) - 3y(n-2) - 7y(n-3) - 5x(n-2) - 0.5x(n-3) = x(n)}$	7	CO2	K2
	(OR)			
c.	A discrete time system is described as $\boldsymbol{y(n) = nx^2(n)}$. Determine whether the system is (i) LTI system or not, (ii) Causal or not	8	CO2	K3
d.	Determine the range of values of a and b for the stability of the LTI system with impulse response $\boldsymbol{h(n) = \begin{cases} b^n & n < 0 \\ a^n & n \geq 0 \end{cases}}$	7	CO2	K2
4.a.	Determine the output $y(n)$ of the discrete time system using convolution operation where the input of the system is given by $\boldsymbol{x(n) = \{2, 3, 4, 5, 6\}}$ and the impulse response is given as $\boldsymbol{h(n) = \{1, 7, 3, 4, 9\}}$	8	CO3	K2
b.	Consider 3 discrete time signals $x_1(n), x_2(n)$ and $x_3(n)$. Then prove that	7	CO3	K1

$$[\boldsymbol{x_1(n)} * \boldsymbol{x_2(n)}] * \boldsymbol{x_3(n)} = \boldsymbol{x_1(n)} * [\boldsymbol{x_2(n)} * \boldsymbol{x_3(n)}]$$

(OR)

c.	Perform cross correlation of the 2 sequences $\boldsymbol{x(n)} = \{\mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}\}$ and $\boldsymbol{y(n)} = \{\mathbf{4}, \mathbf{3}, \mathbf{2}, \mathbf{1}\}$.	8	CO3	K2
d.	Determine the equivalent impulse response of the 2 cascade connected LTI system having impulse responses as $\boldsymbol{h_1(n)} = \left(\frac{\mathbf{1}}{\mathbf{2}}\right)^{\boldsymbol{n}} \boldsymbol{u(n)}$ and $\boldsymbol{h_2(n)} = \left(\frac{\mathbf{1}}{\mathbf{4}}\right)^{\boldsymbol{n}} \boldsymbol{u(n)}$.	7	CO3	K1
5.a.	Determine the z-transform along with RoC of (i) $\boldsymbol{x(n)} = \mathbf{0.5}^{\boldsymbol{n}}\boldsymbol{u(n)}$ (ii) $\boldsymbol{x(n)} = \mathbf{0.2}^{\boldsymbol{n}}\boldsymbol{u(-n-1)}$	8	CO4	K2
b.	If $\boldsymbol{z}\{\boldsymbol{x(n)}\} = \boldsymbol{X(z)}$ then prove that $\boldsymbol{z}\{\boldsymbol{nx(n)}\} = -\boldsymbol{z}\frac{\boldsymbol{d}}{\boldsymbol{dz}}\boldsymbol{X(z)}$.	7	CO4	K1

(OR)

c.	Find the one sided z-transform of the discrete time signal $\boldsymbol{x(n)} = \boldsymbol{na}^{(\boldsymbol{n-1})}$	8	CO4	K1
d.	Determine the inverse z-transform to determine $x(n)$ from the following function: $\boldsymbol{X(z)} = \frac{\mathbf{3+2z^{-1}+z^{-2}}}{\mathbf{1-3z^{-1}+2z^{-2}}}$	7	CO4	K2

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