GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:2171708   **Date:14-12-2023**
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. 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) $x(n)=u(-n)$	03
	(b)	Consider the analog signal $X_a(t)=3\cos 100\pi t$ (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?	04
	(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 $x1(n)=\{2,1,2,1\}$ and $x2(n)=\{1,2,3,4\}$	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. $Y(n)=x(n) - x(n-1) + 2\ x\ (n-2) -3\ y(n-1)+4y(n-2)$	07
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 $x(n) = a^n (\sin w_0 n)\ u(n)$	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 $X_1(n) = \{1,3,5,3\}$ and $X_2(n) = \{2,3,1,1\}$ **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**

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