B. Tech Degree VI Semester (Combined) Examination June 2006

CS/EC/EI/EE 601 DIGITAL SIGNAL PROCESSING

(Prior to 2002 Admissions)

Time : 3 Hours | Maximum Marks : 100

(All questions carry __EQUAL__ marks)

I. (a) Consider a system with unit sample response.

$$h(n) = \begin{cases} a^n; n \geq 0 \\ 0; n < 0 \end{cases}$$

Find the response to an input $x(n) = u(n) - u(n-N)$

(b) Explain the following for z transforms

(i) Region of convergence (ii) Linearity
(iii) Shift of a sequence (iv) Initial value theorem
(v) Convolution of sequence

OR

II. (a) Consider a system described by the difference equation $y(n) = y(n-1) - y(n-2) + 0.5x(n) + 0.5x(n-1)$. Find the response of this system to the input $x(n) = (0.5)^n u(n)$ with initial conditions $y(-1) = 0.75 \ and \ y(-2) = 0.25$.

(b) Find the Z-transform of the sequence $y(n)$ where $y(n) = \sum_{K=-n}^{n} \alpha^{1K1}, n \geq 0$ and $y(n=0)$ for $n < 0$; Assume $1\alpha 1 < 1$.

III. (a) Find the N-Point DFT of the sequence $x(n) = \cos(nwo); 0 \leq n \leq N-1$. Compare the values of the DFT coefficients $X(K)$ when $W_o = 2\pi K_o / N$ to those when $W_o \neq 2\pi K_o / N$.

(b) Explain the decimation in time FFT algorithm using butterfly computation.

OR

IV. (a) Find the 10-point inverse DFT of

$$X(K) = \begin{cases} 3 \ ; \ K = 0 \\ 1 \ ; \ 1 \leq K \leq 9 \end{cases}$$

(b) Derive a radix-3 decimation in frequency FFT for $N = 3^v$ and draw the corresponding flow graph $N = 9$.

(Turn Over)

(b) The unit sample response of an FIR filter is

$$h(n)=\begin{cases} a^n; 0\le n\le 6 \\ 0;\ \text{otherwise}\end{cases}$$

(i) Draw the direct form implementation of the above system.

(ii) Show that the corresponding system function is $H(z)=\frac{1-\alpha^7 z^{-7}}{1-\alpha z^{-1}};\ |z|>0$

OR

VI. (a) Compare IIR and FIR filters.

(b) Let $A(z)$ be and FIR filter with lattice filter coefficients $\lceil 1=\frac{1}{3}, \lceil 2=\frac{1}{3}, \lceil 3=1$

(i) Find the zeros of the system function $A(z)$.

(ii) Repeat for the case where $\lceil 3=-1$

VII. (a) Explain the cascade and parallel structures of an IIR system.

(b) Design a low pass Butterworth filter that has a 3 dB cut off frequency 06 1.5KHZ and an attenuation 06 40 dB at 3.0KHZ.

OR

VIII. (a) Design a Chebyschev high pass filter with an equiripple pass band with

$0\le\left|H\left(e^{jw}\right)\right|\le 0.1; 0\le w\le 0.\pi$ and

$0.9\le\left|H\left(e^{jw}\right)\right|\le 1.0;\ 0.3\pi\le w\le\pi$ using bilinear transformation.

(b) Explain the butter worth approximation and Chebyshevs approximation of IIR filters.

IX. (a) Express the fractions $\frac{7}{32}$ & $\frac{-7}{32}$ in sign magnitude, one's complement, two's complement notation using 6 bits.

(b) Explain the signal processor architecture with neat diagram along with an example.

OR

X. (a) Sketch neatly a programmable digital processor and explain along with common example.

(b) Explain the quantization error in fixed point number system and quantization of filter coefficients.

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