Code No: NR311102 **NR**

III B.Tech I Semester Supplementary Examinations, April/May 2005
DIGITAL SIGNAL PROCESSING
(Common to Bio-Medical Engineering and Electronics & Computer Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find the impulse and step responses for the given system:
y(n)+y(n-1) = x(n)-2x(n-1)
   (b) Test the following systems for linearity, time invariance, causality and stability.
      i. $y(n) = a^{|x(n)|}$
      ii. y(n) = $sin(2nf\pi/F)x(n)$

2. (a) Discuss the frequency-domain representation of discrete-time systems and signals. By deriving the necessary relation.
   (b) Draw the frequency response of LSI system with impulse response
$h(n) = a^n u(-n)$ $(|a| < 1)$

3. (a) Define DFT of a sequence. Compute the N - point DFT of the sequence.
$X(n) = Cos(2\pi rn/N), 0 \leq n \leq N-1$ and $0 \leq r \leq N-1$
   (b) Explain how DFT can be obtained by sampling DFS for a given sequence.

4. (a) Draw the butterfly line diagram for 8 - point FFT calculation and briefly explain. Use decimation in-time algorithm.
   (b) What is FFT? Calculate the number of multiplications needed in the calculation of DFT using FFT algorithm with 32 point sequence.

5. (a) With reference to Z-transform, state the initial and final value theorem.
   (b) Determine the causal signal x(n) having the Z-transform $X(Z) = \frac{Z^2+Z}{\left(Z-\frac{1}{2}\right)^2\left(Z-\frac{1}{4}\right)}$.

6. (a) Discuss about the pole locations for the digital Chebyshev filters.
   (b) Compare the impulse invariance and bilinear transformation methods.

7. (a) Explain briefly the method of designing FIR filter using Fourier series method
   (b) Design a FIR filter approximating the ideal frequency response
$H_d(e^{j\omega}) = \begin{cases} e^{-j\alpha\omega}, & for\ |\omega| \leq \pi/6 \\ 0 \quad , & for\ \pi/6 \leq |\omega| \leq \pi \end{cases}$
Determine the filter coefficients for N=13.

8. (a) Write the difference equations for FIR and IIR system and hence derive the transfer function of FIR and IIR system.

(b) Realize the following system with minimum number of multipliers

$$H(Z) = 0.5+0.75Z^{-1}+0.8Z^{-2}+0.9Z^{-3}+2Z^{-4}+0.9Z^{-5}+0.8Z^{-6}+0.75Z^{-7}+0.5Z^{-8}$$

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