B.Tech. Degree VI Semester Examination, April 2009

CS/EC/EI/EE 601 DIGITAL SIGNAL PROCESSING

(1999 Scheme)

Time: 3 Hours Maximum Marks: 100

I a) Test the stability, causality, time invariance and linearity of the system y(n) = n x(n). (10)

b) Obtain the inverse transforms of

i) $$Y_{(z)} = \frac{1}{\left(1+z^{-1}\right)\left(1-z^{-1}\right)^2} ROC|z|>|$$ (10)

ii) $$X_{(z)} = \frac{1}{1-1.5z^{-1}+0.5z^{-2}} ROC|z|>|$$

OR

II a) Determine the impulse response and step response of the system $y(n)=e^k y(n-1)-x(n)$ given that y(n) = 0 for n<0. (10)

b) i) State and prove the delay property of Z transforms. (5)

ii) Explain the terms Convolution and Correlation. (5)

III a) State and prove the periodicity, symmetry and shift properties of DFT. (10)

b) Compute the DFT Co-efficients using decimation in Frequency algorithm $x(n)=\{1,2,3,4,1,2,3,4\}$. (10)

OR

IV a) Explain the following terms

i) Circular Convolution

ii) In place computation

iii) Butterfly structure (10)

b) With necessary equations and flow graphs explain decimation in frequency FFT algorithm for an 8 point sequence. (10)

V a) Explain the frequency sampling method of designing FIR filters. (10)

b) Design an FIR filter satisfying the following specifications using Fourier Series Method.

$$H\left(e^{jw}\right) = o \quad o \le |w| \le \pi/3$$

= 1 otherwise (10)

OR

VI a) State the principle of windowing. What are the desirable characteristics of a window? (10)

b) Design an FIR low pass filter with the following specifications.

$$|H(j\Omega)| = 1; \text{ for } \Omega \le 3 \text{ rad/sec}$$

$$= 0, \text{ for } \Omega > 3 \text{ rad/sec}$$

Sampling frequency 12 rad/sec

Use Hamming window with N = 9 (10)

(Turn over)

VII a) Using the first order sections obtain (i) Cascade form realization and (ii) parallel form realization, for

$$H(z)=\frac{\left(1+0.5z^{-1}\right)\ \left(1+0.25z^{-1}\right)}{\left(1-0.5z^{-1}\right)\ \left(1-0.25z^{-1}\right)\ \left(1-0.125z^{-1}\right)} \quad (10)$$

b) Obtain the digital filter H(z) corresponding to $H_a(s)=s^3/(s+1)\ \left(s^2+s+1\right)$ using bilinear transformation with T = ls (10)

OR

VIII a) Design a digital butter work filter satisfying the constraints

$$0.707\le\left|H\left(e^{jw}\right)\right|\le \text{ for } o\le \pi/2$$

$$\left|H\left(e^{jw}\right)\right|\le 0.2 \text{ for } 3\pi/4\le w\le\pi$$

With T = 1 Sec and using impulse invariance, realize the filter using parallel form. (10)

b) Explain Bilinear transformation. (10)

IX a) Explain any two applications of DSP (10)

b) Explain limit cycle oscillations? Why this problem does not exist in FIR filters. (!0)

OR

X a) Explain truncation and rounding errors in digital filters. (10)

b) Describe the architecture of a DSP Processor. (10)

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