MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EI-605A

DIGITAL SIGNAL PROCESSING (EC)

Full Marks: 70

Time Allotted: 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1×10=10

1. Choose the correct alternatives from *any ten* of the following:

(i) A signal x[n] is anti symmetric or odd when

(a) x[–n]=x[n]·x[n]
(b) x[n]= –x[n]
(c) $x[n]=[x[n]]^2$
(d) x[–n]= –x[n]

(ii) The region of Convergence of Z-Transform of a unit step function is

(a) $|z| > 1$
(b) $|z| < 1$
(c) (Real part of Z)>0
(d) (Real part of Z)<0

(iii) A discrete time signal $x(n) = (-1)^n$ is periodic with fundamental period:

(a) 4
(b) 6
(c) 2
(d) 0

(iv) If R_1 is the ROC of x(n) and R_2 is the ROC of y(n), then the ROC of x(n) convoluted y(n) is

(a) R_1+R_2
(b) $R_1- R_2$
(c) $R_1 \cap R_2$
(b) $R_1 \cup R_2$

(v) The region of Convergence of the Z-Transform of the signal $2^n u(n) - 3^n u(-n-1)$ is

(a) $z > 1$
(b) $z < 1$
(c) $2 < z < 3$
(d) does not exist

Turn Over

(vi) A system described by $y(n) = nx(n)$:

(a) Linear Time varying and stable
(b) Non-Linear, Time invariable and unstable
(c) Non Linear, Time varying and stable
(d) Linear, Time varying and stable

(vii) The poles of Butterworth low pass filter like on

(a) an ellipse
(b) a circle
(c) a parabola
(d) a rectangle

(viii) $x(n) = \left(\frac{1}{3}\right)^n u(n)$ is

(a) Energy signal
(b) Power signal
(c) Both (a) and (b)
(d) None of these

(ix) The value of twiddle factor W_8^4 is given by

(a) 1
(b) $-j$
(c) $\frac{1}{\sqrt{2}} - \frac{j}{\sqrt{2}}$
(d) -1

(x) The mapping from analog to digital domain in impulse invariant method is

(a) one to many
(b) many to one
(c) one to one
(d) None of these

(xi) A signal is a power signal if

(a) $E < \infty, P = 0$
(b) $P < \infty, E = 0$
(c) $P < \infty, E < \infty$
(d) $P = \infty, E = 0$

(xii) Overlap save method is used to find

(a) Circular Convolution
(b) Linear Convolution
(c) DFT
(d) Z-Transform

Group – B

(Short Answer Type Questions)

Answer *any three* of the following: 5×3=15

2. Define energy signal and power signal. Calculate the power of the signal sequence

$$x(n) = 2(-1)^n \text{ for } n >= 0$$
$$= 0 \quad \text{for } n < 0$$

3. The impulse response of a DTILTI system is $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine expression for the amplitude response and the phase response of the system. 5

4. A discrete time system is causal if for every choice of n_0 the value of the output sequence $y(n)$ at $n=n_0$ depends on only the values of the input sequence $x(n)$ for $n \leq n_0$. From this definition derive the causality condition for a discrete-time LTI system i.e., $h(n)=0$ for $n<0$. 5

5. Find the impulse response $h(n)$ for each of the causal LTI discrete-time systems satisfying the following difference equations and indicate whether each system is an FIR or an IIR system: 5

   (i) $y(n) = x(n) - 2x(n-2) + x(n-3)$

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

6. Find the order of Butterworth filter that has a 2dB passband attenuation at a frequency of 20rad/sec and –10dB stopband attenuation at 30 rad/sec. 5

Group – C

(Long Answer Type Questions)

Answer any three of the following: 15×3=45

7. (a) Find out the relation between Fourier transform and Laplace transform with Z– transform.

   (b) Find the causal signal which is having the Z–transform as

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

   (c) Use one sided Z–transform to find out the solution of difference equation given by $y(n) = \frac{1}{2}y(n-1) + x(n); n > 0$. Given that, $y(-1) = 1$ and $(n) = (1/3)^n$. 5+5+5=15

8. (a) Obtain a cascade realization of the system characterized by the transfer function

   $H(z) = 2(z+2)/\{z(z-0\cdot1)(z+0\cdot5)(z+0\cdot4)\}$

   (b) Determine the direct form-II and transposed direct form-II for the given system

   $y(n) = 0\cdot5y(n-1) - 0\cdot25y(n-2) + x(n) + x(n-1)$.

