Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: X61103 Date: 31/12/2012

Subject Name: Digital Signal Processing

Time: 10.30 am - 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 continuous & discrete time signals. And explain the concept of frequency in continuous & discrete time signals.	**07**
	(b)	Give the classification of Systems. Check the systems for Linearity, Causality, and Time Variance. i) $y_1(n) = \|x(n)\|$ ii) $y_2(n) = x(- n)$	**07**
Q.2	**(a)**	Define the z-transform & ROC. Explain the properties of the region of convergence of z-transform with illustrations & sketches.	**07**
	(b)	Define linear convolution & discuss its significance. If Impulse response of Linear Time Invariant system is given by h (n) = {1, 2, 1,-1}, determine the response of the LTI system for the input signal x (n) = {1, 2, 3, 1}.	**07**
		OR	
	(b)	Define correlation & Discuss its application. Determine the cross correlation values of the two sequences, x(n)={1,0,0,1} & h(n)={4,3,2,1}	**07**
Q.3	**(a)**	State & prove the Translation & Convolution property of Z transform.	**07**
	(b)	Determine the z transform for 1) $x_1(n) = \cos(w_0 n)\ u(n)$ 2) $x_2(n) = - a^n u(-n-1)$	**07**
		OR	
Q.3	**(a)**	Discuss causality & stability in terms of z-transform.	**07**
	(b)	Determine the inverse z-transform for 1) $X(z) = 1/(1-1.5z^{-1} + 0.5z^{-2})$ for all possible sequences. 2) $H(z) = 1/((1+z^{-1})(1-z^{-1})^2))$ for ROC: $\|z\| > 1$.	**07**
Q.4	**(a)**	Develop radix 2 FFT algorithm using DIT. Compute 4 point DFT of sequence x(n)={0,1 ,2,3} using DIT FFT algorithm.	**07**
	(b)	Explain Goertzel algorithm.	**07**

OR

Q.4 **(a)** The transfer function of a discrete causal system is given **0 7**

$H(z) = (1- z^{-1}) / (1 - 0.2\ z^{-1} - 0.15\ z^{-2})$

1) Find the diff. equation.
2) Draw cascade & parallel realization.
3) Calculate the impulse response of the system.

(b) Define circular convolution. How it is different form linear convolution. Determine the linear convolution for given sequences $x_1(n) = \{1, 2, 4\}$ & $x_2(n) = \{1, 2\}$ verify the result using circular convolution. **0 7**

Q.5 **(a)** Enlist the properties of Fourier transform. Determine & sketch the frequency spectrum for **0 7**

i) $x_1(n) = a^n\ u\ (n)$

ii) $x_2(n) = \delta\ (n-3)$.

(b) Design a discrete time low pass filter using Butterworth approximation by impulse invariance. The specifications are as follows **0 7**

$$0.89125 \leq |H(w)| \leq 1 \text{ for } 0 \leq w \leq 0.2\pi$$

$$|H(w)| \leq 0.17783 \text{ for } 0.3\pi \leq w \leq \pi$$

OR

Q.5 **(a)** Discuss IIR filter design by approximation of derivative method. Obtain analog filter transfer function **0 7**

$$H(s) = 1/(s^2 +16)$$

(b) Enlist diff. types of architecture of DSP. Discuss any two in brief. **0 7**

****