BTS(C)-VI-03- 516 (A)

B.Tech Degree VI Semester Examination May 2003

CS/EC/EI/EE 601 DIGITAL SIGNAL PROCESSING

(1999 Admissions onwards)

Time: 3 Hours Maximum Marks: 100

I. (a) Check whether the following systems are linear, time-invariant causal and stable.
(i) $y(n) = x(2n)$
(ii) $y(n) = x(n) + n\,x(n+1)$ (12)

(b) Determine the response of the relaxed system characterized by an impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$ to an input sequence $x(n) = 2^n u(n)$. (8)

OR

II. (a) Determine the impulse response h(n) of a causal and stable LTI system whose input x(n) and output y(n) are related by the difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$. (8)

(b) Find out the z-transform and ROC of the finite duration sequence $x(n) = \{2,4,5,7,0,1\}$. (4)

(c) Determine all possible signals associated with $X(z) = \frac{1}{1-\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}}$ (8)

III. (a) State and prove time shifting property of DFT. (8)
(b) Compute the DFT of the sequence $\{1,1,-2,-2\}$. (8)
(c) Establish the relationship between DFT and Z-transform. (4)

OR

IV. (a) Distinguish between linear and circular convolution of 2 sequences. (6)
(b) What are the differences and similarities between DIT and DIF algorithms? (8)
(c) Explain the following terms:
(i) in-place computation.
(ii) butterfly structure. (6)

V. (a) Obtain a cascade realization involving minimum number of delays for a system having transfer function $H(z) = (1+z^{-1})(\frac{1}{2} - \frac{1}{4}z^{-1} + \frac{1}{2}z^{-2})$ (6)

(b) Explain the different techniques for FIR filter design. (14)

OR

VI. (a) State the principle of windowing. What are the desirable characteristics of a window. (10)

(b) Design an FIR filter satisfying the following specifications using Fourier Series method

$H(e^{jw}) = 0 \quad 0 \le |w| \le \pi/3$
$= 1$ otherwise. (10)

VII. (a) Explain in detail, any two methods for digitizing the transfer function of an analog filter. (10)

(b) Realize the following transfer function using cascade and parallel structures.

$$H(z) = \frac{0.44z^2 + 0.362z + 0.02}{z^3 + 0.4z^2 + 0.18z - 0.2}$$ (10)

OR

VIII. (a) What is bilinear transformation ? State its advantages and disadvantages. (8)

(b) Using bilinear transform, design a high pass filter, monotonic in pass band with a cut-off frequency of 1000 Hz and down 10dB gain at 350 Hz. The sampling frequency is 5000 Hz. (12)

IX. (a) Find the steady state noise power due to product roundoff in the realization of the transfer function $H(z) = \frac{1}{1-az^{-1}}$. (8)

(b) Explain the different types of arithmetic employed in digital systems, bringing out their merits and demerits. (12)

OR

(a) Explain briefly the major application areas of digital signal processing. (12)

(b) What is meant by limit cycle oscillations? Why this problem does not exist in FIR digital filters? (8)

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