BE(EXTC) VII (R) D.T.S.P.

16/05/09 M-2

Con. 2689–09. VR–4797

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assumptions made should be **clearly** stated.
(4) **Illustrate** answers with **sketches** wherever **required**.

1. Attempt any **four** :– 20

(a) Impulse response of the highpass filter is obtained from the impulse response of the low pass filer by changing the signs of the odd numbered samples in impulse response of low pass filter. Justify.

(b) Explain the relationship between DFT and DCT.

(c) A two pole low pass filter has the system function $H(z) = \dfrac{b_0}{\left(1-pz^{-1}\right)^2}$

Determine the values of b_0 and p such that the frequency response H(w) satisfies the conditions $H(0) = 1$ and $\left|H\left(\frac{\pi}{4}\right)\right|^2 = \frac{1}{2}$

(d) Compare IIR and FIR filters.

(e) Give any three advantages and disadvantages of digital filter.

2. (a) Sample the given continuous time signal $x_{in}(t) = \sin[2\pi 1000t] + 0.5\sin[2\pi 2000t]$, at 8000 samples/s and find out eight point DFT using DIT FFT algorithm. 10

(b) For given sequence x(n) = {2, 0, 01}, perform following operations – 10

(i) Find out 4 pint DFT of x(n)

(ii) Plot x(n), its periodic extension $x_p(n)$ and $x_p(n-3)$

(iii) Find out 4 point DFT of $x_p(n-3)$

(iv) Add phase angle in (i) with factor $-\left[\frac{2\pi rk}{n}\right]$ where N = 4, r = 3, k = 0,1,2,3

(v) Comment on results you had in point (i) and (ii).

3. (a) The unit sample response of a system is h(n) = {3,2,1}. Use the overlap save method to determine its output sequence in response to the repeating input sequence x(n) = {2,0,–2,0,2,1,0,–2,–1,0}. 10

(b) What is DCT ? Explain how DCT is classified in four types as DCT-I, DCT-II, DCT-III and DCT-IV. Which type is mostly used and why ? 10

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4. (a) The transfer function of discrete time causal system is given below 10

$$H(z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$$

(i) Find the difference equation
(ii) Draw cascade and parallel realization
(iii) Show pole and zero diagram and then find magnitude at $\omega = 0$ and $\omega = \pi$
(iv) Calculate the impulse response of the system.

(b) Obtain the lattice realization for the system – 10

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

5. (a) Consider the following specifications for a low pass fitler 10

$0.99 \leq |H(e^{jw})| \leq 1.01 \quad 0 \leq |\omega| \leq 0.3\pi$ and

$|H(e^{jw})| \leq 0.01 \quad 0.35\pi \leq |\omega| \leq \pi$

Design a linear phase FIR filter to meet these specifications using the window design method.

(b) Explain the pole zero locations for Type I, Type II, Type III and Type IV linear phase FIR filters. 10

6. (a) Use the bilinear transformation to design a discrete – time Chebychev high–pass filter an equiripple passband with 10

$0 \leq |H(e^{jw})| \leq 01 \quad 0 \leq |\omega| \leq 0.1\pi$ and

$0.9 \leq |H(e^{jw})| \leq 1.0 \quad 0.3\pi \leq |\omega| \leq \pi$

(b) With the help of block diagram, explain TMS 32 C 5 X series of processors. 10

7. Write short notes (any **two**) :– 20

(a) Frequency sampling realization of FIR filters
(b) Finite Word Lengths in digital filters
(c) Digital Resonator