Nov-Dec 2010

[3863] – 444

T.E. (Computer) (Semester – I) Examination, 2010
DIGITAL SIGNAL PROCESSING (New)
(2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) 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**.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*6) Assume suitable data, if **necessary**.*

SECTION – I

1. A) How an arbitrary DT sequence can be represented by convolution operation ? Obtain linear convolution of u(n) and δ (n) using graphical method. **8**

   B) State linearity and time invariant properties of a DT system and test it for

   $y(n) = x(n) - 2.x\ (n - 2)$. **8**

   OR

2. A) How a DT system is represented/described in time domain ? Define the impulse response of a DT system and show that for a causal system. **8**

   $h(n) = 0$ for $n < 0$

   B) Why the problem of aliasing is observed during sampling process ? Show that all the frequencies $F_K = F_O \pm K.F_S$, K: integer are the aliases of frequency F_O. **8**

3. A) Compare N point DFT with FT. What is the significance of N in DFT ? Why it is necessary to have $N \geq L$ where L : length of a DT signal. **10**

   B) State and prove windowing theorem of a Fourier Transform (FT). **8**

   OR

P.T.O.

4. A) Obtain DT frequencies $\{W_K\}$ for 6 point DFT. State the convolution and periodicity property of DFT. What is DFT spectral leakage ? **10**

   B) Explain how DFT can be used for linear filtering. How N-pt. circular convolution can be used to obtain linear convolution ? **8**

5. A) How computational complexity of N-point DFT is reduced using FFT algorithm ? What is in-place computation and bit-reversal indexing in FFT ? **8**

   B) Using ZT properties, obtain ZT of a DT signal x(n) = 2n. u (–n –1) sketch the ROC. **8**

OR

6. A) Derive the first stage of DIF (decimation in frequency) FFT algorithm. Draw the basic butterfly structure for the same. **8**

   B) Obtain a causal sequence x(n) from its ZT **8**

$$X(Z) = \frac{3}{Z - \frac{1}{4} - \frac{1}{8Z}}$$

SECTION – II

7. A) Define a system function H(Z). What is pole zero plot of a system ? Determine H(Z) and draw a pole zero plot for a system. **10**

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

   B) Express system function H(Z) for FIR and IIR system from the N^{th} order difference equation. How properties of DT system can be described using H(Z) ? **8**

OR

8. A) Knowing H(Z), how frequency response of a system can be obtained ? Use simple geometric construction to obtain the frequency response of a system having h(n) = {0.5, 0.5}. **10**

   B) Determine the impulse response of a system. **8**

   y(n) = 2x(n) – x(n – 1) – 3y (n – 1) – 2y (n – 2)

9. A) Define a DT filter. What do you mean by a linear phase response ? What is group delay ? State the advantages and disadvantages of FIR filter over an IIR filter. **8**

B) What is frequency prewarping ? Design second order low pass filter using BLT method having

$H(S) = \frac{1}{S^2 + \sqrt{2}\,S + 1}$ with cut-off freq. F_c = 1KHz and sampling frequency F_s = 10 KHz. Use frequency prewarping. **8**

OR

10. A) Compare Hanning window with rectangular window. Write the algorithmic steps to design an FIR filter using Hanning window. **8**

B) Stable analog filter always gives stable digital filter. Justify the statement. Explain impulse-invariance method for the design of an IIR filter. **8**

11. A) Obtain direct and cascade form FIR filter structure for a system having

$H(Z) = (1 + Z^{-1})\,(1 + \frac{1}{2}\,Z^{-1} + \frac{1}{2}\,Z^{-2} + Z^{-3})$ **8**

B) Obtain direct form – I and direct form – II IIR filter structure for a system

$H(Z) = \frac{Z^2 + \frac{1}{3}Z}{Z^2 - \frac{3}{4}Z + \frac{1}{8}}$ **8**

OR

12. A) How DSP processors are different than conventional microprocessors ? List the important features of ADSP 21XX DSP processor. What is DAG ? **8**

B) How image is represented by digital computer ? Explain the application of DSP in image processing w.r.t. image enhancement. **8**