

Roll No.....

## EC - 603

### B.E. VI Semester

Examination, December 2012

## Digital Signal Processing

*Time : Three Hours*

*Maximum Marks : 100*

*Minimum Pass Marks :35*

*Note : 1. Attempt one question from each Unit.*

*2. All questions carry equal marks.*

### UNIT-I

1. a) Explain about energy signal & power signal determine whether the unit step sequence is energy or power signal

- b) The accumulator  $y_{(n)} = \sum_{k=-\infty}^n x(k)$  is excited by a sequence

$x(n) = n u(n)$ . Determine its output under the condition that

- i) It is initially relaxed
- ii) Initially  $y(-1) = 1$

OR

- 2) a) Determine the impulse response  $h(n)$  for the system described by the second order difference equation

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

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b) A discrete time system is realized by the structure shown in fig.1.

i) determine the impulse response.

ii) Determine a realization for its inverse system that is the system which produces  $x(n)$  as an output when  $y(n)$  is used as an input.

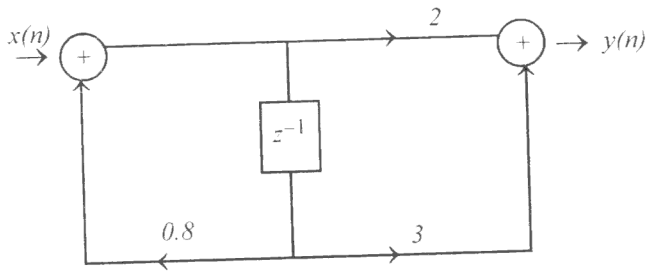


fig.1

## UNIT-II

3) a) Determine the convolution  $x(n)$  of the signals

$$x_1(n) = \{1, -2, 1\} \text{ and } x_2(n) = \begin{cases} 1, & 0 \leq n \leq 5 \\ 0, & \text{else where} \end{cases}$$

b) Determine the response of the system

$$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$$

$$\text{to the input signal } x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$$

OR

4) a) Determine the z-Transform of the following signals

i)  $x(n] = -n a^n u(-n-1)$

ii)  $x(n] = (-1)^n \left( \cos \frac{\pi}{3} n \right) u(n)$

- b) Determine the casual signal  $x(n)$  if its  $z$  - transform  $X(z)$  is given by

$$\text{i) } Y(z) = \frac{1 - 2z^{-1} + z^{-2}}{1 + 4z^{-1} + 4z^{-2}}$$

$$\text{ii) } X(z) = \frac{1}{1 - z^{-1} + \frac{1}{2}z^{-2}}$$

### UNIT-III

- 5) a) Determine the Fourier transform of the signal

$$x(n) = a^{|n|} \quad -1 < a < 1$$

- b) Prove that multiplication of the DFT's of two sequence is equivalent to the circular convolution of two sequences in the time domain.

OR

- 6) Find the DTFT of the following infinite duration sequence of length  $L$

$$x(n) = \begin{cases} A, & \text{for } 0 \leq n \leq L-1 \\ 0, & \text{otherwise} \end{cases}$$

Also find the inverse DTFT to verify  $x(n)$  for  $L=3$  and  $A = 1$

### UNIT - IV

- 7) Given  $x(n)=2^n$  and  $N = 8$ . Find  $X(k)$  using DIT FFY algorithm.

OR

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- 8) Develop a radix-4 DIT FFT algorithm for evaluating the DFT for  $N=16$  and hence determine the 16 point DFT of the sequence.

### UNIT - V

- 9) A filter is to be designed with the following desired frequency response

$$H_d(e^{j\omega}) = \begin{cases} 0 & -\pi/4 \leq \omega \leq \pi/4 \\ e^{-j\omega} & \pi/4 < |\omega| < \pi \end{cases}$$

Determine the filter coefficients  $h_d(n)$  if the window function is defined as

$$w(n) = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

Also determine the frequency response  $H(e^{j\omega})$  of the designed filter.

OR

- 10) Determine  $H(z)$  for a Butterworth filter satisfying the following constraints.

$$\begin{aligned} \sqrt{0.5} \leq |H(e^{j\omega})| &\leq 1 & 0 \leq \omega \leq \pi/2 \\ |H(e^{j\omega})| &\leq 0.2 & 3\pi/4 \leq \omega \leq \pi \end{aligned}$$

with  $T=15$ . Apply impulse invariant Transformation.

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