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06EE64

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. The sequence x(n) is given by $x(n) = \delta(n) + \delta(n-1) - 2\delta(n-5) + 5\delta(n-7)$. Find the DFT of sequence x(n). Plot its magnitude and phase angle. **(08 Marks)**

b. Find IDFT of the sequence given below:

$X(k) = 3; \quad k = 0$

$1; \quad k = 1, 2.....9$ **(04 Marks)**

c. State and prove property of symmetry. **(04 Marks)**

d. State and prove circular frequency shift. **(04 Marks)**

2 a. Obtain the linear convolved output $y(n) = x(n) * h(n)$ using circular convolution. Given that, $x(n) = \{1, 1, 0, -1, -1\}$ and $h(n) = \{1, 2, 3, 2, 1\}$. **(06 Marks)**

b. Find the output of LTI system whose impulse response, $h(n) = \{1, 1, 1\}$ and input signal, $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, ...\}$ using overlap add method. Use block length, N = 5. **(14 Marks)**

3 a. If $x(n) = \{1, 2, 3, 4, 1, 2, 2, 1\}$. Compute DFT of x(n) using DIF-FFT algorithm. **(10 Marks)**

b. Find the sequence x(n) corresponding to the 8-point DFT, $X(K) = \{4, 1 - j2.41, 0, 1 - j0.414, 0, 1 + j0.414, 0, 1 + j2.414\}$ by using any of the Radix 2 FFT algorithms to compute the IDFT. **(10 Marks)**

4 a. A linear time-invariant digital IIR filter is specified by the following transfer function $H(Z) = \dfrac{(z-1)(z-2)(z+1)z}{(z-0.5-j0.5)(z-0.5+j0.5)(z-j0.25)(z+j0.25)}$. Realize direct form I and II structure. **(06 Marks)**

b. Obtain a parallel realization for the transfer function given below:

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z-0.25)(z^2 - z + 0.5)}.$$ **(08 Marks)**

c. Realize the linear-phase FIR filter having the following impulse response:

$$h(n) = \delta(n) - \frac{1}{4}\delta(n-1) + \frac{1}{2}\delta(n-2) + \frac{1}{2}\delta(n-3) - \frac{1}{4}\delta(n-4) + \delta(n-5).$$ **(06 Marks)**

PART – B

5 a. Explain the frequency transformation technique to transform a normalized low pass filter to lowpass, band pass and band reject filters. **(08 Marks)**

b. Design a lowpass Chebyshev filter to satisfy the following specifications :

i) Acceptable pass band ripple of 2 dB at a cut off frequency of 40 rad /sec

ii) Stop band ripple of 20 dB or more at 52 rad/ sec. **(12 Marks)**

6 a. Explain BILINEAR TRANSFORMATION. **(08 Marks)**

b. A digital low pass filter is required to meet the following specifications :

i) $20 \log_{10} | H(w) | w = 0.2\pi \geq - 1.9328$ dB

ii) $20 \log_{10} | H(w) | w = 0.6\pi \leq - 13.9794$ dB

Filter must have maximally flat frequency response. Find H(z), using impulse invariant transformation. **(12 Marks)**

7 a. A low pass FIR filter is to be designed with the following desired frequency transformation methods.

$$H_d(e^{jw}) = \begin{cases} e^{-j2w}, & -\pi/4 \leq w \leq \pi/4 \\ 0, & \pi/4 < |w| \leq \pi \end{cases}$$

Determine the filter co-efficient $h_d(n)$ if the window co-efficient are defined as

$$w(n) = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

Also determine the frequency response $H(e^{jw})$ of the designed filter. **(12 Marks)**

b. Explain the design procedure of FIR filters, using windows concept. **(08 Marks)**

8 a. Realize FIR filter for given h(n) using frequency sampling technique. h(n) = {1, 1, 0.5, 1, 1}. **(10 Marks)**

b. Draw and explain briefly the architecture of TMS320C5X family DSP processor. **(10 Marks)**

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