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Roll No. ....

EC/EI/IT-603

B. E. (Sixth Semester) EXAMINATION, June, 2009

(Common for EC, EI & IT Engg. Branch)

DIGITAL SIGNAL PROCESSING

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *five* questions. All questions carry equal marks. Notation have standard meaning.

1. (a) What is the concept of circular convolution ? Compare the circular convolution with linear convolution.

   (b) Find the DFS expansion of the following sequence :

   $$\tilde{x}(n) = A \cos\left(\frac{n\pi}{2}\right)$$

   $\tilde{x}(n)$ is periodic with a period $N = 4$.

2. (a) Compute the N-point DFT of each of the following sequences :

   (i) $x_1(n) = \delta(n)$

   (ii) $x_2(n) = a^n \quad 0 \le n \le N$

   (b) Find the N-point DFT of the sequence :

   $$x(n) = 4 + \cos^2\left(\frac{2\pi n}{N}\right) \quad n = 0, 1, \dots\dots . N - 1$$

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signal flow graph for the following discrete-time system described by the difference equation :

$$y(n) = b(0)x(n) + b(1)x(n-1) + a(1)y(n-1)$$

(b) The unit sample response of an IIR filter is :

$$h(n) = \begin{cases} \alpha^n & 0 \le n \le 6 \\ 0 & \text{otherwise} \end{cases}$$

Draw the direct form implementation of this system.

4. Consider the causal linear shift invariant filter with system function :

$$H(z) = \frac{1 + 0 \cdot 875\,z^{-1}}{(1 + 0 \cdot 2\,z^{-1} + 0 \cdot 9\,z^{-2})(1 - 0 \cdot 7\,z^{-1})}$$

Obtain Direct form I and Direct form II signal flow graph for the above function.

5. Discuss an eight point decimation in time FFT algorithm and signal flow graph. How does the algorithm become fast ?

6. Design a low pass Butterworth filter to meet the following specification :

$$f_p = 6\text{ kHz}$$

$$f_s = 10\text{ kHz}$$

$$\delta_p = \delta_s = 0 \cdot 1$$

Obtain system function of the Butterworth filter.

7. Using window design method design a linear phase FIR filter of order $N = 24$ to approximate the following ideal frequency response magnitude :

$$|H_d(e^{j\omega})| = \begin{cases} 1 & |w| \le 0 \cdot 2\,\pi \\ 0 & 0 \cdot 2\,\pi < |w| \le \pi \end{cases}$$

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8. Write short notes on any *two* of the following :

    (i)   Telegen's theorem

   (ii) Discrete Random process

  (iii) Autocorrelation and cross-correlation

  (iv) Correlation method of spectrum analysis

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