USN | | | | | | | | | | 10EE64

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Perform circular convolution of two sequences using DFT & IDFT method. **(12 Marks)**
$x_1(n) = (1, 1, 2, 1)$ and $x_2(n) = (1, 2, 3, 4)$.

b. Find the DFT of the sequence
$x(n) = 1$ for $0 \le n \le 2$
0 otherwise
For N = 8. Plot magnitude and Phase spectrum of X(k). **(08 Marks)**

2 a. 14 – point DFT of 14 real time sequences is X(k). The first 8 samples of X(k) are given by $X(0) = 12$, $X(1) = -1 + j3$, $X(2) = 3 + j4$, $X(3) = 1 - j5$, $X(4) = -2 + j2$, $X(5) = 6 + j3$, $X(6) = -2 - j3$, $X(7) = 10$. Find the remaining samples of X(k). Also find $\sum_{n=0}^{7} |x(n)|^2$. **(05 Marks)**

b. Compare Linear convolution with circular convolution. **(03 Marks)**

c. Compute y(n) of a FIR filter with impulse response h(n) = (3, 2, 1) and x(n) = (2, 1, -1, -2, -3, 5, 6, -1, 2, 0,2, 1). Use only 8 – point circular convolution in your approach. Compare the result by solving problem using i) Overlap Save method ii) Overlap Add method. **(12 Marks)**

3 a. What are FFT Algorithms? Show comparison between DIT, DIF – FFT Algorithms. **(08 Marks)**

b. Compute 8 – point DFT of the sequence x(n). Using DIT & DIF – FFT Algorithms.
x(n) = (1, 1, 1, 1, 1, 1, 1, 1). **(12 Marks)**

4 a. Calculate the number of multiplications needed in the calculation of DFT & FFT with N = 4, 16, 64, 256 and also find the speed improvement factor. **(12 Marks)**

b. Compute IDFT of the sequence X(k).
X(k) = {4, 1 - j2.414, 0, 1 - j0.414, 0, 1 + j0.414, 0, 1 + j2.414}. **(08 Marks)**

PART – B

5 a. Compare Digital filter with analog filter. Also explain advantages and disadvantages of digital filter. **(08 Marks)**

b. For the given specifications $\alpha_p = 3dB$, $\alpha_s = 16dB$, $f_p = 1KHz$, $f_s = 2KHz$. Determine the order of the filter using Chebyshev type – I approximation. Find H(s). **(08 Marks)**

c. For the given specification $\alpha_p = 1dB$, $\alpha_s = 30dB$, $\Omega_p = 200$ rad/sec , $\Omega_s = 600$ rad/sec. Determine the order of low pass butterworth filter. **(04 Marks)**

6 a. Explain the transforming of an analog normalized low pass filter into analog high pass, band pass and band reject filter using frequency transformation methods. **(08 Marks)**

b. Using Bilinear transformation design a high pass filter, monotonic in passband with cutoff frequency of 1000Hz at $\alpha_p = 3dB$ and down to 10dB at 350Hz. The sampling frequency is 5000Hz. **(12 Marks)**

7 a. Explain the design of FIR filters using windows. **(10 Marks)**

b. Design a filter with

$$H_d(e^{jw}) = e^{-j3w} \quad ; \quad -\pi/4 \le w \le \pi/4.$$

$$= 0 \quad ; \quad \pi/4 < |w| \le \pi.$$

Using Hamming window with N = 7. **(10 Marks)**

8 a. Obtain Direct form – I , Direct form – II , Cascade and Parallel form realization for the system $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$. **(14 Marks)**

b. Realize the system in Parallel form :
$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$. **(06 Marks)**

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