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06EE64

Sixth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least 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. State and explain circular convolution property of DFT. **(08 Marks)**

b. Given $x(n) = \left(\frac{1}{2}\right)^n [u(n) - u(n-1)]$. Find Q(n) without computing DFT,

if $Q(n) = W_4^{2k}\, x(k)$ **(04 Marks)**

c. Given $x(n) = n + 1;\ 0 \le n \le 9$ and $h(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2)$. Determine output y(n) of LTI system using overlap Add method. Use 6 point circular convolution. **(08 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. Realize a linear phase FIR filter having impulse response

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

b. Give the direct form II realization of

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z - \frac{1}{4})(z^2 - z + \frac{1}{2})}$$ **(06 Marks)**

c. Realize $H(z) = \dfrac{(z-1)(z+1)(z-2)z}{(z - \frac{1}{2} + j\frac{1}{2})(z - \frac{1}{2} - j\frac{1}{2})(z - j/4)(z + j/4)}$ in parallel form. **(08 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. Obtain transfer function of IIR digital filter from given H(s) using impulse invariance method for frequency of 5 samples/sec.

$$H(s) = \frac{1}{(s+1)(s+2)}$$ **(06 Marks)**

b. Determine H(z) of a IIR filter using bilinear transformation for the given specification of analog Butterworth filter (monotonic pass band and stop band).

$A_P = -3dB$; $f_P = 500$ Hz
$A_S = -15dB$; $f_S = 750$ Hz
and $f = 2000$ samples/sec **(14 Marks)**

7 a. Given $H_d(e^{-j\omega}) = \begin{cases} e^{-j\omega T} & \text{for } -\omega_c \le |\omega| \le \omega_c \\ 0\ ; & \text{otherwise} \end{cases}$.

Find $H(e^{j\omega})$ and obtain $h_d(n)$ of FIR filter for M = 7 and ω_c = 1 rad/sample of symmetric filter using rectangular window. **(14 Marks)**

b. What are the advantages and disadvantages of FIR filters? **(06 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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