GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII EXAMINATION – WINTER 2025

Subject Code:3171003   **Date:15-11-2025**
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)**	Define the following systems: Moving Average, Compressor, Accumulator.	**03**
	(b)	Determine Z.T for the sequence $x(n) = -a^n u(-n-1)$ and discuss its ROC.	**04**
	(c)	Define linear convolution and obtain the same for two infinite duration sequences given as, $x_1(n)= a^n u(n)$ & $x_2(n)= b^n u(n)$.	**07**
Q.2	**(a)**	State and prove time reversal property of Z.T.	**03**
	(b)	A stable LTI system is represented by the difference equation $y(n) - x(n) + \frac{1}{5}x(n-1) - \frac{1}{7}y(n-1) = 0$, find its impulse response using DTFT.	**04**
	(c)	Determine the original sequence x(n) if its Z.T is given by $X(z) = \frac{1+2z^{-1}+z^{-2}}{1-\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}}, |Z| > 1.$	**07**

OR

	(c)	Determine zero input response of a system represented by a LCCDE $y(n) - 3 y(n-1) - 4 y(n-2) = 0,$ if its solution is exponential with initial conditions $y(-1)= 5$ & $y(-2)= 0.$	**07**
Q.3	**(a)**	If a system is having a difference equation $x(n)+0.9*y(n-1)- y(n)=0$, then find (i) its Inverse System (ii) Impulse response of the Inverse System.	**03**
	(b)	Realize the following FIR system function $H(z) =1 + \frac{1}{2}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{2}z^{-3} + z^{-4}$ with minimum numbers of multipliers.	**04**
	(c)	Define All pass system and obtain minimum phase-all pass decomposition for the system with $H(z) = \frac{(1+3z^{-1})(1-0.5z^{-1})}{z^{-1}(1+0.3z^{-1})}$	**07**

OR

Q.3	**(a)**	A causal system function is $H(z) = \frac{1-z^{-1}}{(1+0.75z^{-1})}$, then obtain corresponding impulse response.	**03**
	(b)	Explain types of linear phase FIR Systems.	**04**
	(c)	Explain All pass system in detail with derivation of magnitude, phase, group delay and its applications.	**07**

Q.4 **(a)** Compare FIR and IIR filters.   **03**

(b) Compute 4 point DFT of a sequence   **04**
$x[n] = \delta[n] -2*\delta[n-1] + 3*\delta[n-2]+2* \delta[n-3].$

(c) If $H(z) = 8 * \dfrac{1-0.5z^{-1}+ 1.375z^{-2}-0.25z^{-3}}{1-1.25z^{-1}+0.75z^{-2}- 0.125z^{-3}}$, then obtain direct form-I and II realizations.   **07**

OR

Q.4 **(a)** Give advantages and disadvantages of digital filters.   **03**

(b) Compute IDFT of X(k)= (4,2,0,4) **.**   **04**

(c) Discuss structures for Linear phase FIR Systems .   **07**

Q.5 **(a)** Explain frequency warping and Pre-warping regarding filter design.   **03**

(b) Discuss Kaiser Window for FIR Filter design.   **04**

(c) Explain signal flow graph of the decimation in frequency decomposition of an N point DFT computation into two N/2 point computation if N=8.   **07**

OR

Q.5 **(a)** Discuss symmetry property of DFT.   **03**

(b) Explain Goertzel Algorithm.   **04**

(c) Enlist methods for IIR filter design and explain any one in detail.   **07**

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