SVKM's NMIMS

MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B. Tech (Computer) Year: III Semester: V
Batch : **2013-2014**

Academic Year: 2013-2014

Subject : **Digital Signal Processing**

Date : 10/06/2014

Marks: 100
Time: 10.00 am to 1.00 pm
Durations: 3 (hrs)

Re-Examination

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

1. Question No. 1 is compulsory.
2. Out of remaining questions, attempt any 4 questions.
3. In all 5 questions to be attempted.
4. All questions carry equal marks.
5. Answer to each new question to be started on a fresh page.
6. Figures in brackets on the right hand side indicate full marks.

Q1 Attempt any four (5 marks each)

(a) Describe Classification of various discrete time signals along with examples of each.

(b) Classify and prove whether the following systems are linear or non-linear and time variant or time invariant.

(i) $Y(n)= x^2(n)$

(ii) $Y(n)= x(n^2)$

(iii) $Y(n)= 2x(n)+1$

(iv) $Y(n)= nx(n)$

(c) Explain Region of convergence and Give properties of ROC of Z transform.

(d) Explain IIR filters have recursive realization always,

(e) Determine cross correlation of the following sequence.
$x[n] = \{1, 0, 0, 1\}$, $h[n] = \{4, 3, 2, 1\}$

(f) Explain Gibbs phenomenon and frequency warping effect with respect to Digital filters.

Q2 (a) Compute the output y(n) of a filter using overlap add method ,with impulse response $h(n)= \delta(n)+2\delta(n-1)+ 2\delta(n-2)$ and $x(n) =[6,4,1,4,2,6,4,3,6,4,1]$ 10

(b) Explain Causality and Stability for a LTI system. State conditions for Causality and stability in terms of Z transform along with suitable examples. 10

Q3 (a) The impulse response of a system is given as – 10

$$h(n) = \left(\frac{1}{8}\right)^n u(n) + \left(-\frac{1}{5}\right)^n u(n-1)$$

I. Solve for H(z) along with ROC

II. Comment on the system as causal, FIR/IIR and BIBO Stable

III. Draw a parallel realization of the system

(b) Compute circular convolution for the given sequences using graphical method, x(n) = [1,2,1,1] and h(n) = [1,1,2,1].Also find Linear convolution using circular convolution. 10

Q4 (a) Find the eight point DFT of the sequence, x(n) = [1,1,1,1,0,0,0,0], Use DIF FFT flow graph. 10

(b) Using the results derived in (a) and applying DFT properties compute : 10

I. $x1[n] = [1,0,0,0,0,1,1,1]$

II. $x2[n] = [0,0,1,1,1,1,0,0]$

III. $x3[n] = [1,0,-1,-1,-1,0,1,1]$

Q5 (a) Explain the steps involved in designing a butterworth IIR filter and Discuss Bilinear Transformation method. 10

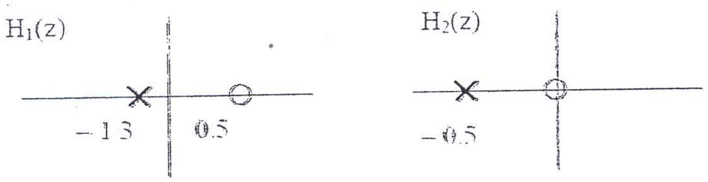
(b) Draw the cascade and lattice structure realization of the given FIR filter: 10

$y(n) = x(n)+ 2.5\, x(n-1)- 0.5x(n-2)+ 0.75x(n-3)$

Q6 (a) Design an ideal differentiator with frequency response $H(e^{jw}) = jw$; $-\pi \leq w \leq \pi$, using a Hamming Window. (assume N=8). 10

(b) Design a second order low pass butterworth filter using impulse invariant technique. Given 3dB cut off frequency = 50Hz and sampling frequency 500 samples/sec. 10

Q7 (a) A causal DT system has transfer function H(z) such that $H(z) = H_1(z)\, H_2(z)$. 10
The pole-zero diagram of H1(z) and H2 (z) is as follows :-



(i) Find the transfer function of total system.
(ii) Find difference equation of system.
(iii) Find the response of the system to the input $x(n) = (-1/2)^n\, u(n)$.
(iv) What is magnitude and phase response of the system at $w = 0$ and $w = \pi$.

(b) State and Prove any four properties of Discrete Fourier Transform. 10

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