Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 170804 **Date: 16/12/2015**

Subject Name: Discrete Time Signal Processing

Time: 10:30am to 1:00pm **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)** Discuss the advantages of DSP over ASP. **07**

(b) Given signal x[n] = {1, -1, 1, 0, 1, 2, 3, 4} , Compute the following **07**

$\uparrow$

i) x[-n] ii) x[-n-1] iii) x[-n+1] iv) x[n-1] v) x[n+1]

Q.2 **(a)** Prove that LTI system is stable if its impulse response is absolutely summable. **07**

(b) Perform circular Convolution of sequence $x_1[n] = \{1,3,5,3\}, x_2[n] = \{2,3,1,1\}$ **07**

OR

(b) Perform Linear Convolution of a given sequence using DFT **07**

$x[n] = \{1,2\}$, $h[n] = \{2,1\}$

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Q.3 **(a)** Verify the following property of Fourier Transforms **07**

(i) Time-shifting property

(ii) Frequency-shifting property

(b) Compute the Convolution of the following signal **07**

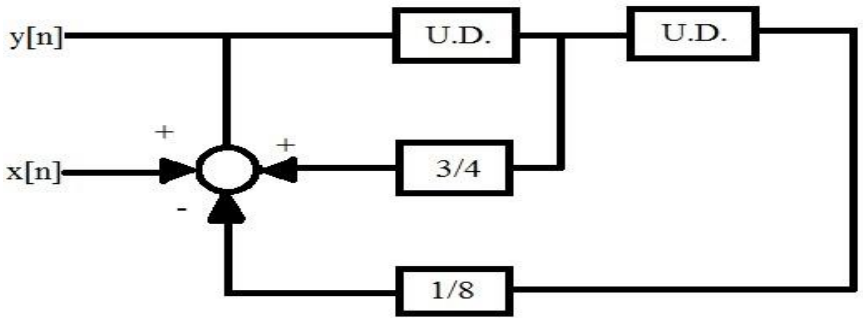
$$x(n) = \begin{cases} \alpha^n & -3 \le n \le 5 \\ 0 & Elsewhere \end{cases}, \quad h(n) = \begin{cases} 1 & 0 \le n \le 4 \\ 0 & Elsewhere \end{cases}$$

OR

Q.3 **(a)** Given $x[n] = \{1,2,2,1,0,0,0,0\}$, Find X[k] using DIT-FFT Algorithm **07**

(b) Find out the impulse response of system given in the figure below **07**

$$x(n) = \begin{cases} \left(\frac{1}{2}\right)^n & n \geq 0 \\ 0 & Elsewhere \end{cases}$$



Q.4 **(a)** Determine the Z-transform of x(n) = (cos ω_0 n) u(n) **07**

(b) Determine Inverse Z-transform using long division method **07**

$$X(Z) = \frac{Z^2}{0.5 - 1.5Z + Z^2} \quad for\ ROC \quad |Z| < 0.5$$

OR

Q.4 **(a)** Determine Z-transform and ROC of signal x(n) = [3 (4^n) - 5 (3^n)] u(n) **07**

(b) Obtain inverse Z-transform using partial fraction method **07**

$$X(Z) = \frac{1 - \frac{1}{2}Z^{-1}}{1 - \frac{1}{4}Z^{-2}} \qquad |Z| > \frac{1}{2}$$

Q.5 **(a)** Compare the commonly used windowing techniques for FIR filter design. **07**

(b) 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**

OR

Q.5 **(a)** Discuss Various steps for Design FIR digital filter using Kaiser window. **07**

(b) Discuss Bilinear Transformation technique for IIR filter design. **07**

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