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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 $0 \leq n \leq 2$,
 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 $\alpha_p = 3\text{dB}$, $\alpha_s = 16\text{dB}$, $f_p = 1\text{KHz}$, $f_s = 2\text{KHz}$. Determine the order of the filter using Chebyshev type – I approximation. Find $H(s)$. (08 Marks)
 c. For the given specification $\alpha_p = 1\text{dB}$, $\alpha_s = 30\text{dB}$, $\Omega_p = 200 \text{ rad/sec}$, $\Omega_s = 600 \text{ rad/sec}$. 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 $\alpha_p = 3\text{dB}$ 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

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

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

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)
