Code No: EC502 **OR**

III B.Tech(ccc) Regular Examinations, December 2007
DIGITAL SIGNAL PROCESSING
(Electronics & Communication Engineering)

Time: 3 hours Max Marks:100

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The unit-sample response of a linear-shift-invariant system is known to be zero. Except in the interval $N_0 \leq n \leq N_1$. The input x(n) is known to be zero except in the interval $N_2 \leq n \leq N_3$. As a result, the output is constrained to be zero except in some interval $N_4 \leq n \leq N_5$. Determine $N_4 and N_5$ in terms of $N_0, N_1, N_2 and N_3$.

   (b) By direct evaluation of the convolution sum, determine the step response of a Linear shift-invariant system whose unit-sample response h(n) is given by $h(n) = a^{-n}u(-n)$, 0 < a < 1. [10+10]

2. (a) With reference to Z-transform, state the initial and final value theorem.

   (b) Determine the causal signal x(n) having the Z-transform $X(Z) = \frac{Z^2+Z}{\left(Z-\frac{1}{2}\right)^2\left(Z-\frac{1}{4}\right)}$. [8+12]

3. Prove the following properties of the discrete Fourier series for periodic sequences.

Sequences	Discrete Fourier Series
(a) x(n+m)	$W_N^{-Km}X(K)$
(b) x*(n)	X*(-K)
(c) x*(-n)	X*(K)
(d) Re[x(n)]	$X_e(K)$
(e) jlm[x(n)]	$X_o(K)$

[20]

4. (a) Compute Discrete Fourier transform of the following finite length sequence considered to be of length N.
      i. $x(n) = \delta(n + n_0)\ where\ 0 < n_0 < N$
      ii. $x(n) = \infty^n\ where\ 0 < \infty < 1$.

   (b) If x(n) denotes a finite length sequence of length N, show that $x((-n))_N = x((N-n))_N$. [10+10]

5. (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 } [10+10]

6. Determine the system function H(Z) of the lowest order Chebyshev digital filter that meets the following specifications.

(a) 1 db ripple in the passband $0 \leq |W| \leq 0.3\pi$

(b) At least 60 db attenuation in the stopband $0.35\pi \leq |W| \leq \pi$. Use the bilinear transformation. [20]

7. (a) Design a linear phase low pass filter with a cut-off frequency of $\pi/2$ radians/seconds. Take N=7

(b) Write the magnitude and phase functions of Finite Impulse Response filter when

i. impulse response is symmetric & N is odd

ii. impulse response is symmetric & N is even. [10+10]

8. Realise the FIR transfer function
$H(z) = (1 + 0.8Z^{-1})^5 = 1 + 4Z^{-1} + 6.4Z^{-2} + 5.12Z^{-3} + 2.048Z^{-4} + 0.32768Z^{-5}$ in the following forms.

(a) Two different direct forms.

(b) Cascade of first-order sections

(c) Cascade of one first - order and two second order sections and

(d) Cascade of one second - order and one third order sections.
Compare the computational complexity of each and above realizations. [20]

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