Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII(OLD) • EXAMINATION – WINTER 2016

Subject Code: 170804 **Date: 25/11/2016**

Subject Name: Discrete Time 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.**

Q.1 **(a)** Define the following systems: (i) Stable (ii) Causal (iii) Linear (iv) Time invariant, and (v) Memory less. **07**

(b) Generate the sequence y[n] by the convolution of the finite length input sequence x[n] = -2 δ[n] + δ[n- 2] - δ[n- 3] + 3 δ[n-4] and impulse response h[n] = δ[n] + 2 δ[n-1]- δ[n-3]. Plot the convolution sum. **07**

Q.2 **(a)** Define Z- transform. Draw analogy between Z –transform and Discrete time Fourier transform. **07**

(b) What do you by region of convergence (ROC) in context to Z –transform. Write down properties of ROC. **07**

OR

(b) Explain properties of Z- transform. **07**

Q.3 **(a)** Find DFT of signal, x(n) = u[n] – u[n-1] and plot its amplitude and phase response. **07**

(b) Perform the circular convolution of the following two sequences: **07**
$x_1(n) = (\mathbf{2},1,2,1)$ and $x_2(n) = (\mathbf{1},2,3,4)$.

OR

Q.3 **(a)** A finite duration sequence of length L is given as **07**

$$x(n) = \begin{cases} 1, & 0 \le n \le L-1 \\ 0, & otherwise \end{cases}$$

Determine Discrete Fourier Transform (DFT) of this sequence and plot its magnitude and phase spectrum.

(b) Write properties of discrete-time Fourier transform. **07**

Q.4 **(a)** Define Fourier transform of a discrete-time signal x(n) and find the DTFT of the sequence: sin [nπ/2] u(n). **07**

	(b)	Find the 4-point DFT of sequence, x(n) = {**2**,1,4,3} by using radix-2 decimation in frequency (DIF) FFT.	**07**

P.T.O.

OR

Q.4	**(a)**	What is Fast Fourier Transform (FFT)? Explain method of calculating DFT using radix-2 decimation in time (DIT) FFT.	**07**
	(b)	Compute the DFT of the four-point sequence, x(n) = (**0** 1 2 3) using linear transformation method.	**07**
Q.5	**(a)**	What are different specifications required to design a low pass IIR digital filter? Compare IIR digital filter design using the Butterworth and Chebyshev approximations.	**07**
	(b)	Write transfer function for FIR digital filter. Why FIR digital filters can have an exact linear phase? Explain.	**07**

OR

Q.5	**(a)**	What do you understand by FIR digital filter? Explain in brief FIR digital filter design using windowing techniques.	**07**
	(b)	Explain impulse invariance and bilinear transformation techniques of IIR filter design.	**07**

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