9. (a) Determine the condition for BIBO stability of a causal DTILTI system. Hence prove that an LTI system is BIBO stable if and only if the ROC of the system function includes unit circle.

   (b) The impulse response of a discrete time system is given by $h(n) = \{2, -1, 4\}$. If the input sequence is $x(n) = \{3, 5, 1, 6\}$; find the ouput sequence $y(n)$ by using graphical convolution method. 10+5=15

10. (a) Find the 4 point DFT of the sequence $x(n) = \{1, -2, 3, 4\}$.

    (b) Find the circular convolution of the following discrete time sequence:

    $x_1(n) = \{1, 3, 5, 7\}$ and $x_2(n) = \{2, 4, 6, 8\}$ using graphical method. Check the result by matrix method of convolution. 7+5+3=15

11. (a) What do you mean by windowing?

(b) What is rectangular window?

(c) Design the symmetric FIR low pass filter using rectangular window for which desired frequency response is expressed as

$$H_d(e^{jw}) = \begin{cases} e^{-j\omega\tau} & , \text{ for } |\omega| \le \omega_c \\ 0 & , \text{ elsewhere.} \end{cases}$$

(d) Determine $H(z)$ using impulse invariant method at $5Hz$ sampling frequency from $H(s) = \frac{2}{(s+1)(s+2)}$. 2+2+6+5=15

12. (a) What is meant by order of a filter?

(b) Design a digital Butterworth IIR filter for the given frequency response

$0{\cdot}85 \le |H(e^{j\omega})| \le 1$ for $0 \le \omega \le 0{\cdot}2\pi$

$|H(e^{j\omega})| \le 0{\cdot}2$ for $0{\cdot}45\pi \le \omega \le \pi$

Use impulse invariant method.

(c) What are the major factors to be taken into consideration in determining the choice of a specific system realization from amongst many possible representations? 2+10+3=15

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EI-605A

DIGITAL SIGNAL PROCESSING

Time Allotted : 3 *Hours* *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) The digital system described by $y(n) = ax(n) + b$ is a

   a) linear system

   b) non-linear system

   c) non-causal system

   d) dynamic system.

ii) The ROC of the Z-transform of a causal sequence is

a) the interior of a circle

b) the exterior of a circle

c) a rectangle

d) an annular region.

iii) For normal DFT calculations number of complex multiplications required is

a) N b) 2N

c) $2N^2$ d) N^2.

iv) Poles of a Butterworth filter lie on

a) circle b) circle and ellipse

c) ellipse d) none of these.

v) The convolution of $u(n)$ with $u(n-4)$ at $n = 5$ is

a) 5 b) 1

c) 2 d) 0.

vi) The sequence of $x(n) = (-1)^n$ is periodic with a period of

a) 6 samples b) 2 samples

c) 0 sample d) none of these.

vii) If a discrete time signal is anti-causal then ROC will include

a) $Z = 0$ b) $Z = \infty$

c) $Z = 0$ and $Z = \infty$ d) none of these.

viii) The Z transform of $u(-n)$ is

a) $\frac{1}{(1-z^{-1})}$ b) $\frac{z}{(1-z)}$

c) $\frac{1}{(1-z)}$ d) $\frac{1}{(z-1)}$.

ix) $y(n) = e^{x(n)}$ is

a) linear and time invariant system

b) linear and time variant system

c) non-linear and time invariant system

d) non-linear and time variant system.

x) If $X(z) = Z\{x(n)\}$, then $Z\{nx(n)\}$ is equal to

a) $X\frac{dX(z)}{dz}$ b) $-X\frac{dX(z)}{dz}$

c) $X^{-1}\frac{dX(z)}{dz}$ d) $-X^{-1}\frac{dX(z)}{dz}$.

xi) During FFT calculations using DIF algorithm,

a) outputs are in bit reversal form

b) inputs are taken in bit reversal form

c) both input and output are taken in bit reversal form

d) none of these.

xii) An analog signal is expressed by the equation, $x(t) = 3\cos 50\pi t + 10\sin 300\pi t - \cos 100\pi t$. The Nyquist rate of the signal is

a) 150 Hz b) 300 Hz

c) 25 Hz d) 50 Hz.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Find the circular convolution of two sequences $x(n) = \{\underset{\uparrow}{1}, 1, 2, 2\}$ and $y(n) = \{\underset{\uparrow}{1}, 2, 3, 4, 5\}$.

