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Code No: NR410201 NR

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS
DIGITAL SIGNAL PROCESSING
(ELECTRICAL & ELECTRONIC ENGINEERING AND INFORMATION TECHNOLOGY)
NOVEMBER 2005 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 = nu(n) where is real and 0 < < 1 . If the input is x(n) = n u(n), 0 < || < 1 ,determine thethe output f(n) in the form y(n) = (k1 n + k2 nu(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) If x(n) ! x(ej!) Constitute a Fourier transform pair. Prove the following:
Sequence Fourier Transform
i. x*(n) X (e-j!
ii. xo(n) jIm[X(ej!]

(b) Let x(n) and X(ej!) represent a sequence and its transform. Determine, in terms of X(ej!), the transform of each of the following sequences :
i. g(n) = x(n/2) n even 0 n odd
ii. x2(n)

[8+8]

3. (a) Prove the following properties
i. arg[X(K)] = -arg[X((-K)N)RN(K)]
ii. Im[X(K)] = -Im[X((-K))NRN(K)]

(b) If X(K) denotes the N-point DFT of N-Point sequence x(n), show that with N even and if x(n) = x(N-1-n) then X(N/2)=0.

[8+8]

4. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.

(b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 }

[8+8]

5. (a) An LTI system is described by the equation y(n)=x(n)+0.81x(n-1)-0.81x(n- 2)-0.45y(n-2). Determine the transfer function of the system. Sketch the poles and zeroes on the Z-plane.

(b) Define stable and unstable system test the condition for stability of the first order IIR filter governed by the equation y(n)=x(n)+bx(n-1).

6. Design a Digital IIR low pass filter with pass band edge at 1000 Hz and stop band edge at 1500 Hz for a sampling frequency of 5000 Hz. The filter is to have a pass

band ripple of 0.5 db and stop band ripple below 30 db. Design Butter worth filler using both impulse invariant and Bilinear transformations.

[16]

7. A low pass filter is to be designed with the following desired frequency response. Hd(ej!) = □ e-j2!, -□ /4 □ ! □ □ /40, □ /4 □ |!| □ □ Determine the filter coefficients hd(n) if the window function is defined as !(n) = □ 1, 0 □ n □ 40, otherwise Also determine the frequency response H(ej!) of the designed filter. And plot the magnitude and phase spectra.

[16]

8. (a) Explain in detail the short time Fourier analysis for speech signals

(b) What is a vocoder? Explain with a block diagram.