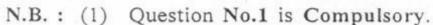
- TE-III Digital Signal Processing

02.12.15

(3 Hours)

[Total Marks: 80

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- (2) Attempt any Three questions from the remaining five questions.
- (3) Assume suitable data if necessary.
- 1. Answer the following (Any Four):

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- (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).
 - (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 10 FFT algorithm.
 - (b) Prove the relation between the analog and digital filter by means of Bilinear 10 Transformation Technique.
- 4. (a) Determine the output of a Linear FIR Filter whose impulse response h(n) = {3, 2, 10 1) x(n) = [1, 0, 2, 1, 0, -2, -1, 0, 3, 1] using over lap add method.
 - (b) Determine the frequency response of the system $h(n) = a^n u(n)$ magnatude and phase response of it.
- 5. (a) $y(n) = x(n) + \frac{1}{6}x(n-1) + \frac{1}{6}y(n-1) + \frac{1}{6}y(n-z)$ Realize the system by using Direct 10 form - 1 cascade and parallel form realization.
 - (b) Design a digital Butterworth filter that satisfy the following constraint using Bilinear 10 Transformation. Assume T = 1 Sec

$$0.9 = \leq \left| \mathbf{H} \left(e^{j\omega} \right) \right| \leq 1 \qquad 0 \leq \omega \leq \frac{\pi}{2}$$
$$\left| \mathbf{H} \left(e^{j\omega} \right) \right| \leq 0.2 \quad \frac{3\pi}{4} \leq \omega \leq \pi$$

TURN OVER

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

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

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

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

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).

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