

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VII EXAMINATION-SUMMER 2023****Subject Code: 2171708****Date: 28/06/2023****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) Find which of the signals are causal or non-causal. 03	
	a) $x(n)=u(n+4)-u(n-2)$	
	b) $x(n)=(1/4)^n u(n+2)-(1/2)^n u(n-4)$	
	c) $x(n)=u(-n)$	
	(b) Consider the analog signal $X_a(t)=3 \cos 100\pi t$ 04	
	(a) Determine the minimum sampling rate required to avoid aliasing.	
	(b) Suppose that the signal is sampled at the rate $F_s = 200$ Hz .What is the discrete-time signal obtained after sampling?	
	(c) What is aliasing effect and how it can be eliminated? 07	
Q.2	(a) Obtain the linear convolution of $x(n) = \{1,2,0,1\}$ & $h(n) = \{0,1,0,1\}$ 03	
	(b) Perform the circular convolution of the two sequences $x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$ 04	
	(c) Determine the impulse response $h(n)$ for the system described by the second-order difference equation $y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1)$ 07	
	OR	
	(c) Determine the direct form I , form II and cascade realization for following system. 07	
	$Y(n)=x(n) - x(n-1) + 2 x (n-2) -3 y(n-1)+4y(n-2)$	
Q.3	(a) Find the z transform for $x(n) = u(-n-1)$. 03	
	(b) Explain with suitable example recursive and non-recursive system. 04	
	(c) List out the properties of Z transformation with suitable detail. 07	
	OR	
Q.3	(a) Prove the periodicity of DTFT. 03	
	(b) Compute 4 point DFT of the given sequence $x[n]=\{1,0,1,0\}$ 04	
	(c) Explain various properties of ROC. 07	
Q.4	(a) Derive the lattice structures of FIR filters. 03	
	(b) List out the properties of z-transform. 04	
	(c) List out and prove properties of DFT. 07	
	OR	
Q.4	(a) Explain Notch filters with respective waveform. 03	
	(b) Explain bilinear transformation method for FIR filter design. 04	
	(c) Derive the Z transformation for $x(n) = a^n (\sin \omega_0 n) u(n)$ 07	
Q.5	(a) Find out inverse z transform of $X(z) = 1+z^{-1} / (1- z^{-1} + 0.5z^{-2})$ 03	

- (b) Perform the circular convolution of two sequence $X1(n) = \{1,3,5,3\}$ and $X2(n) = \{2,3,1,1\}$ **04**
- (c) Explain Radix-2 Decimation in Time algorithm. **07**

OR

- Q.5** (a) Derive the frequency sampling structures of IIR filters. **03**
- (b) Determine auto-correlation of the following signal:
 $x(n) = \{1, 2, 1, 1\}$ **04**
- (c) Determine the eight point DFT of the signal $x(n)=\{1,1,1,1,1,1,0,0\}$ and sketch its magnitude and phase. **07**
