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06EE64

Sixth Semester B.E. Degree Examination, June-July 2009
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Determine DFT of the sequence x (n) = {1, 1, 2, 2, 3, 3}. Draw magnitude and phase plots. **(10 Marks)**

b. A discrete time LTI system has impulse response h (n) = 2δ (n) - δ (n – 1). Determine the output of the system if the input is x (n) = {δ (n) + 3 δ (n-1) + 2δ (n-2) - δ (n-3) + δ (n-4)} using circular convolution. **(05 Marks)**

c. g(n) and h (n) are the two sequences of length 6, with 6pt DFT's G (k) Δ H (k) respectively. The sequence g (n) = {4, 3, 1, 5, 2, 6}. The DFT's are related by circular frequency shift as $H(k) = G((k-3))_6$. Determine h (n) without computing DFT and IDFT. **(05 Marks)**

2 a. The six samples of the 11 point DFT x (k) of a real sequence x (n) of length 11 are: x (0) = 12, x (2) = -3.2 – J2, x(3) = 5.3 – J4.1, x(5) = 6.5 + j9 x(7) = -4.1 + j0.2 and x(10) = -3.1 + j5.2. Determine the remaining 5 DFT samples. **(06 Marks)**

b. Using overlap add method, determine output y(n) of a filter whose impulse response in h(n) = {1, 1, 1} and input x(n) = {3, -1, 0, 1, 3, 2, 0, 1, 2, 1}. Use 6 point circular convolution. **(14 Marks)**

3 a. Given x(n) = {1, 2, 3, 4, 4, 3, 2, 1}. Find x(k) using DIF – FFT algorithm. Draw signal flow graph. **(12 Marks)**

b. Develop DIT – FFT algorithm for composite value of N = 6. Draw the corresponding signal flow graph. **(08 Marks)**

4 a. Draw the direct form I and II realizations of a system with transfer function.

$$H(z) = \frac{0.28z^2 + 0.319z + 0.04}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}.$$ **(06 Marks)**

b. Obtain the cascade and parallel realizations for the system function given by

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{\left(1 + \frac{1}{2}z^{-1}\right)\left(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}\right)}.$$ **(14 Marks)**

PART – B

5 a. Design a Butterworth analog high pass filter with the specifications: Pass band gain of kp = -2dB at pass band edge frequency Ωp = 200 rad/sec and stop band gain of Ks = - 20dB at stop band edge frequency Ωs = 100 rad/sec. **(10 Marks)**

b. Design a chebyshev analog low pass filter that has a -3dB cut off frequency of 100 rad/sec and a stop band attenuation of 25dB or greater for all radian frequencies past 250 rad/sec. **(10 Marks)**

6 a. Explain Impulse Invariant Transformation method of transforming an analog filter to digital filter. (08 Marks)

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

$20 \log |H(w)|_{w=0.2\pi} \geq -1.9328$ dB

$20 \log |H(w)|_{w=0.6\pi} \leq -13.9794$ dB.

The filter must have a maximally flat frequency response. Find H(z) to meet the above specifications using impulse invariant transformation. (12 Marks)

7 a. Design a Low pass FIR filter with desired frequency response $Hd(w) = \begin{cases} 1e^{-j2w} & |00| \leq \pi/4 \\ 0 & \frac{\pi}{4} \leq |w| \leq \pi \end{cases}$. Use rectangular window with N = 5. (10 Marks)

b. The frequency response of an FIR filter is given by $H(w) = e^{-j3w}(1 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w)$. Determine the coefficients of the impulse response h(n) of the FIR filter. (10 Marks)

8 a. The desired frequency response of a low pass filter is $Hd(w) = \begin{cases} e^{-j3w} & 0 \leq w \leq \pi/2 \\ 0 & \pi/2 \leq w < \pi \end{cases}$. Design the filter for N = 7, using frequency sampling technique. (12 Marks)

b. Draw the architecture of TMS 320C5x family of DSP processors and explain. (08 Marks)

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