EE55

USN

NEW SCHEME

Fifth Semester B.E. Degree Examination, Dec.06/Jan. 07
Electrical and Electronics Engineering
Digital Signal Processing

Time: 3 hrs.] [Max. Marks:100

Note: ***Answer any FIVE questions.***

1 a. Determine 8 point DFT of the sequence $x(n) = \{1, 1, 1, 1\}$. Sketch its magnitude and phase spectra. **(10 Marks)**

b. Find 'N' point DFT of the sequence $x(n) = e^{j\omega nn}$. $0 \le n \le N-1$. **(05 Marks)**

c. 5 samples of the 8 point DFT X(K) are X(O) = 0.25, X(1) = 0.125 − j 0.3018, X(6) = X(4) = 0, X(5) = 0.125 − j 0.0518. **(05 Marks)**
Determine the remaining samples, if the sequence x(n) is real valued sequence.

2 a. g(n) and h(n) are two sequences of length 6. They have 6 point DFT's G(k) and H(k) respectively. G(n) = { 4.1, 3.5, 1.2, 5, 2, 3.3 }
The DFT's G(k) and H(k) are related by circular frequency shift as $H(k) = G((k-3))_6$.
Determine h(n) without computing IDFT. **(08 Marks)**

b. A long sequence x(n) is filtered through a filter of impulse response h(n) to give output y(n). Compute y(n) using overlap add technique. Given x(n) and h(n)as follows
x(n) = { 1,2, 0, -3, 4, 2, -1, 1, -2, 3, 2, 1, -3 }
h(n) = { 1, 1, 1 }. Use 6 point circular convolution. **(12 Marks)**

3 a. Given x(n) = n+1 and N = 8, determine x(k) using DIF – FFT algorithm. Mark all intermediate outputs and write all necessary equations. **(10 Marks)**

b. Derive and draw the complete decimation – in time (DIT) signal flow graph to compute DFT of a 6 point sequence. Mark all intermediate outputs and write corresponding computations. **(10 Marks)**

4 a. Realize the system function H(Z) in cascade and parallel form.

$$H(Z) = \frac{(Z-1)(Z-2)(Z+1)Z}{\left[Z-\left(\frac{1}{2}+\frac{j}{2}\right)\right]\left[Z-\left(\frac{1}{2}-\frac{j}{2}\right)\right]\left[Z-\frac{j}{4}\right]\left[Z+\frac{j}{4}\right]}$$ **(14 Marks)**

b. Realize the FIR filter having impulse response

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

Use minimum number of multipliers. **(06 Marks)**

5 a. Design a Butterworth analog highpass filter that will meet the following specifications : i) maximum pass band attenuation = 2dB
ii) Pass band edge frequency = 200 rad/sec.
iii) Minimum stop band attenuation = 20dB
iv) Stop band edge frequency = 100 rad/sec. **(10 Marks)**

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b. Determine the system function H(z) of the lowest order chebyshev filter that meets the following specifications.

   i) 3 dB ripple in the pass band $0 \le |W| \le 0.3\pi$.

   ii) At least 20 dB attenuation in the stop band $0.6\pi \le W \le \pi$.

Use Bilinear transformation. **(10 Marks)**

6 a. Explain Impulse Invariant Transformation. **(08 Marks)**

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

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

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

Filter must have a maximally flat frequency response. Find H(Z) using Impulse invariant transformation. **(12 Marks)**

7 a. A filter is to be designed with the following desired frequency response.

$$H_d(w) = 0 \quad -\frac{\pi}{4} < w < \frac{\pi}{4}$$

$$= e^{-j2w} \quad \frac{\pi}{4} < w < \pi$$

Find the frequency response of the FIR filter designed using rectangular window.

$W_R(n) = 1 \quad 0 \le n \le 4$

$= 0 \quad$ otherwise. **(10 Marks)**

b. A low pass filter has the desired frequency response

$Hd(w) = Hd(e^{jw}) = e^{-j3w} \quad 0 < w < \pi/2$

$= 0 \quad \pi/2 < w < \pi$.

Determine h(n) based on frequency sampling technique, Use N = 7. **(10 Marks)**

8 Write notes on :

a. DSP architecture (TMS 320 c5 × processes) **(08 Marks)**

b. Advantages and disadvantages of frequency sampling design. **(06 Marks)**

c. Advantages and disadvantages of IIR and FIR filters. **(06 Marks)**

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