BT–6/J08

Digital Signal Processing

Paper : ECE-306 E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt any **FIVE** questions.

SECTION—I

1. (a) Find the z-transform of the following signal and sketch the pole-zero pattern for it :

$$x(n)=\frac{1}{2}(n^2+n)\left(\frac{1}{3}\right)^{n-1} u(n-1).$$

(b) Determine all possible signals x(n) associated with the z-transform :

$$X(z)=\frac{5z^{-1}}{(1-2z^{-1})(3-z^{-1})}.$$

(c) State and explain the properties of z-transform. 10 + 6 + 4

2. (a) Draw the flow graph of an 8-point DIF FFT and explain.

(b) Find the DFT of the following sequence x(n) using DIT FFT:

$x(n) = (1, -1, -1, -1, 1, 1, 1, -1)$. 10 + 10

3. (a) Describe the effect of quantization of coefficients in FIR filters.

(b) Obtain the direct form I, direct form II, cascade and parallel structures for the following system :

$y(n) = y(n-1) - 0{\cdot}5y(n-2) + x(n) - x(n-1) + x(n-2)$.

10 + 10

4. (a) Consider the system described by the difference equation

$y(n) = ay(n-1) - ax(n) + x(n-1)$

(i) Show that it is all-pass

(ii) Obtain direct from II realization of the system.

(b) Explain Direct form, Cascade and transposed form structures for FIR filters. 10 + 10

5. (a) Explain the Type-I Frequency sampling method of designing an FIR filter.

(b) Compare the frequency domain characteristics of different types of window functions. 10 + 10

6. (a) Explain the procedure of designing and FIR filter using Kaiser window.

(b) Explain the procedure of designing an IIR filter by Bilinear Transformation. 10 + 10

7. (a) Describe an IIR filter design by impulse invariant method.

(b) Design a digital Chebyshev filter to satisfy the constraints

$0 \cdot 707 \leq |H(e^{i\omega})| \leq 1, \quad 0 \leq |\omega| \leq 0 \cdot 2\pi$

$|H(e^{i\omega})| \leq 0 \cdot 1, \quad 0 \cdot 5\pi \leq |\omega| \leq \pi$

using bilinear transformation and assuming T = 1s. 10 + 10

8. Write short notes on any TWO of the following : 10 + 10

(i) Chebyshev filters

(ii) Overlap add and overlap save method.

(iii) Properties of DFT.