



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121657

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15
FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

Time : 3 Hours]

[Total Marks : 100

- 1 Attempt any FOUR parts 5×4=20
- (a) What are the differences between DFT and DTFT?
 - (b) Find the circular convolution of two sequences:
 $x(n)=\{1,2,2,1\}$ and $y(n) = \{1,2,3,1\}$ using matrix method.
 - (c) Realize the system given by difference equation
 $y(n) = -0.1 y(n-1) +0.72 y(n-2)+0.7 x(n)-0.252x(n-2)$
in parallel form.
 - (d) List the advantages of digital Signal Processing over Analog signal Processing.
 - (e) What are the differences between the Impulse invariant and bilinear response? Explain the importance of the poles in Butterworth and Chebyshev filters.
 - (f) How the product of two DFT's result in circular convolution ?

2 Attempt any TWO parts 10×2=20

- (a) Compute the circular convolution of the following sequences using DFT and IDFT

$$x(n) = \{1, 2, 3, 1\} \quad h(n) = \{4, 3, 2, 2\}$$

- (b) A certain discrete-time LTI filter has the following data

- (a) Poles are at 0.2 and 0.4
- (b) Zeros are at -0.4 and origin
- (c) Gain of filter is 0.5

Find the cascade form of realization.

- (c) Why DFT is preferred over Fourier transform? Explain with suitable example. What are the various properties of the DFT?

3 Attempt any TWO parts 10×2=20

- (a) Derive the signal to noise ratio of the A/D converters. Compare the truncation and rounding errors using fixed point and floating point representation.

- (b) What are the various sampling techniques are used in DSP ? How the reconstruction takes place? Explain them briefly.

- (c) Why discrete time processing of continuous time signals, continuous time processing of discrete time signals is required? Explain with suitable examples.

4 Attempt any TWO parts

10×2=20

- (a) A low pass filter is to be designed with the following desired frequency response

$$\begin{cases} e^{-j2\omega}, & -\pi/4 \leq \omega \leq \pi/4 \end{cases}$$

$$H_d(e^{j\omega}) = \begin{cases}$$

$$\begin{cases} 0, & \pi/4 < |\omega| \leq \pi \end{cases}$$

Find the filter coefficients $H_d(n)$ if the Window Function is defined as

$$\begin{cases} 1, & 0 \leq n \leq 4 \end{cases}$$

$$w(n) =$$

$$\begin{cases} 0, & \text{Otherwise} \end{cases}$$

- (b) Describe for the design of FIR filters. What are advantages and disadvantages of Kaiser Window method over other filters?
- (c) Design a digital Butterworth filter that satisfies the following constraint using bilinear Transformation.

Assume $T=1s$.

$$0.9 < |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq \pi/2$$

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

5 Attempt any TWO parts

$10 \times 2 = 20$

(a) Find DFT of the two sequence using only FFT flow graph $X_1(n) = \{1, 1, 1, 1\}$, $X_2(n) = \{2, 1, 2, 1\}$

(b) Find the DFT of the sample data sequence

$X(n) = \{1, 1, 2\}$ and compute the corresponding amplitude and phase spectrum.

(c) The Five samples of 9 point DFT are given as follows:

$X(0) = 23$, $X(1) = 2.242 - j$, $X(4) = -6.379 + j4.121$

$X(6) = 6.5 + j2.59$, $X(7) = -4.153 + j0.264$

Find the other four DFT's.
