QP Code : 29718

Time: 3 hrs   Marks: 100

NOTE: 1) Question No. I is compulsory.
         2) Attempt any **four** questions from the remaining Six questions
         3) Assumptions made should be clearly stated.
         4) Assume any suitable data wherever required but justify the same.

Q1   20
   a) Find $y(n)$ using frequency domain analysis if $x(n) = \{1,2,-1\}$ and $h(n) = \{3,2\}$
   b) Identify the following filters based on their passband by sketching their frequency response $h(n) = \{1, -0.5\}$
   c) Obtain a digital filter transfer function H(ω) by applying Impulse invariance transformation on the analog TF

$$H_a(s) = \frac{s+2}{s^2+4s+3} \quad \text{Use } f_s = 1Ksa/sec$$

   d) Find convolution of $x_1(n) = \{ 1,2,3,4\}$ with $x_2(n) = \{5,6,7,8\}$ when both the signals are periodic

Q2
   a) Determine 8 point FFT for a continuous time signal using DIT FFT algorithm
$$x[n] = \{1,2,1,2,02,1,2\} \qquad\qquad 10$$
   b) $x(n) = \{1 + 5j,\ 2 + 6j,\ 3 + 7j,\ 4 + 8j\}$.   10
      i.   Find DFT X(K)
      ii.   Using the results above and not otherwise find DFT of $x_1(n) = \{ 1,2,3,4\}$

Q3
   a) Perform circular convolution and circular crosscorrelation of

$$x_1(n) = cos\frac{2\pi n}{N} \quad \text{with} \quad x_2(n) = sin\frac{2\pi n}{N} \quad 0 \leq n \leq N-1 \qquad 10$$

   b) One of the zeros of an anti symmetric FIR filter is at $0.5\angle60°$. Show the locations of other zeros. What is the minimum order of this filter? Also find the transfer function and impulse response of this filter   10

Q4
   a) Consider the sequence $x[n] = 4\delta(n) + 3\delta(n-1) + 2\delta(n-2) + \delta(n-3)$.
     Let $X(K)$ be the six point DFT of $x(n)$. Find the sequence $w(n)$ that has six point DFT $W(K)$ such that $W(K) = Re\{X(K)\}$ 10
   b) Determine parallel and cascade form realization of   10

$$H(Z) = 0.7\frac{1-0.36z^{-2}}{(1+0.1z^{-1}-0.72z^{-2})}$$

Q5
   a) The desired response of a low pass filter is   10

$$H_d(\omega) = e^{-j3\omega} \qquad -\frac{3\pi}{4} \leq \omega \leq \frac{3\pi}{4}$$
$$= 0 \qquad \frac{3\pi}{4} \leq |\omega| \leq \pi$$

Determine the frequency response $H(e^{j\omega})$ for M=7 using a Hamming window

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   b) Find poles of a low pass Butterworth filter for N=3. Sketch location of poles in s plane. Also find normalized transfer function.   **10**

Q 6

   a) Explain the need of a low pass filter with a decimator and mathematically prove that
$$\omega_y = \omega_x D$$
                                       10

   b) Explain Goertzel's Algorithm   **10**

Q7 Write notes on   **20**

   a) Interpolation process
   b) Chirp Z Algorithm
   c) Adaptive echo cancellation
   d) Frequency sampling realization of FIR filters

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