16/05/19

[F.T]

B. E. DEGREE EXAMINATION, April/May 2019.

College of Engineering, Anna University

Subject: EE8402 DIGITAL SIGNAL PROCESSING

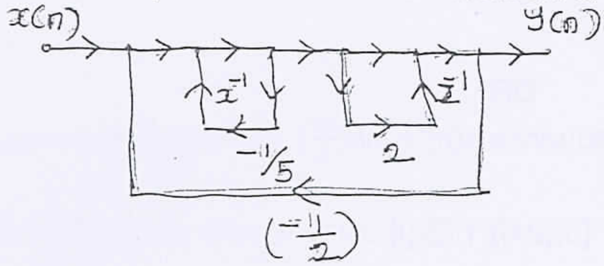
Branch: Electrical and Electronics Engineering; Regulation 2012

Time: Three hours   Answer ALL questions   Max.Marks : 100

PART – A   (10x2 = 20)

1. Determine whether y(n) = 2x(n)+3 is casual and linear.
2. Find the impulse response of the system described by the difference equation.
   y(n) = x(n)+2x(n-1)+x(n-2)
3. Sketch the unit sample response of a linear shift invariant system with $h(n) = a^n u(n)$ with |a|<1.
4. Find the Z transform of x(n) = u(n)
5. Find the discrete fourier series representation for the sequence
   $x(n) = \sum_{k=-\infty}^{\infty} x(n-10k)$ where x(n) = 1 $0 \le n < 5$
   0   else
6. Find $x(n) = x_1(n) * x_2(n)$ where $x_1(n) = x_2(n) = 1$ $0 \le n \le n-1$
   0 else

7. The system function of an FIR filter is $H(Z) = (1+0.2Z^{-1}+0.8Z^{-2})$. Find a linear phase system that has a frequency response with the same magnitude as that of H(Z).
8. Find the system function of the network shown in fig.



9. An analog butterworth filter is described by the transfer function $H(s) = \frac{1}{1+(\frac{s}{\Omega c})}$ Find the transfer function of the digital Butterworth filter with $\omega_c = 0.25\pi$ rad. (use impulse invariant technique).
10. Determine the order of the low-pass butterworth filter that has a 3.dB cut off frequency of 1kHZ and an attenuation of 40dB at 2kHZ.

PART – B (5x16 = 80)

11. a) (i)Test the stability of the first order IIR filter governed by the equation
$y(n) = x(n)+b\,y(n-1)$, $|b|<1$ (10)

(ii) Determine the unit step response of the I order difference equation.
$y(n) + ay(n-1) = x(n)$ $|a|<1$ (6)

12.(a) (i) Determine the Z-transform of

1) Sin ($\omega_0 n$) (5)

2) n u(n) (5)

(ii) Using residue method, find the inverse Z-transform of

$$X(z) = \frac{1}{(z-0.25)(z-0.5)} \quad \text{ROC} : |z|>0.5$$ (6)

OR

12(b) A causal system is represented by the following difference equation

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

Find (i) System transfer function H(z) (3)

(ii) Plot the poles and zeros (3)

(iii) Unit sample response (5)

(iii) Frequency response of the system (5)

13 (a) Using DFT and IDFT compute the circular periodic convolution of the two sequences.

$x_1(n) = \{1,1,2,2\}$

$x_2(n) = \{1,2,3,4\}$

OR

13(b) (i) Find the 4 point DFT of the sequence $x(n) = \sin(\frac{n\pi}{4})$ and sketch the magnitude and phase spectrum. (8)

(ii) Determine the IDFT of $X(k) = \{3,(2+j),1,(2-j)\}$ using 4 point decimation in time FFT technique. (8)

14.a) Using Decimation in frequency FFT algorithm compute DFT for $x(n) = \{1,0,0,0,0,0,0,0\}$

OR

14 b) Consider the causal linear shift invariant filter with system function.

$H(z) = \frac{1+0.875z^{-1}}{(1+0.2z^{-1}+0.9z^{-2})(1-0.7z^{-1})}$ Draw a signal flow graph for this system using

1. Direct form I (3)
2. Direct form II (3)
3. Cascade form (5)
4. Parallel form. (5)

15.a) Using frequency sampling technique design a linear phase low pass filter with the following specifications $\omega_c = \pi/4$ rad/sec. and N=15 and plot the magnitude response.

OR

15b) Design a digital FIR high pass filter with the following frequency response.

$H(e^{j\omega}) = 1$ for $\pi/4 \leq \omega \leq \pi$

$= 0$ for $|\omega| \leq \pi/4$ of length N=11 using Hanning window. Give the filter transfer function.