3. Consider a system described by the difference equation, $y(n) = y(n-1) - y(n-2) + 0.5x(n) + 0.5x(n-1)$. Find the response of this system to the input $x(n) = 0{\cdot}5^n u(n)$ with initial conditions $y(-1) = 0{\cdot}75$ and $y(-2) = 0{\cdot}25$.

4. Define energy and power of a signal. Find out the energy of the sequence $x(n) = \{2, 1, \underset{\uparrow}{3}, -1, 2, 0, 1, -1\}$.

5. Sketch the magnitude response of a Butterworth filter and derive an expression of order of such a filter ?

6. Consider an LTI system with frequency response

$$H\left(e^{j\omega}\right) = e^{-j\left(\omega-\frac{\pi}{4}\right)}\left(\frac{1+e^{-j2\omega}+4e^{-j4\omega}}{1+\frac{1}{2}e^{-j2\omega}}\right)$$

Determine the output $y(n)$ for all n if the input is $x(n) = \cos(\pi n/2)$ for all n.

7. Prove that the energy of a real valued energy signal is equal to the sum of the energy of its even and odd components.

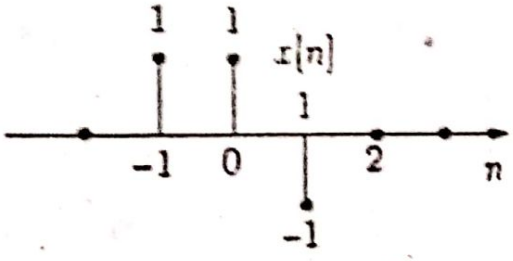
GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Describe how tabulation method can be used to find out the convolution sum.

b) A DTLTI system with impulse response $h(n) = \{\underset{\uparrow}{1}, 1, 1\}$ is excited by a sequence, $x(n) = \{\underset{\uparrow}{4}, 3, 2, 1\}$. Determine the output $y(n)$ of the system using the tabulation method.

c) The signal $x[n]$ shown in the figure below is convolved with itself to get $y[n]$. Find out $y[-1]$.



5 + 6 + 4

9. a) Define ROC. What are the properties of ROC ?

b) State and prove initial value theorem regarding Z-transform ?

c) For a causal LTI system, the output $y(n)$ is related to input $x(n)$ by the difference equation $y(n) = \frac{1}{4} y(n-1) + x(n)$. Calculate $y(n)$ while $x(n) = \delta(n-1)$. (Hint : use Z transform)

(2 + 3) + 5 + 5

[Turn over

10. a) Find the DTFT of the sequence,

$$x(n) = \{\underset{\uparrow}{1}, -1, 1, -1\}.$$

b) Find the IDTFT of $X\left(e^{j\omega}\right) = e^{-j\omega}\left(\frac{1}{2} + \frac{1}{2}\cos\omega\right)$.

c) Point out the difference between DTFT and DFT.

d) What is the difference between linear convolution and circular convolution ? 4 + 4 + 3½ + 3½

11. a) Draw the following :

i) Direct Form II

ii) Cascade structures for the system described by the difference equation :

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

b) Design a digital Butterworth filter to satisfy the following constraints :

$$0.8 \le \left|H\left(e^{j\omega}\right)\right| \le 1,\ 0 \le \omega \le \frac{\pi}{2}$$

$$\left|H\left(e^{j\omega}\right)\right| \le 0.1,\ \frac{3\pi}{4} \le \omega \le \pi$$

Use bilinear transformation. Consider a sampling period of 1 second. (4 + 4) + 7

12. a) Find the DFT of a sequence $x(n) = \{\underset{\uparrow}{1}, 1, 0, 0\}$ and find the IDFT of $Y(k) = \{\underset{\uparrow}{1}, 0, 1, 0\}$.

b) Determine the output response $y(n)$ if $h(n) = \{\underset{\uparrow}{1}, 1, 1, 1\}$; $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ by using circular convolution (graphical method).

c) Compute the N-point DFT of (i) $x(n) = \delta(n)$, (ii) $x(n) = \delta(n - n_0)$.

d) Describe decimation in frequency FFT algorithm for 8 pt. DFT. $(2\frac{1}{2} + 2\frac{1}{2}) + 4 + 2 + 4$

13. Write short notes on any *three* of the following : 3×5

a) Radix-2 decimation in frequency algorithm

b) Nyquist sampling theorem

c) IIR and FIR filters

d) Utility of FFT over DFT

e) Chebyshev filter

f) BIBO stability in Z domin

g) Difference between DTFT and DFT

h) Mapping of s-plane to z-plane.

