Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 170804 **Date: 28-11-2013**

Subject Name: Discrete Time Signal Processing

Time: 10:30 TO 01:00 **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)** With the help of mathematical expression and suitable figure explain the following functions: **07**

(i) Unit step function (ii) Impulse function (iii) Complex exponential sequences.

(b) The input x(t) and the impulse response h(t) of a continuous time LTI system are given by x(t) = u(t) and $h(t) = e^{-\alpha t}\ u(t)$, $\alpha > 0$. Compute the output, y (t) given by y (t) = x (t) * h (t). **07**

Q.2 **(a)** Find the z-transform X (z) and sketch the pole-zero plot with the ROC for the following sequence: $x[n] = (1/2)^n u(n) + (1/3)^n u(n)$. **07**

(b) Using the power series expansion technique, find the inverse z-transform of the following: $X(z) = 1/(1- az^{-1})$, $|z| > |a|$ **07**

OR

(b) Using partial-fraction expansion find the inverse z-transform of the following: $X(z) = z/(2z^2 - 3z + 1)$, $|z| < 1/2$ **07**

Q.3 **(a)** What are the conditions for convergence of Fourier Transforms? Write down the properties of Fourier Transform. **07**

(b) (i) Find the Fourier transform of the rectangular pulse signal x(t) defined by **07**

$$x(t) = p_a(t) = \begin{cases} 1 & |t| < a \\ 0 & |t| > a \end{cases}$$

(ii) Plot its magnitude spectrum.

OR

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

(i) Time-shifting property: $x(t - t_o) \leftrightarrow e^{-j\omega t_o} X(\omega)$

(ii) Frequency-shifting property: $x(t)\, e^{j\omega t_o} \leftrightarrow X(\omega - \omega_o)$

(b) Find the Fourier transforms of the following signals: **07**

(i) $x(t) = e^{-j\omega_o t}$

(ii) $x(t) = \sin w_o t$

Q.4 **(a)** Explain circular convolution with example. **07**

(b) Compute 4- point DFT of causal three sample sequence given by: **07**

$x(n) = 1/3\ ;\ 0 \le n \le 2$

$= 0\ ;$ else

OR

Q.4 **(a)** Define Discrete Fourier Transforms (DFT) and inverse Discrete Fourier Transforms (IDFT) with the help of suitable mathematical expressions. **07**

(b) Compute circular convolution of the following two sequences using DFT: **07**

$x(n) = \{\underset{\uparrow}{1}, 0.5\}$ and $h(n) = \{0.5, \underset{\uparrow}{1}\}$

Q.5	**(a)**	Define Fast Fourier Transform (FFT). Make a detailed comparison between DFT and FFT.	**07**
	(b)	What is decimation in frequency Radix-2 FFT? Explain.	**07**

OR

Q.5	**(a)**	Differentiate between discrete time IIR and FIR systems. Explain structure for realization of IIR systems.	**07**
	(b)	Explain Filter design by Impulse Invariance technique.	**07**

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