

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII EXAMINATION – SUMMER 2025****Subject Code:2171003****Date:08-05-2025****Subject Name:Digital Signal Processing****Time:02:30 PM TO 05:00 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) State and prove convolution property of Z transform.	03
	(b) Prove Nyquist sampling criteria.	04
	(c) Check linearity of $w[n] = \log_{10}(x[n])$ and time invariance of the compressor $Y[n]=x[Mn]$.	07
Q.2	(a) Explain about ROC of Z Transform.	03
	(b) State and prove the periodicity property in DFT	04
	(c) Realize the following system functions in the direct form I and II.	07
	$y(n) = 0.5 x(n) - 0.5 x(n-2) - 1.3 y(n-1) - 0.36 y(n-2)$	
	OR	
	(c) Compare FIR and IIR Filters	07
Q.3	(a) Define causal system , non-causal and anti-causal system	03
	(b) What are the applications of Multirate system	04
	(c) Find the N-point DFT for $x(n) = a^n$ for $0 < a < 1$	07
	OR	
Q.3	(a) Distinguish the canonic and non-canonic structures.	03
	(b) What is a Kaiser window? In what way is it superior to other window functions	04
	(c) Draw the block diagram of a multistage interpolator and explain it	07
Q.4	(a) Prove differential property of Z - Transform	03
	(b) What is a Hamming window function? Obtain its frequency domain characteristics.-	04
	(c) Given $x(n) = \{1,2,3,4,4,3,2,1\}$, find $X(k)$ using DIF FFT algorithm.	07
	OR	
Q.4	(a) What is the impulse invariant technique?	03
	(b) Plot the spectrum of rectangular pulse using fourier transform	04
	(c) Find the stability of the IIR filter	07
	$4Y[n] = Y[n] - 2 Y[n-1] + x[n] - 5x[n-1] + 6x[n-2]$	
Q.5	(a) What is bilinear transformation for filter design	03
	(b) Explain steps for FIR filter design	04
	(c) In detail show the role of MAC and Barrel Shifter in the functioning of digital signal processor.	07

OR

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| Q.5 | (a) | How FFT is more efficient to determine DFT of sequence? | 03 |
| | (b) | What is meant quantization error? How to avoid it? | 04 |
| | (c) | How can sampling rate be converted by a rational factor M/L ? | 07 |
