Code No: NR320402 **NR**

III B.Tech II Semester Supplementary Examinations, Apr/May 2006
DIGITAL SIGNAL PROCESSING
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering and Electronics & Telematics)

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) = $sin(2nf\pi/F)x(n)$ [8+8]

2. (a) Prove the modulation and time shifting properties of distribute time Fourier transform.
   (b) A discrete system is given by following difference equation
y(n)-5y(n-1) = x(n) + 4x(n-1)
where x(n) is the input and y(n) is the out put. Determine its magnitude and phase response as a function of frequency.

[8+8]

3. (a) What is " padding with Zeros " with an example, Explain the effect of padding a sequence of length N with L Zeros or frequency resolution.
   (b) Compute the DFT of the three point sequence $x(n) = \{2, 1, 2\}$. Using the same sequence, compute the 6 point DFT and compare the two DFTs. [8+8]

4. (a) Implement the Decimation in frequency FFT algorithm of N-point DFT where N-8. Also explain the steps involved in this algorithm.
   (b) Compute the FFT for the sequence x(n) = { 1, 1, 1, 1, 1, 1, 1, 1 } [8+8]

5. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$
   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find
      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]

6. (a) Find the order and poles of a low pass Butterworth filter that has a -3db bandwidth of 500 Hz and an attenuation of 40db at 1KHz.

(b) Convert the following analog filter with transfer function $H(S) = S + 0.1/(S + 0.2)^2 + 9$ into a digital IIR filter by using bilinear transformation method. The digital IIR filter is having a resonant frequency of $Wr = \pi/2$. [8+8]

7. (a) Outline the steps involved in the design of FIR filter using windows.

(b) Determine the frequency response of FIR filter defined by y(n) = 0.25x(n)+ x(n-1)+ 0.25x(n-2). Calculate the phase delay and group delay. [8+8]

8. (a) Explain the different structures for realisation of IIR system. and explain how conversion can be made from direct form I structure to direct form II structure.

(b) Realize the given system in cascade and parallel form
H(Z) = $\frac{1+\frac{1}{2}Z^{-1}}{\left[1-Z^{-1}+\frac{1}{4}Z^{-2}\right]\left[1-Z^{-1}+\frac{1}{2}Z^{-2}\right]}$ [8+8]

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