BTS 157 (F)

B.TECH. DEGREE VII SEMESTER EXAMINATION IN
ELECTRONICS AND COMMUNICATION ENGINEERING
MAY 2002

EC 701 DIGITAL SIGNAL PROCESSING
(1995 Admissions)

Time: 3 Hours Maximum Marks: 100

I. (a) Determine the response of a Linear Time invariant system with impulse response

$$h(n) = 0.5\delta(n-2) + \delta(n-1) + 0.5\delta(n)$$

for an input sequence

$$x(n) = \delta(n-3) + \delta(n-2) + \delta(n-1) + \delta(n).$$ (12)

(b) Determine the autocorrelation sequence corresponding to $x(n) = \sin \dfrac{2\pi n}{M}$ where M is a positive integer, and check the periodicity of the sequence from autocorrelation. (8)

OR

II. (a) Distinguish between Fourier transform and z - transform. (4)

(b) Explain the different methods used for the computation of inverse Z - transform. (8)

(c) Evaluate the inverse z - transform of

(i) $Y(z) = \dfrac{12 + 8z^{-1} - 3z^{-2}}{12 - 7z^{-1} + z^{-2}}$ $|z| > \dfrac{1}{3}$

(ii) $Y(z) = \dfrac{2}{(z+0.5)(z+1)}$ $0.5 < |z| < 1$ (8)

(Turn over)

III. (a) Determine the unit sample response of a two dimensional filter for which the unit impulse response

$$h(m,n) = \begin{cases} 1 & |m| < M \text{ and } |n| < N \\ 0 & \text{otherwise} \end{cases}$$ (12)

(b) Define a 2 dimensional unit step sequence and unit impulse sequence.
Express 2 dimensional unit step sequence in terms of unit impulse sequence. (8)

OR

IV. (a) Define separability and prove that if the input $x(m,n)$ and impulse response $h(m,n)$ are separable, then the output $y(m,n)$ is also separable. (10)

(b) State the Hilbert Transform relations for the DFT. (10)

V (a) What is meant by block convolution?
Explain any one method in detail. (10)

(b) Define DFT and state and prove any two properties of it.
Establish the relation between DFT and z - transform. (10)

OR

VI. Evaluate the output of an LTI system with impulse response

$$h(n) = 0.5 \quad n = 0$$
$$= 1 \quad n = 1$$
$$= 0 \quad \text{otherwise}$$

for an input sequence

$$x(n) = 1 \quad n = 0$$
$$= 0.5 \quad n = 1$$
$$= 0 \quad \text{otherwise}$$

using DFT approach. (20)

Contd..................3.

VII. Design a Chebyshev low pass filter using Bilinear transform for the givben specifications.

Pass band $-1dB < |H(j\Omega)| \le 0dB$ for $0 \le \Omega \le 1404\pi$ rad|sec

Stop band $|H(j\Omega)| < -60dB$ for $\Omega \ge 8268\pi$ rad|sec

sampling frequency 10 KHz. (20)

OR

VIII. (a) Obtain direct form I, II, parallel and cascade structures for the system

$$H(z) = \frac{2(1-z^{-1})\,(1+\sqrt{2}z^{-1}+z^{-2})}{(1+0.5z^{-1})\,(1-0.9z^{-1}+0.81z^{-2})}$$ (14)

(b) Explain the Fourier transform method of design of FIR filters. (6)

IX. (a) Briefly explain the different types of problems introduced by finite word length in a digital filter. (12)

(b) Determine the variance of round-off noise at the output of the two cascade realization of the filter system with transfer function

$$H_1(z) = \frac{1}{1-\frac{1}{2}z^{-1}} + H_2(z) = \frac{1}{1-\frac{1}{4}z^{-1}}$$ (8)

OR

X. (a) What is meant by limit cycle oscillations. (8)

(b) Obtain the dead band range of the filter described by

$$y(n) = 0.95y(n-1) + x(n)$$ (12)

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