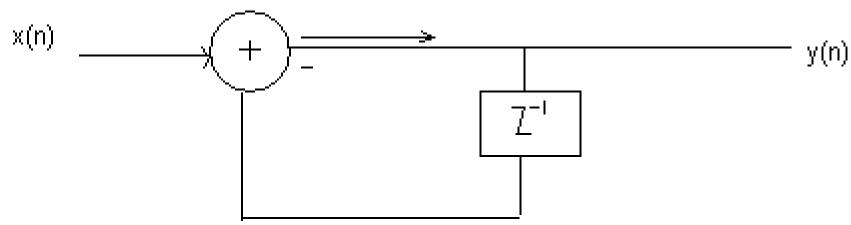
SIXTH SEMESTER EXAM-2008 CPEC 5302

DIGITAL SIGNAL PROCESSING

SET - A

1.Answer the following questions.

(a). Find the response of the system, if a = 1, b=-1, x(n) = delta(n) and the system is initial at rest.



(b). Find out the Nyquist rate for the signal x(t)= 2% cos(500pi t)
(c). What is the stability condition of an LTI system ?
(d). At which band an ideal filter is distortionless ?
(e). How the DFT and DTFT of one discrete time signal related ?
(f). Find out the impulse response of the LTI system given by

$$y(n) = k1\ x(n) + k2\ x(n-1) + k3\ x(n-2).$$

(g). What are the disadvantages of FFT over DFT ?
(h). Draw the signal flow graph of a first order digital filter.
(i). Show whether the systems are (i) Linear / Non Linear ,(ii) TV/TIV

$$y(n) = \sum_{k=-\infty}^{n} x(k)$$

$$y(n) = x(n^2)$$

(j). what is the aliasing effect ?

2. (a). Determine the impulse response for the given system described by difference equation

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

(b). compute and sketch the step response of the system :

$$y(n)= 1/M \left(\sum_{k=0}^{N-1} x(n-k)\right)$$

3. (a).determine convolution of the following pairs of signal by means of ZT.

$X_1(n) = 0.5^n\ u(n),\ X_2(n)= \cos \pi\ nu(n)$

(b). Consider the fir filter represented as $y(n) = x(n) + x(n-4)$. Compute and sketch the magnitude and phase spectrum.

4. (a). Let x(n) be a real valued N point sequence. Develop a method to compute a N point DFT x'(k),which contains only the odd harmonics by using a real N/2 point DFT.

(b). Perform linear convolution of the following sequence by overlap method.
$x(n) = \{1,-1,2,-2,3,-3,4,-4\}$
$h(n) =\{1,-1\}$

5. $x(n)= \delta(n)+ 2\delta(n-1)+ \delta(n-3)$
(i) Find the four point DFT of X(n).
(ii) If y(n) is the four point circular convolution of x(n) with itself, find y(n) and four point DFT y(k).

6. Design an FIR digital filter approximating the ideal low frequency response.

$$H_d(\omega)= \begin{cases} 1, & |\omega| \leq (\pi/6) \\ 0, & \pi/6 \leq |\omega| \leq \pi \end{cases}$$

(i) Determine the coefficients of 25 tap filter based on window method with a rectangular window.
(ii). Plot the magnitude and phase response of the filter.

7. (a). With impulse invariance, a first order pole in Ha(s) at s = sk is mapped to a pole in H(z) at $Z = e^{s_k T}$
.

$$\frac{1}{s - s_k} = \frac{1}{1 - e^{s_k t} z^{-1}}$$

Determine how a second order pole is mapped with impulse variance.

(b). A second order continuous time filter has a system function

H(s) = 1/(s-a) + 1/(s-b)

where a<0.b<0 are real. Determine the location of poles of H(z) if he filter designed using impulse invariance technique with T = 2 sec.

8. (a). find the direct form II realization for the system described by difference equation.

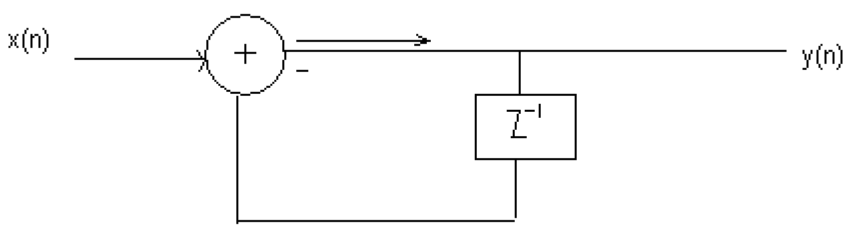
Y(n) = 3/4 y(n-1) =3/4 y(n-2)+x(n) -1/3 x(n-1)

(b). explain the power spectrum estimation using he Bartlet method.

SET-B

1.Answer the following questions.

(a). Find the response of the system, if a = 1, b=-1, x(n) = delta(n) and the system is initial at rest.



(b). Find out the Nyquist rate for the signal x(t)= 2% cos(500pi t)
(c). What is the stability condition of an LTI system ?
(d). At which band an ideal filter is distortionless ?
(e). How the DFT and DTFT of one discrete time signal related ?
(f). Find out the impulse response of the LTI system given by

y(n) = k1 x(n) + k2 x(n-1) + k3 x(n-2).

(g). What are the disadvantages of FFT over DFT ?
(h). Draw the signal flow graph of a first order digital filter.
(i). Show whether the systems are (i) Linear / Non Linear ,(ii) TV/TIV

$$y(n) = \sum_{k=-\infty}^{n} x(k)$$

$$y(n) = x(n^2)$$

(j). what is the aliasing effect ?

2. (a). Determine the impulse response for the given system described by difference equation

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

(b). compute and sketch the step response of the system :

$$y(n)= 1/M \left(\sum_{k=0}^{N-1} x(n-k)\right)$$

3. (a). find the direct form II realization for the system described by difference equation.

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

(b). Consider the fir filter represented as y(n) = x(n) +x(n-4). Compute and sketch the magnitude and phase spectrum.

4. (a). Let x(n) be a real valued N point sequence. Develop a method to compute a N point DFT x'(k),which contains only the odd harmonics by using a real N/2 point DFT.

(b). Perform linear convolution of the following sequence by overlap method.

x(n) = {1,-1,2,-2,3,-3,4,-4}

h(n) ={1,-1}

5. x(n)= ********************

(i) Find the four point DFT of X(n).

(ii) If y(n) is the four point circular convolution of x(n) with itself, find y(n) and four point DFT y(k).

6. Determine the mean and the autocorrelation of the sequence x(n), which is the output of a ARMA (1,1) process described by difference equation

x(n) =0.5 x(n-1) + w(n) - w(n-1).

7. For zero mean, jointly Gaussian random variable X1,2,X3,X4 it is known that E(X1 X2 X3 X4) = E(X1 X2) E(X3 X4) + E(X1 X3) E(X2 X40 + E(X1 X4) + E(X2 X3)

Use this result to derive the mean square value of r'xx(m) and the variance which is

$$Var[r'_{xx}(m)] = E[|r'_{xx}(m)^2|] - E|[r'_{xx}(m)]|$$

8. Determine the coefficient {h(n)} of a linear phase FIR of length N = 15 which has a symmetric unit sample response and a frequency response that

$$H_r\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0,1,2,3 \\ 0, & k = 4,5,6,7 \end{cases}$$

satisfies the condition.