

(b) DFT of a sequence $x(n)$ is given by $X(k) = \{6, 0, -2, 0\}$. Determine circular autocorrelation of $x(n)$ using DFT and IDFT.

(c) Find the circular convolutions of the two sequences $x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{1, 2, 3, 4\}$ using graphical method.

(d) State and prove that circular convolution property of DFT.

(e) Differentiate between Discrete time Fourier Transform (DTFT) and discrete Fourier transform (DFT) of a sequence.

(f) Find the linear convolution using circular convolution of the following sequences:

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

5. Attempt any two parts of the following : $2 \times 10 = 20$

(a) Compare the computational complexity of FFT algorithm with direct computation of DFT.

(b) Show that the output data is in bit reversed order for the DIF algorithm for $N = 8$.

(c) Derive the radix-2 DIT FFT algorithm for $N = 8$. Also compute the 8 point DFT of a sequence

$$x(n) = \{1/2, 1/2, 1/2, 1/2, 0, 0, 0, 0\}$$
 using DIT FFT Algorithm.

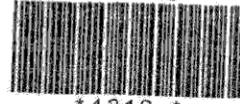
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EEC-602

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

PAPER ID : 131602

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B.Tech. (Semester-VI)

SPL. THEORY EXAMINATION, 2014-15

DIGITAL SIGNAL PROCESSING

Time : 3 Hours]

[Total Marks : 100

Note: Attempt all questions.

1. Attempt any two parts of the following: $2 \times 10 = 20$

(a) What are linear phase FIR filters? How can the symmetry of these filters help to simplify the network structure? A linear phase filter has the following unit sample response: $h(0) = -0.01$, $h(1) = -0.02$, $h(2) = -0.10$, $h(3) = 0.40$, $h(4) = -0.10$, $h(5) = 0.02$, $h(6) = -0.01$. Draw the signal flow graph for this system that requires the minimum number of multiplications.

(b) Determine and draw the cascade and parallel realizations for the system described by the function:

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(1)

[Contd...

$$H(z) = \frac{10 \left(1 - \frac{1}{2}z^{-1}\right) \left(1 - \frac{2}{3}z^{-1}\right) \left(1 - 2z^{-1}\right)}{\left(1 - \frac{3}{4}z^{-1}\right) \left(1 - \frac{1}{8}z^{-1}\right) \left(1 - z^{-1} + \frac{1}{2}z^{-1}\right)}$$

(c) Draw the direct form structures of the following system functions:

(i) $H_1(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 0.75z^{-1} + 0.125z^{-2}}$

(ii) $H_2(z) = 1 - 2.88z^{-1} + 3.404z^{-2} + 1.74z^{-3} + 0.4z^{-4}$

2. Attempt any four parts of the following : 4×5=20

(a) Design a filter for the following specifications:

- (i) Monotonic pass band and stop band
- (ii) -3.01 cutoff frequency of 0.5π
- (iii) Magnitude down at least 15 dB at 0.75π

(b) For the transfer function $H(s) = \frac{1}{s^2 + \sqrt{2}s + 1}$. Find

the corresponding system function $H(z)$ using bilinear transformation.

- (c) Explain frequency warping effect and pre-warping with respect to bilinear transformation.
- (d) Derive the parameters i.e. order N and cut off frequency Ω_c for a Chebyshev Filter.
- (e) Derive the mathematical expression for impulse invariant technique. Discuss its disadvantage and how it will be taken care of?
- (f) Describe the method to design IIR filters by approximation of derivatives.

3. Attempt any two parts of the following : 2×10=20

- (a) Design FIR low pass filter using rectangular window with pass band gain of unity, cutoff frequency of 200 Hz, sampling frequency of 1 KHz. Assume M = 7.
- (b) Briefly explain the frequency sampling method of designing FIR filter. An FIR filter has the following in the impulse response: $h(n) = h(M - 1 - n)$ or M odd. Derive its frequency response and show that it has linear phase.
- (c) What do you mean by Gibb's phenomenon? What is the cause of Gibb's phenomenon? How can it be minimized?

4. Attempt any four parts of the following : 4×5=20

- (a) Obtain 4-Point DFT for the sequence $x(n) = u(n) - u(n - N)$.