

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. VIIth Semester–Examination – Nov- 2011

Subject code: 171704

Subject Name: Digital Signals & Systems

Date: 26/11/2011

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) Find homogeneous solution of a given system difference equation: **07**

$$y(n) - 3y(n-1) - 4y(n-2) = x(n)$$

$$y(-1) = 5 ; \quad y(-2) = 0$$

(b) Obtain the inverse z transform of the following **07**

$$Z + 2$$

$$X(z) = \frac{\quad}{2Z^2 - 7Z + 3}$$

$$\text{If ROC is (1) } |Z| > 3 \quad (2) |Z| < 1/2$$

Q.2 (a) Define Cross correlation and Auto correlation. State the use of Evaluating correlation of two sequences. Explain how correlation can be expressed in terms of convolution. **07**

(b) State and illustrate properties of DFT **07**

OR

(b) Compute the Fourier transform of the following signals: **07**

(1) $x(n) = (\alpha^n \sin w_0 n) u(n)$, $|\alpha| < 1$

(2) $x(n) = u(n) - u(n-6)$

Q.3 (a) The analog signal $x(t)$ given below **07**

$$X(t) = 2\cos(2000\pi t) + 3\sin(6000\pi t) + 8\cos(12000\pi t)$$

Calculate:

(1) Nyquist rate of sampling

(2) If the given $x(t)$ is sampled at the sampling frequency $F_s = 5000\text{Hz}$, what is the discrete time sequence obtained after sampling?

(3) What is the analog signal $y(t)$ we can reconstruct from the samples if ideal interpolation is used?

(b) Compute and sketch the magnitude and phase spectra for the following signals ($a > 0$) **07**

(1) $X_a(t) = \{ Ae^{-at}, t \geq 0 \text{ and } 0, t < 0 \}$

(2) $X_a(t) = Ae^{-a|t|}$

OR

Q.3 (a) Determine and sketch the magnitude and phase response of the following systems **07**

(1) $y(n) = \frac{1}{2} [x(n) + x(n-1)]$

(2) $y(n) = \frac{1}{2} [x(n+1) + x(n-1)]$

(b) Perform the circular convolution of the following two sequences: **07**

$$X_1(n) = \{ 2, 1, 2, 1 \} \quad \text{and} \quad X_2(n) = \{ 1, 2, 3, 4 \}$$

$\uparrow$
 $\uparrow$

Q.4 (a) Compute the linear convolution $y(n)$ of the signals: **07**

$$x(n) = \{ \alpha^n, -3 \leq n \leq 5 \text{ and } 0, \text{ elsewhere} \}$$

$$h(n) = \{ 1, 0 \leq n \leq 4 \text{ and } 0, \text{ elsewhere} \}$$

(b) Determine the Z transform of the following signals: **07**

(1) $x(n) = n^2 u(n)$

(2) $x(n) = -n a^n u(n-1)$

OR

Q.4 (a) Explain the properties of the Z transform **07**

(b) For a given discrete system, check whether they are **07**

(1) Time variant / Time invariant

(2) Stable / Unstable

(3) Linear / Nonlinear

(4) Causal / Anti causal

(5) Static / dynamic

$$Y(n) = X(2n)$$

$$Y(n) = X(-n)$$

Q.5 (a) Determine the unit step response of the system described by the difference equation **07**

$$y(n] = 0.9 y(n-1) - 0.81 y(n-2) + x(n)$$

under the following initial conditions.

$$y(-1) = y(-2) = 1$$

(b) Determine the eight point DFT of the signal **07**

$$x(n) = \{ 1, 1, 1, 1, 1, 1, 0, 0 \}$$

an sketch its magnitude and phase

OR

Q.5 (a) Explain in detail – Sigma Delta Modulation system **07**

(b) Determine the cross correlation sequence $r_{xy}(l)$ of the sequences **07**

$$x(n) = \{ \dots, 0, 0, 2, -1, 3, 7, 1, 2, -3, 0, 0, \dots \}$$

$\uparrow$

$$y(n) = \{ \dots, 0, 0, 1, -1, 2, -2, 4, 1, -2, 5, 0, 0, \dots \}$$

$\uparrow$
