Code No: NR410201 **NR**

IV B.Tech I Semester Supplementary Examinations, April/May 2005
DIGITAL SIGNAL PROCESSING
(Common to Electrical & Electronic Engineering and Information Technology)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Give the advantages and disadvantages of DSP over ASP.
   (b) Derive an expression for a Parsevals relation for discrete time periodic signals.
   (c) Check whether the following systems are linear.
      i. $y(n) = \frac{1}{N}\sum_{m=0}^{N-1} x(n-m)$
      ii. $y(n) = [x(n)]^2$

2. (a) Prove that the convolution in time domain leads to multiplication in frequency domain for discrete time signals
   (b) The out put y(n) for a linear shit invariant system, with the input x(n) is given by
   Y(n) = x(n)-2x(n-1)+x(n-2)
   Compute and sketch the magnitude and phase response of the system $|w| \leq \pi$

3. (a) Define DFT of a sequence x(n). Obtain the relationship between DFT and DTFS.
   (b) Consider a sequence $x(n) = \{2, -1, 1, 1\}$ and T = 0.5 compute its DFT and compare it with its DTDT.

4. (a) Let x(n) be a real valued sequence with N-points and Let X(K) represent its DFT , with real and imaginary parts denoted by $X_R(K)$ and $X_1(K)$ respectively. So that X(K) = $X_R(K) + JX_1(K)$. Now show that if x(n) is real, $X_R(K)$ is even and $X_1(K)$ is odd.
   (b) Compute the FFT of the sequence x(n) = { 1, 0, 0, 0, 0, 0, 0, 0 }

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. (a) What are characteristics of the transfer function of the Chebyshev filter.

(b) Find the transfer function H(S) of the third order normalized Chebyshev filter for following specifications: $f_p = 1KHZandf_a = 3KHZ$.

7. Design a low pass Finite Impulse Response filter that approximate the following frequency response:
$H(f) = \begin{cases} 1\,;\ 0 \le f \le 1000\,Hz \\ 0\,;\ elsewhere\,\text{in}\,the\,range\,0 \le f \le f_s/2 \end{cases}$
when the sampling frequency is 8000 sps. The impulse response duration is to be limited to 2.5 msec. Draw the filter structure.

8. (a) Explain the structures for realisation of FIR system and draw the direct form structure of the FIR system described by the transfer function
H(Z) $= 1 + \frac{1}{2}Z^{-1} + \frac{3}{4}Z^{-2} + \frac{1}{4}Z^{-3} + \frac{1}{2}Z^{-4} + \frac{1}{8}Z^{-5}$

(b) Realize the following IIR system by cascade and parallel forms.
$y(n) + \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) - 2x(n-1) + x(n-2)$

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