Code No: NR311102 **NR**

III B.Tech I Semester Supplementary Examinations, November 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) Consider a LSI system with unit sample response $h(n)n = \alpha^n u(n)$ where α is real and $0 < \alpha < 1$. If the input is $x(n) = \beta^n\, u(n), 0 < |\beta| < 1$,determine the the output f(n) in the form $y(n) = (k_1\alpha^n + k_2\beta^n u(n)$ by explicitly evaluating the convolution sum.
   (b) Define causality and stability of LSI system and state the conditions for stability.

   [12+4]

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 $|w| \leq \pi$

   [8+8]

3. (a) Define DFT. Guide tow properties of DFT.
   (b) Discuss the effects of truncating a sequence x(n) of infinite duration.
   (c) Compute the DFT of $X(n) = \{-1, 0, -1\}$ with T = 0.5. Plot the DFT sequence suggest a method for improving frequency resolution. [4+6+6]

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) Explain how the analysis of discrete time invariant system can be obtained using convolution properties of Z transform.
   (b) Determine the impulse response of the system described by the difference equation y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1) using Z transform. [8+8]

6. (a) Compare the Digital Butterworth and Chebyshev filters.
   (b) Explain method of constructing Butterworth circle in the Z-plane using Bilinear transformation method. [8+8]

7. (a) Compare the performances of rectangular window, hamming window and Keiser window

(b) The desired response of a low pass filter is
$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -3\pi \le \omega \le 3\pi/4 \\ 0 \quad , & 3\pi/4 \le |\omega| \le \pi \end{cases}$
Determine $H(e^{j\omega})$ for M=7 using a Hamming window. [6+10]

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.
$y(n) + \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) - 2x(n-1) + x(n-2)$ [8+8]

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