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EI-605A

DIGITAL SIGNAL PROCESSING

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) If $x_1(n)$ and $x_2(n)$ are finite length sequences of sizes L and M respectively, their linear convolution has the length

a) $L + M - 2$

b) $L + M - 1$

c) $L + M$

d) $\text{Max}(L, M)$.

[Turn over

ii) In the context of sampling with sampling interval T, the mapping between S and Z plane is

a) $Z = \exp(ST)$ b) $S = ZT$

c) $S = \exp(ZT)$ d) $Z = ST$.

iii) The inverse Z transform of $\frac{Z}{Z-1}$ is

a) $u(n)$ as well as $u(-n)$

b) $u(-n)$ but not $u(n)$

c) $u(n)$ as well as $u(-n-1)$

d) $u(n)$ but not $u(-n-1)$.

iv) In FFT, for calculating N-point DFT total number of complex addition required is

a) N^2 b) $(N-1)\log_2 N$

c) $\frac{N}{2}\log_2 2N$ d) $N\log_2 N$.

v) For a stable system, the impulse response $h(nT)$

a) is defined for $n \geq 0$ b) contains impulses

c) decays to zero d) is infinite in length.

vi) A control system has a Z transform ROC

a) within a circle b) outside a circle

c) on a circle d) through the plane.

vii) Chebyshev type I filter

a) is all pole filter

b) is all zero filter

c) contains both poles and zeros

d) contains either poles and zeros.

viii) FIR filter is of

a) non-recursive and non-linear type

b) non-recursive and linear type

c) recursive and non-linear type

d) recursive and linear type.

ix) If Fourier transform of $x(n)$ is $X[\omega]$, the Fourier transform of $n \times (n)$ is

a) $-j\frac{dX[\omega]}{d\omega}$ b) $\frac{dX[\omega]}{d\omega}$

c) $j\frac{dX[\omega]}{d\omega}$ d) none of these.

x) Zero padding is a signal, if it

a) reduces aliasing

b) increases time resolution

c) increases frequency resolution

d) has no effect.

[Turn over

xi) The system having input $x(n)$ related to output $y(n) = \log_{10} |x(n)|$ is

a) non-linear, causal, BIBO stable

b) linear, non-causal, BIBO stable

c) linear, non-causal, BIBO unstable

d) non-linear, causal, BIBO unstable.

xii) Impulse invariant method of digital filter design can be used to design

a) low-pass filter b) high-pass filter

c) any type of filter d) FIR filter.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Determine whether or not $x(n)$ is periodic. If periodic, determine its fundamental period : $x(n) = \cos\frac{\pi}{3}n + \cos\frac{3\pi}{4}n$.

3. What are the different methods available to find out inverse Z transform of a sequence ?

Determine the inverse Z transform of causal signal given by $X(Z) = \frac{1}{(1-2z^{-1})(1-z^{-1})^2}$.

Find the DFT of $x(n) = \{\underset{\uparrow}{1},1,2,2\}$.

Find out the impulse response of the system described by given differential equation using Z transform.

$$y(n) - 0 \cdot 7y(n-1) + 0 \cdot 12y(n-2) = x(n-1) + x(n-2)$$

For the function $x_1(n)$ and $x_2(n)$ compute $y(n) = x_1(n) * x_2(n)$ using graphical method :

$$x_1(n) = \delta(n) + \delta(n-1) - \delta(n-2) - \delta(n-3)$$

$$x_2(n) = \delta(n) - \delta(n-2) + \delta(n-4).$$

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

a) Prove that an LTI system is BIBO stable if and only if the ROC of the system function includes the unit circle.

b) Determine the inverse Z transforms of

$$X(z) = \log(1 - 0 \cdot 5z^{-1}), |z| > 0 \cdot 5$$

c) Compute the circular convolution of the following two sequences using concentric circle method : $3 + 6 + 6$

$$x(n) = \{\underset{\uparrow}{1},2,3,-1,2\}, h(n) = \{\underset{\uparrow}{2},2,1\}$$

[Turn over

8. a) Find out the 8-point DFT of the following sequence

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

b) What do you mean by zero padding ?

c) Find the output $y(n)$ of a filter whose impulse response is $h(n) = \{\underset{\uparrow}{1},1,1\}$ and the input signal $x(n) = \{\underset{\uparrow}{3},-1,0,1,3,2,0,1,2,1\}$ using (i) Overlap-save method, (ii) Overlap-add method. 6 + 2 + 7

9. a) What is the difference between IIR and FIR filter ?

b) Explain Gibbs phenomenon in digital filter design. How can it be eliminated ?

c) Design a Butterworth filter the bilinear transformation for the specifications :

$0 \cdot 8 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq \omega \leq 0 \cdot 2\pi$

$\leq |H(e^{j\omega})| \leq 0 \cdot 2, \quad 0 \cdot 6\pi \leq \omega \leq \pi$ 3 + 4 + 8

10. a) Explain the bit reversal technique.

b) Find the DFT of a sequence

$x(n) = \{\underset{\uparrow}{1},2,3,4,4,3,2,1\}$ using DIT-FFT Algorithm.

