BT-6/J04

Digital Signal Processing

Paper : ECT-308

Time : Three Hours] [Maximum Marks : 75

Note : (1) Solve any FIVE questions.
(2) Question number 9th in compulsory.
(3) Remaining four questions should be solved by selecting only ONE question from each of the four different sections.

SECTION-I

1. (a) Z-transform of a sequence x (n) is

$$X(z)=\frac{1-a^2}{(1-az)(1-az^{-1})};\ z<|z|<\frac{1}{a} \text{ with } 0\ 0<a<1.$$

Determine x (n) by contour integration. 10

(b) Explain Schur-Cohn stability criterion. 5

2. By means of DFT and IDFT. Determine output y(n) of a system with impulse response $h(n)=\left\{\underset{\uparrow}{1},2,3,1\right\}$; for the input $x(n)=\left\{\underset{\uparrow}{4},3,2,2\right\}$ 15

SECTION-II

3. (a) Lattice co-efficients of an FIR filter are $K_1=0.65$, $K_2=-0.34$ and $K_3=0.8$. 10

(i) Find the impulse response

(ii) Draw the equivalent direct-form structure

(b) Determine the zeros and sketch the zero pattern for the FIR lattice filter with parameters : 5

$$K_1=\frac{1}{2};K_2=\frac{1}{3};K_3=1$$

4. (a) Obtain the cascade and parallel structures for the following systems.

(i) $y(n)=\frac{1}{2}y(n-1)+\frac{1}{4}y(n-2)+x(n)+x(n-1)$ 5

(ii) $y(n)=\frac{3}{4}y(n-1)-\frac{1}{8}y(n-2)+x(n)+\frac{1}{3}x(n-1)$ 5

(b) Explain the transposed structure for implementation of IIR filter. 5

SECTION-III

5. (a) Write a note on filter design specification. 5
   (b) Explain Gibb's phenomenon and design of FIR filters using windows. 10

6. Determine the co-efficients of 25 tap filter that approximates the following ideal frequency response 15

$$Hd(w) = \begin{cases} 1, & |w| \leq \pi/6 \\ 0, & \text{otherwise} \end{cases}$$

Use rectangular window

SECTION-IV

7. A digital low pass filter is required to meet the following specification 15
   pass band ripple $\leq$ ldB and
   pass band edge = 4 KHz
   stop band edge = 6 KHz
   sample rate = 24 KHz
   stop band attenuation $\geq$ 40 dB
   Use bilinear transformation and determine order and poles of Butterworth filter.

8. Explain the least square methods for designing IIR filters. 15

Compulsory Question

9. Write technical notes on the following :
   (a) Frequency selective filters 3
   (b) State space structures 4
   (c) Alternation theorem 4
   (d) Impulse invariance method 4