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 wether 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

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

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.

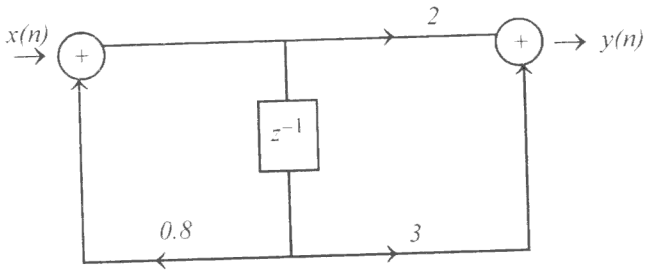

fig.1

UNIT-II

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

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

b) Determine the response of the system

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

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

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

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

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

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

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

UNIT - IV

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

OR

8) Develop a rad *x-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

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

Determine the filter coefficients *hd(n)* if the window function is defined as

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

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

OR

10) Determine H(z) for a Butter worth filter satisfying the following constraints.

$$\sqrt{0.5} \le \left|H(e^{j\omega})\right| \le \perp \quad 0 \le \omega \le \pi/2$$

$$\left|H(e^{j\omega})\right| \le 0.2 \quad 3\pi/4 \le \omega \le \pi$$

with T=15. Apply impulse invariant Transformation.

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