Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3171003 Date:04-12-2023

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.**

Q.1	**(a)**	Define the following systems: Accumulator, forward difference, backward difference.	**03**
	(b)	Explain commutative, distributive and associative properties of linear convolution.	**04**
	(c)	Discuss the inverse system and explain how a system and its inverse system both can be causal and stable.	**07**
Q.2	**(a)**	Give one example for each system: Memoryless, Time-invariant, stable.	**03**
	(b)	Relate Z.T with DTFT. Also give applications of Z.T.	**04**
	(c)	Explain differentiation and convolution properties of DTFT.	**07**
		OR	
	(c)	Explain differentiation and convolution properties of ZT.	**07**
Q.3	**(a)**	A system function is given by H(z)=$\frac{1}{(1-0.25z^{-1})}$, then find corresponding difference equation and impulse response.	**03**
	(b)	If H(z)=$1+\frac{1}{2}z^{-1}+\frac{1}{2}z^{-2}+z^{-3}$, then realize this function with minimum number of multipliers.	**04**
	(c)	Find magnitude and phase response at ω=0 and π for a system function H(z)=$\frac{1}{(1-0.5z^{-1})}$	**07**
		OR	
Q.3	**(a)**	Discuss All pass system briefly.	**03**
	(b)	Explain structures for linear phase FIR systems.	**04**
	(c)	Find out all pass and minimum phase description of given system H(z)= $\frac{(1+3z^{-1})}{(1+0.5z^{-1})}$	**07**
Q.4	**(a)**	Give advantages of digital filters.	**03**
	(b)	Discuss design steps of IIR filter using bilinear transformation.	**04**
	(c)	Explain basic structure for IIR systems.	**07**
		OR	
Q.4	**(a)**	Give limitations of Impulse Invariance method of designing IIR filter.	**03**
	(b)	Discuss Goertzel algorithm.	**04**
	(c)	Explain design of FIR filters by Kaiser window and mention its advantages against the commonly used windows.	**07**
Q.5	**(a)**	Define N-point DFT & IDFT. What is Twiddle factor ?	**03**
	(b)	Discuss types of linear phase FIR systems.	**04**

	(c)	Explain decimation in frequency algorithm for radix-2.	**07**

OR

Q.5	**(a)**	Briefly explain frequency warping and pre-warping.	**03**
	(b)	Convert the given Analog Filter in to the digital filter using impulse invariance technique. $Ha(s)=(s + a) /\{(s + a)^2 + b^2 \}$	**04**
	(c)	If a causal sequence is given by $x(n) = \cos(n\pi/2),\ 0 \leq n \leq 3,$ $= 0$, otherwise. , then compute 4 point DFT.	**07**

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