

BTS 157 (F)

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

**EC 701 DIGITAL SIGNAL PROCESSING  
(1995 Admissions)**

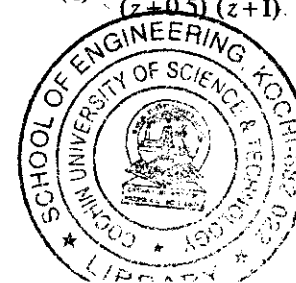
Time: 3 Hours

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
- $$x(n) = \delta(n-3) + \delta(n-2) + \delta(n-1) + \delta(n). \quad (12)$$
- (b) Determine the autocorrelation sequence corresponding to
- $$x(n) = \sin \frac{2\pi n}{M}$$
- 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) 
$$Y(z) = \frac{12 + 8z^{-1} - 3z^{-2}}{12 - 7z^{-1} + z^{-2}} \quad |z| > \frac{1}{3}$$

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



(Turn over)

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

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

- (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

$$h(n) = \begin{cases} 0.5 & n = 0 \\ 1 & n = 1 \\ 0 & \text{otherwise} \end{cases}$$

for an input sequence

$$x(n) = \begin{cases} 1 & n = 0 \\ 0.5 & n = 1 \\ 0 & \text{otherwise} \end{cases}$$

using DFT approach. (20)

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

Pass band  $-1dB < |H(j\Omega)| \leq 0dB$  for  $0 \leq \Omega \leq 1404\pi \text{ rad/sec}$

Stop band  $|H(j\Omega)| < -60dB$  for  $\Omega \geq 8268\pi \text{ rad/sec}$   
sampling frequency 10 KHz. (20)

OR

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

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

- (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

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

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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