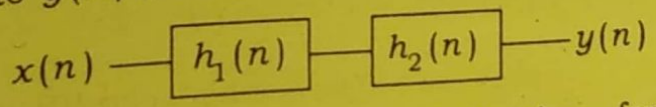
c) Write down the properties of ROC. 2 + 10 + 3

1. a) Determine whether the signal is energy or power signal : $x(n)=r(n)-r(n-4)$.

b) An interconnection of LTI systems is shown below. The impulse responses are

$$h_1(n)=\left(\frac{1}{2}\right)^n[u(n)-\delta(n)] \text{ and } h_2(n)=u(n-2).$$

Let the impulse response of the overall system from $x(n)$ to $y(n)$ be denoted as $h(n)$. Evaluate $h(n)$.



c) Obtain the cascade form realization for the system given by the difference equation

$$y(n)=-0\cdot1y(n-1)+0\cdot2y(n-2)+3x(n)+3\cdot6x(n-1)+0\cdot6x(n-2).$$

4 + 6 + 5

2. Write short notes on any *three* of the following : 3 × 5

a) Mapping of *S*-plane and *Z*-plane

b) Circular Convolution

c) Warping effect & Prewarping

d) Radix-2 DIT algorithm

e) Discrete LTI system

f) DSP TMS320C 5416 processor.

CS/B.Tech/Even/EIE/6th Sem/EI-605A/2014

2014

Digital Signal Processing

Time Alloted : 3 Hours *Full Marks : 70*

The figure in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP - A
(Multiple Choice Type Questions)

1. **Choose the correct alternatives for any ten of the following:** 10x1=10

i) It the length of two sequences is given by M and N respectively then the total length of the convoluted sum-

a) L-M+1

b) L+M-1

c) L+M+1

d) L-M-1

ii) During mapping of many points from s-plane to Z-plane aliasing occurs when the

a) Sample of two sinusoidal signals of frequencies which differ by a multiple of the sampling frequency

b) Sample of two sinusoidal signals of frequencies which differ by a even multiple of the sampling frequency

c) Sample of two sinusoidal signals of frequencies which differ by a odd multiple of the sampling frequency

d) None of the above

iii) For normal DFT calculations number of complex multiplication required

a) N

b) 2N

c) $2N^2$

d) N^2

iv) If the input and output sequence is M and N respectively then the total number of memory location required in direct form-II structure is-

a) MIN{M,N}

b) M+N-1

c) M+N

d) MAX {M,N}

v) The Z-transform of u(-n) is

a) $1/(1-Z^{-1})$

b) $Z/(1-Z)$

c) $1/(1-Z)$

d) $1/(Z-1)$

vi) The inverse Z transform of $\frac{1}{1-Z^{-1}}$

a) u(n) as well as u(-n)

b) u(-n) but not u(n)

c) u(n) as well as u(-n-1)

d) u(n) but not u(-n -1)

vii) If X (z) =Z {x(n)}, then Z {nx(n)} is equal to

a) $z\frac{d}{dz}X(z)$

b) $-z\frac{d}{dz}X(z)$

c) $z^{-1}\frac{d}{dz}X(z)$

d) $-z^{-1}\frac{d}{dz}X(z)$

viii) DFT [x(N-m)] is equal to

a) X(N-m)

b) X(N-k)

c) X(m-k)

d) X(m+k)

[7 ...er]

d) none of these

ix) To design a digital filter using Bilinear Transformation we have to substitute

a) $s = \frac{2}{T}\frac{z-1}{z+1}$

b) $s = 2T\frac{z-1}{z+1}$

c) $s = \frac{2}{T}\frac{z+1}{z-1}$

d) $s = \frac{1}{T}\frac{z-1}{z+1}$

x) During fft calculations using DIF algorithm-

a) Outputs are in bit reversal form

b) Inputs are taken in bit reversal form

c) Both input and outputs are taken in bit reversal form

d) None of this

xi) The system having input x(n) related to output $y(n)=\log_{10}|x(n)|$ is

a) non linear, causal. BIBO stable.

