B. Tech Degree VI Semester Examination, April 2009

CS/EE 602 DIGITAL SIGNAL PROCESSING

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART – A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) Determine if the system described by the following input-output equations are linear or non liner.

(i) $y(n)=x(n)+\dfrac{1}{x(n-1)}$

(ii) $y(n)=x^2(n)$.

(b) Define Z-Transform and list the properties of Region of Convergence.

(c) Prove if $X_3(k)=X_1(k)X_2(k)$, then $x_3(n)=\sum_{M=0}^{N-1} x_{1(m)}\; x_2\left[(n-m)\right]_N$.

(d) What is meant by 'in-Place' in DIT and DIF algorithms? Draw the basic butterfly diagram for DIT and DIF algorithms.

(e) Compare FIR and IIR filters.

(f) Explain the need for employing window technique for FIR filter design.

(g) Explain zero-input limit cycle oscillations with an example.

(h) Explain the data addressing modes of TMS 320C54X fixed point processor.

PART – B

(4 x 15 = 60)

II. (a) Find the inverse Z-transform of $X_{(z)}=\log\left(1-0.5z^{-1}\right);|z|>0.5,$ using differentiation property. (6)

(b) Determine the unit step response of the system whose difference equation is $y(n)-0.7y(n-1)+0.12y(n-2)=x(n-1)+x(n-2)$ if $y(-1)=y(-2)=1$. (9)

OR

III. (a) Explain the classification of discrete time signals. (5)

(b) Find the discrete convolution of the two signals $x(n)=e^{-n^2}$ and $h(n)=3n^2$. (10)

IV. (a) Explain any five properties of DFT. (10)

(b) Compute the DFT of a sequence $(-1)^n$ for $N=4$. (5)

OR

V. (a) Compute the IDFT of the sequence using DIF algorithm.

$$X_{(k)}=\{4,1-j2.414,0,1-j0.414,0,1+j0.414,0,1+j2.414\}$$ (12)

(b) Explain Bit-reversal. (3)

(Turn Over)

VI. (a) What are the different types of window sequences used in FIR filter design? Give the functional representation of each window. (8)

(b) Realize the following system function using minimum number of multipliers.

(i) $H(Z)=1+\frac{1}{3}Z^{-1}+\frac{1}{4}Z^{-2}+\frac{1}{4}Z^{-3}+\frac{1}{3}Z^{-4}+Z^{-5}$

(ii) $H(Z)=\left(1+Z^{-1}\right)\left(1+\frac{1}{2}Z^{-1}+\frac{1}{2}Z^{-2}+Z^{-3}\right)$. (7)

OR

VII. (a) Realize the system given by difference equation.

$y(n)=-0.1y(n-1)+0.72y(n-2)+0.7x(n)-0.252x(n-2)$ in parallel form. (5)

(b) Obtain the Direct form II, Cascade and Parallel form realization for the following system. $y(n)=-0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)$

$+0.6x(n-2)$. (10)

VIII. (a) With neat diagram explain the architecture of a typical DSP Processor. (10)

(b) Explain truncation and rounding. (5)

OR

IX. (a) The output signal of an A/D converter is passed through a first order low pass filter, with transfer function given by

$$H(Z)=\frac{(1-a)Z}{Z-a}\quad 0<a<1.$$

Find the steady state output noise power due to quantization at the output of the digital filter. (7)

(b) Explain any two applications of DSP. (8)

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