[3763] – 194

T.E. (Computer) Semester – I Examination, 2010
DIGITAL SIGNAL PROCESSING
(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answers to the **two** Sections should be written in **separate** books.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Assume **suitable** data, **if necessary**.*
*4) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 from Section – **I** and Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12 from Section – **II**.*

SECTION – I

1. A) Explain the ADC process as sampling, quantization and coding. **10**

   B) What is the importance of linear convolution in D.S.P. ?

   Define unit impulse signal and represent a D.T. Signal x (n) in terms of $\delta(n)$. **8**

   OR

2. A) State the following properties with **one** example **each** :
   i) Time invariant system.
   ii) Stability.
   iii) Linearity.
   iv) Invertibility. **10**

   B) Define the following terms :
   i) Impulse response of a D.T. System.
   ii) Non-recursive system.
   iii) Even signal.
   iv) Natural response. **8**

P.T.O.

3. A) Define R.O.C. of Z Transform. State its properties. Derive the relationship between Z Transform and F Transform. 8

   B) Obtain inverse Z transform using P.F.E. method for a causal sequence where,

   $$X(z) = \frac{z^3}{(z-2)(z-1)^2}.$$ 8

OR

4. A) State and prove the convolution property of F transform. 8

   B) State the necessary conditions for the existence of F.T. Obtain F.T. of D.T. signal $x(n) = -a^n u(-n-1)$. 8

5. A) Describe the behaviour of causal D.T. signal by means of pole-zero plot w.r.t. position of poles. 8

   B) Solve the difference equation using Z transform, and obtain the impulse response h (n).

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

OR

6. A) Using simple geometric construction, obtain the frequency response for a system

   $$y(n) = \frac{1}{2}[x(n) + x(n-1)].$$ 8

   B) Define system function H (z). How it is described for F.I.R. and I.I.R. system ? State causality and stability property w.r.t. H(z). 8

SECTION – II

7. A) Derive decimation in time (D.I.T.) F.F.T. algorithm for N-point D.F.T. upto 1st stage. Draw signal flow graph for N = 8. 10

   B) State any 4 properties of D.F.T. Define circular shifting. 8

OR

8. A) Explain how D.F.T. can be used for linear filtering. How we can obtain linear convolution from N-point circular convolution ? State the computational complexity of N-point circular convolution. **10**

B) Obtain 4-point D.F.T. using linear transformation matrix for $x(n) = \{\underset{\uparrow}{0}, 1, 2, 3\}$. **8**

9. A) State the characteristics of Ideal filter. What are the advantages and disadvantages of Digital filter over analog filter ? **8**

B) Using Impulse invariance method design a D.T. filter with following specification :

$$H(s) = \frac{1}{s^2 + 3s + 2}, F_s = 5 \text{ samples/s.}$$ **8**

OR

10. A) What is Gibbs phenomenon ? How F.I.R. filter are designed using windowing method ? **8**

B) State the Transformation Formula used in B.L.T. method for I.I.R. filter design. Obtain the relation showing the frequency warping effect and draw it graphically. **8**

11. A) Describe F.I.R. filter by means of system function H (z). Explain how it is realized for direct and cascade form. **8**

B) Obtain the linear phase F.I.R. filter structure for $h(n) = \{\underset{\uparrow}{1}, \frac{1}{2}, -\frac{1}{4}, \frac{1}{2}, 1\}$.

Draw the same and obtain its complexity. **8**

OR

12. A) Realize Direct form – I for I.I.R. filter and obtain the difference equation of system :

$$H(z) = \frac{7z^2 - 5.25z + 1.375}{z^2 - 0.75z + 0.125}.$$ **8**

B) Draw the functional block diagram of A.D.S.P. 21XX D.S.P. processor and explain its various features. **8**