b) linear, non causal, BIBO stable.

c) linear, non causal, BIBO unstable.

d) non linear, causal, BIBO unstable.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following 3x5=15

stem response is given by: $y(n)=\sum_{k=0}^{m} a(k)x(n-k)+\sum_{k=1}^{n} b(k)y(n-k)$,
ck whether the system is LTI or not. 5

ch down some advantages and limitations of DSP. 4+1

d the inverse Z-Transform of $X(z)=\frac{z(z^2-3z+4)}{(z-4)(z-2)(z-1)}$

ROC $2<|Z|<4$. 4

ng the bilinear transformation find out the order of a high utterworth filter having passband with cutoff frequency of nd down 10dB at 350 Hz. The sampling frequency is 5 KHz. 5

ermine the direct form II structure for the given system. 5
)=0.3y(n-1)-0.5 y(n-2)+0.75 y(n-3)+0.25x(n-1)+0.55x(n).

[Turn ov

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3x15=

7. a) Prove that an LTI system is BIBO stable if and only if the R of the system function includes the unit circle.

   b) Find the z-transform and ROC of the signal for a>b & a<b

   $x(n) = a^n u(n) + b^n u(-n-1)$

   d) Using the residue method find inverse z transform

   $\frac{1 - 1/(4z)}{1 - 1/(9z)}$ ROC: $|Z| > 1/3$ 2+7

8. a) Find out the 8-point DFT of the following sequence

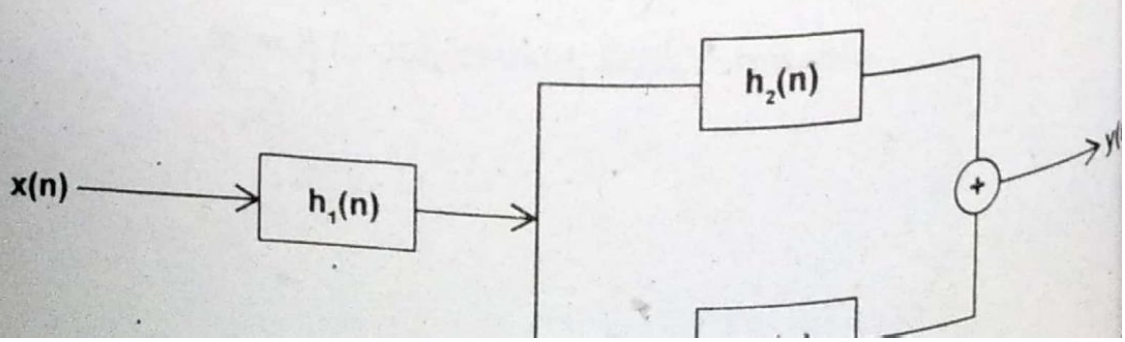
   x(n)={1,1,1,1,1,1,0,0}

   b) What is twiddle factor?

   c) Compute the N-point DFT for the function $\delta(n)$.

   d) Find the output y(n) of a filter whose impulse response h(n)={ 1,1,1} and the input signal x(n) = {3,-1,0,1,3.2,0,1,2,1} usi Overlap-add method. 5+2+2

9. a) An interconnection of LTI systems is shown below. T impulse responses are $h_1(n)=(1/2)^n[u(n)-u(n-4)]$; $h2(n)=\delta(n)$ a $h3(n)=u(n-2)$. Let the impulse response of the overall syst from x(n) to y(n) be denoted as h(n). Evaluate h(n).



MODEL QUESTION PAPI

CS/B.Tech/Even/EIE/6th Sem/EI-605A/2014

Design a Butterworth filter the bilinear transformation for the pecifications

$$0.8 \le \left|H(e^{j\omega})\right| \le 1, \quad 0 \le \omega \le 0.2\pi$$

$$\le \left|H(e^{j\omega})\right| \le 0.2, \quad 0.6\pi \le \omega \le \pi$$

Determine whether or not x(n) is periodic. If periodic, determine fundamental period:

$$x(n) = \cos\frac{\pi}{3}n + \cos\frac{3\pi}{4}n$$

Find the DPT of a sequence x(n) = {1,2,3,4,4,3,2,1} using DIT gorithm.

5+10

rite short notes on any three:- 3x5=15

a) Distinguish FIR and IIR filter.

b) Circular Convolution.

c) Warping effect & Prewarping.

d) Window technique in digital filter design

e) LTI System.