TE-VII | Digital Signal Processing | INST

02.12.15

QP Code : 6354

(3 Hours) [Total Marks : 80

N.B. : (1) Question **No.1** is **Compulsory.**
(2) **Attempt** any **Three** questions from the remaining five questions.
(3) **Assume** suitable **data** if **necessary.**

1. Answer the following (Any **Four**) : 20
   (a) State and prove the convolution property of z-transform.
   (b) Draw the single butterfly of 2 - Radix DIT & DIF FFT algorithm.
   (c) State and prove the complex conjugate property of DFT.
   (d) The transfer function of analog filter is $H(S) = \frac{S+2}{(S+1)(S+3)}$ design a digital IIR filters by means of IIT. Assume T = 0.1 Sec.
   (e) Determine IDFT of $x(k) = [6, -1-j, 0, -1+j]$ by using DIT FFT algorithm.

2. (a) If $x_1(n) = [1, 2, 0, 3]$ and $x_2(n) = [1, 2, 3, 2]$. Find the DFT of both the sequence by using DFT only once (not otherwise). 10
   (b) Derive and draw the FFT for N = 6 = 2.3 using DIT FFT algorithm. 10

3. (a) If $x_1(n) = [1, 2, 3, 5]$ and $x_2(n) = [2, 4, 2, 3]$. Obtain $x_1(n) \otimes x_2(n)$ by using DIF FFT algorithm. 10
   (b) Prove the relation between the analog and digital filter by means of Bilinear Transformation Technique. 10

4. (a) Determine the output of a Linear FIR Filter whose impulse response $h(n) = \{3, 2, 1\}$ $x(n) = [1, 0, 2, 1, 0, -2, -1, 0, 3, 1]$ using over lap add method. 10
   (b) Determine the frequency response of the system $h(n) = a^n u(n)$ magnatude and phase response of it. 10

5. (a) $y(n) = x(n) + \frac{1}{4}x(n-1) + \frac{1}{6}y(n-1) + \frac{1}{6}y(n-z)$ Realize the system by using Direct form - 1 cascade and parallel form realization. 10
   (b) Design a digital Butterworth filter that satisfy the following constraint using Bilinear Transformation. Assume T = 1 Sec 10

$$0.9 = \leq \left|H\left(e^{j\omega}\right)\right| \leq 1 \quad 0 \leq \omega \leq \pi/2$$

$$\left|H\left(e^{j\omega}\right)\right| \leq 0.2 \quad 3\pi/4 \leq \omega \leq \pi$$

TURN OVER

6. (a) A pass filter is to be designed which following frequency response 10

$$Hd\left(e^{j\omega}\right) = e^{-j3\omega} \quad -\frac{3\pi}{4} \le \omega \le \frac{3\pi}{4}$$

$$\frac{3\pi}{4} \le |\omega| \le \pi$$

Determine the filter coefficient h(n) by using Hamming window.

(b) A one state decimator is characterised by the following decimator factor = 3 10

Antialising filter coefficient

h(0) = -0.06 = h(4)

h(1) = 0.30 = h(3)

h(2) = 0.62

Given the data x(n) with a successive [6, -2, -3, 8, 6, 4, -2]. Calculate and list filtered output w(n) and the output of the decimator y(n).
