Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 2171003 Date: 21/06/2023

Subject Name: Digital Signal Processing

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed**

			MARKS
Q.1	**(a)**	Explain the basic blocks used in the Digital Signal Processing System.	**03**
	(b)	Answer the following: 1. Define the Unit Impulse sequence. 2. Whether the signal *y(n) =sin(3n)* is periodic or non-periodic? Show the mathematical steps involved. 3. Define: Correlation of discrete time signals 4. Why the ROC of Z-Transform cannot contain any pole?	**04**
	(c)	Compute the convolution of ***x(n)= u(n)-u(n-a),*** where *a:* no. of letters in your first name, for exa: If first name = Amit than , ***a = 4*** and ***h(n)= {1 2 2 1}*** using graphical method.	**07**
Q.2	**(a)**	Let ***x[n] = (6-n) (u[n] – u[n-6]).*** Sketch the signal: ***x[4-n]***	**03**
	(b)	Define the following terms: • Energy Signal • Power Signal Determine whether the following signal is power signal, energy signal or neither. $$x[n] = \begin{cases} n, & 0 \le n \le 5 \\ 10-n, & 5 \le n \le 10 \\ 0, & Otherwise \end{cases}$$	**04**
	(c)	Determine r_{xx} and r_{xy} for following sequences: *x(n)={1,1,0,1}* and *y(n)={4,-3,-2,1}*	**07**
		OR	
	(c)	Define following terms: (a)Causal System, (b) Random Signal, (c) Discrete signal, (d) LTI System	**07**
Q.3	**(a)**	Define the Region Of Convergence (ROC) of Z-Transform.	**03**
	(b)	What is the z-transform of the following finite duration signal: ***x(n)={2,4,5,7,0,1}*** The signal starts from ***n = -2*** and ends at ***n=3***	**04**

(c) State the Properties of Z-Transform and derive any two property. **07**

OR

Q.3 **(a)** Compare the direct form-I and II structures of an IIR systems, with M-zeros and N-poles. **03**

(b) Determine H(ω) for the system, $y\,(n) = -0.1y(n-1) + 0.2y(n-2) + x(n) + x(n-1).$ **04**

(c) Develop Direct form – II realization of following system: **07**

$$\mathrm{H(Z)} = \frac{3 + 3.6z^{-1} + 0.6z^{-2}}{1 + 0.1z^{-1} - 0.2z^{-2}}$$

Q.4 **(a)** Calculate the percentage saving in calculations in a 512-point radix-2 FFT, when compared in direct DFT. **03**

(b) Let *x (n)* = {A, 2, 3, 4, 5, 6, 7, B}. If X(0) = 20 and X(4)=0, find A and B. **04**

(c) Write short note on Goertzel algorithm. **07**

OR

Q.4 **(a)** Write the difference equation that characterizes a system whose frequency response is **03**

$$H(\omega) = \frac{1 - e^{-j\omega} - 3e^{-2j\omega}}{1 + \frac{1}{3}e^{-j\omega} + \frac{1}{6}e^{-2j\omega}}$$

(b) Explain Adaptive filters with suitable application. **04**

(c) Compare IIR filter and FIR filter. **07**

Q.5 **(a)** Determine the inverse z-transform of **03**

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

(b) Explain the followings in context of DSP processor architecture: (1) MAC (2) Pipelining **04**

(c) What is windowing? Explain in detail the process of converting IIR system in to FIR system using rectangular window. **07**

OR

Q.5 **(a)** Define following terms: **03**
1. Convolution
2. Discrete Time Fourier Transform (DTFT)
3. Quantization

(b) Explain the following with reference to the multirate signal processing: Decimation, Interpolation **04**

(c) Define FFT. Find 4 point DFT of the sequence ***x(n) = { 2,1,4,3}*** by DIF FFT algorithm also plot the magnitude and phase plot. **07**

****