2002 SCHEME

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EC52

Fifth Semester B.E. Degree Examination, June 2012
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Define DFT of a sequence x(n) and if x(n) $\leftrightarrow$ x(k), for a real valued sequence prove that x(k) = x* (N – k). **(06 Marks)**

b. Check if the sequence is even, or odd and state if the DFT is real, imaginary or complex.
i) {1,1,1,0,0,0,1,1}
ii) {1,1,0,0,0,0,-1,-1}
iii) {0,1,1,0,0,0,-1,-1}. **(06 Marks)**

c. Compute the IDFT of the sequence {2, 1+j, 0, 1-j}. **(08 Marks)**

2 a. Consider a sequence x(n) = {1 2 0 3 -2 4 7 5} with DFT X(K). Evaluate the following functions without evaluating the DFT
i) X(0)
ii) X(4)
iii) $\sum_{k=0}^{7} e^{-j\frac{2\pi}{4}k} x(k)$
iv) $\sum_{k=0}^{7} |x(k)|^2$ **(10 Marks)**

b. Consider the sequence x(n) = δ(n) + 2 δ(n – 2) + δ(n – 3).
i) If y(n) is the 4 point circular convolution of x(n) with itself find y(n) and the 4 point DFT of y(k).
ii) With h(n) = δ(n) + δ(n – 1) + 2 δ (n – 3) find the 4 point circular convolution of x(n) and h(n). **(10 Marks)**

3 a. Derive the relationship between Z transform and DFT. **(05 Marks)**

b. If $x(n) = \begin{cases} 1, & 0 \le n \le 5 \\ 0, & \text{elsewhere} \end{cases}$

and x(z) its z transform. If x(z) is sampled at $Z = e^{j\left(\frac{2\pi}{4}\right)k}$ $0 \le k \le 3$. Sketch y(n) obtained as IDFT of x(k). **(07 Marks)**

c. Find the 4 point DFT's of the two sequences using a single 4 point DFT x(n) = {1, 2, 0, 1} h(n) = {2, 2, 1, 1}. **(08 Marks)**

4 a. Determine the 8 point DIT FFT for a continuous signal x(t) = Sin 2 π ft with f = 50 Hz. Draw the signal flow graph indicating x(n), intermediate values and x(k). **(10 Marks)**

b. Develop the 8 point DIF radix – 2 FFT algorithm to find the DFT of a sequence x(n). **(10 Marks)**

5 a. What is bilinear transformation? Obtain the transformation formula for the bilinear transformation. **(10 Marks)**

b. The system function of the analog filter is given as $H_a(s) = \dfrac{s+0.1}{(s+0.1)^2+16}$ obtain the system function of the digital filter using bilinear transformation which is resonant at $w_r = \pi/2$. **(06 Marks)**

c. What are the drawbacks of the backward difference method? **(04 Marks)**

6 a. Determine the system function H(z) using Chebyshev filter that meets the following specifications :

3dB ripple in the PB $0 \le |w| \le 0.3\,\pi$.

At least 20 dB attenuation in the SB $0.6\pi \le |w| \le \pi$ use bilinear transformation. **(15 Marks)**

b. Explain the impulse invariance method of design of a digital filter. **(05 Marks)**

7 a. List the differences between IIR and FIR filters. **(05 Marks)**

b. The desired response of a lowpass filter is $Hd(e^{jw}) = \begin{cases} e^{-j3w}, & -3\pi/4 \le w \le 3\pi/4 \\ 0, & 3\pi/4 < |w| < \pi \end{cases}$ determine $H(e^{jw})$ for N = 7 using Hamming window. **(15 Marks)**

8 a. Obtain the direct form and cascade form realizations for the transfer function $H(z) = \left(1 - \frac{1}{4}z^{-1} + \frac{3}{8}z^{-2}\right)\left(1 - \frac{1}{8}z^{-1} - \frac{1}{2}z^{-2}\right)$. **(06 Marks)**

b. Obtain the cascade and parallel realization for the system function $H(z) = \dfrac{1 + \frac{1}{4}z^{-1}}{\left(1 + \frac{1}{2}z^{-1}\right)\left(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}\right)}$. **(08 Marks)**

c. Realize an FIR filter with impulse response h(n) given by $h(n) = \left(\frac{1}{2}\right)^n [u(n) - u(n-4)]$ using direct form I. **(06 Marks)**

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