Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022

Subject Code:2171708 Date:05-01-2023

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.**

Q.1	**(a)**	Give details about quantization and coding of quantized samples.	**03**
	(b)	Mention sampling theorem and explain its importance with suitable example.	**04**
	(c)	Classify signals and explain all types of signals in brief.	**07**
Q.2	**(a)**	Give difference between causal and non-causal systems	**03**
	(b)	Decide whether system $y(n) = mx(n) + c$ is linear or nonlinear.	**04**
	(c)	Describe advantages of digital signal processing in detail.	**07**
		OR	
	(c)	Determine z transform and ROC of $x(n) = \left(-1/7\right)^n u(n) - \left(1/2\right)^n u(-n-1)$	**07**
Q.3	**(a)**	Calculate energy of a ramp signal.	**03**
	(b)	Brief about architecture of digital signal processor.	**04**
	(c)	Find the z transform of finite duration sequence $x(n) = \left\{6, 1, \underset{\uparrow}{2}, 5, 4, 5\right\}$	**07**
		OR	
Q.3	**(a)**	Why is the FFT considered as more efficient algorithm?	**03**
	(b)	Find sequence $X(k)$ using decimation in time FFT technique for $x(n) = \{1, 0, 0, 1\}$	**04**
	(c)	Determine the inverse z transform of $X(z) = \dfrac{a}{z-a}$ $\lvert z\rvert < \lvert a\rvert$ by power series expansion.	**07**
Q.4	**(a)**	Write any three properties of Discrete Fourier Transform.	**03**
	(b)	With example explain diagram representations of Linear Constant-Coefficient Difference equations.	**04**
	(c)	Determine digital filter for analog filter $H(s) = \dfrac{s+2}{(s+1)(s+3)}$ using impulse invariance method.	**07**
		OR	
Q.4	**(a)**	Brief about overlap-save method for filtering of long data sequences.	**03**
	(b)	Compute 4 point Discrete Fourier Transform of sequence $x(n) = \{\underset{\uparrow}{0}, 1, 2, 3\}$ using DFT definition.	**04**
	(c)	Perform circular convolution for following two sequences $x_1(n) = \{\underset{\uparrow}{1}, 3, 5, 3\}$ and $x_2(n) = \{\underset{\uparrow}{2}, 3, 1, 1\}$	**07**

Q.5 **(a)** Write a note on transposed structure form of discrete time systems. **03**

(b) Explain Hamming window technique for filter design. **04**

(c) Perform linear convolution using mathematical equation for following sequences $x(n) = \{1, 1, \underset{\uparrow}{0}, 1, 1\}$ and $h(n) = \{1, -2, -3, \underset{\uparrow}{4}\}$ **07**

OR

Q.5 **(a)** Write a note on lattice structure form of discrete time systems. **03**

(b) Represent the system transfer function $\frac{Y(z)}{X(Z)} = \frac{1 + 2Z^{-1}}{1 - 0.25Z^{-1} + 0.08Z^{-2}}$ using direct form I and direct form II structure. **04**

(c) Perform cross correlation operation and find $r_{xy}(l)$ for following sequences $x(n) = \{...0, 0, -3, -2, 1, \underset{\uparrow}{4}, 8, -3, 0, 0...\}$ and $y(n) = \{1, 1, 1, \underset{\uparrow}{-1}, 2, -2\}$ **07**

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