Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:171003 Date:07-01-2023

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)**	List advantages of Digital over Analog signal processing with application of DSP.	**07**
	(b)	If the continuous-time signal $x(t) = 2\cos(400\pi t) + 5\sin(1200\pi t) + 6\cos(4400\pi t) + 2\sin(5200\pi t)$ is sampled at a 8 kHz rate generating the sequence x[n], find x[n].	**07**
Q.2	**(a)**	Explain classification of signals with examples.	**07**
	(b)	Obtain the linear convolution of following sequences: $x[n]=\{1,1,\underset{\uparrow}{0},1,1\}$ and $h[n]=\{1,-2,\underset{\uparrow}{-3},4\}$.	**07**
		OR	
	(b)	Find the response of the following difference equation: $y[n] - 5\,y[n-1] + 6\,y[n-2] = x[n]$, for $x[n] = u[n]$.	**07**
Q.3	**(a)**	List properties of Discrete Time Fourier Transform. Prove (1) Shifting and (2) Convolution of two sequences properties.	**07**
	(b)	Determine Z transform of the signal: $x[n] = \delta(n+1) + 3\,\delta(n) + 6\,\delta(n-3) - \delta(n-4)$.	**07**
		OR	
Q.3	**(a)**	List properties of ROC for the Z-Transform.	**07**
	(b)	Determine the inverse Z transform of the system function $H(z) = 1 / [(1 - 0.2\,z^{-1})\,z^{-2}]$	**07**
Q.4	**(a)**	Obtain direct form I realization of the difference equation, $y[n] = b_0\,x(n) + b_1\,x(n-1) + b_2\,x(n-2) + b_3\,x(n-3) - a_1\,y(n-1) - a_2\,y(n-2) - a_3\,y(n-3)$	**07**
	(b)	List properties of DFT. State and Prove any two of them.	**07**

OR

Q.4 **(a)** Obtain direct form I realization for the second order filter given by, **07**

$y[n] = 2b \cos w_0 \, y(n-1) - b^2 \, y(n-2) + x(n) - b \cos w_0 \, x(n-1)$

(b) Give relationship between DFT, DTFT and Z Transform. **07**

Q.5 **(a)** Explain Radix-2 Decimation In Frequency (DIF) Algorithm. **07**

(b) Describe IIR filter design by Impulse Invariant method. **07**

OR

Q.5 **(a)** Explain Goertzel algorithm. **07**

(b) Explain multiplier-Accumulator (MAC) hardware in DSP processors. **07**

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