R18

Time: 3 Hours   **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a)   Check whether following systems are linear, causal, time invariant, stable, static
       $y(n) = x(n) \cos (x(n))$

   b)   Explain in detail about conversion of analog signal to digital signal with suitable block
        diagram and also explain about reconstructing the signal from its samples.   [7+8]

2.a)   Consider causal and stable LTI system whose I/Ps and O/Ps are related through second
        order difference equation $y(n)-(1/6) y(n-1)-(1/6)y(n-2)=x(n)$, determine system impulse
        response $h(n)$ for the system.

   b)   Describe the decimation process with a factor of 'M'. Obtain necessary expression and
        sketch frequency response. Also discuss aliasing effect.   [7+8]

3.a)   Prove the following properties of DFT when $H(K)$ is the DFT of an N-point sequence $h(n)$
        i) $H(K)$ is real and even when $h(n)$ is real and even.
        ii) $H(K)$ is imaginary and odd when $h(n)$ is real and odd.

   b)   Two finite duration sequence are given by $x(n) = \sin (n\pi/2)$ for $n = 0,1,2,3$ and $h(n) = 2n$
        for $n = 0,1,2,3$. Determine circular convolution using DFT & IDFT method.   [8+7]

4.a)   State and prove the properties of Discrete Fourier Transform.
   b)   Compute IDFT of the sequence
        $x(n) = \{ 7, -0.707-j0.707, -j, 0.707-j0.707, 1, 0.707+j0.707, j, -0.707+j0.707\}$ using FFT
        algorithm.   [7+8]

5.a)   Determine system function $H(z)$ for a Butterworth filter using Bilinear transformation
        for the constraints
        $$0.8 \le |H (e^{j\omega})| \le 1, 0 \le \omega \le 0.2\pi$$
        $$|H (e^{j\omega})| \le 0.2, 0.6\pi \le \omega \le \pi \text{ with } T= 1 \text{ sec.}$$
   b)   Discuss the location of poles for Chebyshev filter.   [8+7]

6.a)   Discuss in detail about Butterworth filter. What is the effect of varying order of N on
        magnitude and phase response?
   b)   The specifications of desired low pass filter is
        $$0.8 \le | H(\omega)| \le 1.0 ; 0 \le \omega \le 0.2\pi$$
        $$| H(\omega)| \le 0.2 ; 0.6\pi \le \omega \le \pi$$
   Design a Chebyshev digital filter using impulse invariant Transformation.   [8+7]

7.a) Determine the filter coefficients of h(n) of length M=15 obtained by sampling method with its frequency response as

$$H(2\pi K/15) = 1 \quad ; K=0,1,2,3,4$$
$$= 0.4 \quad ; K=5$$
$$= 0 \quad ; K=6,7$$

b) Design a HPF of length 8 with cut off frequency of 4 rad/sec using Hamming window. Plot the magnitude and phase response.   [7+8]

8.a) What is the need for signal scaling? How the overflow error scaling is performed?

b) Realize system with following difference equation
y(n) = (3/4) y(n-1) – (1/8) y(n-2) + x(n) + (1/3)x(n-1) using Direct form-I and Direct form-II.   [7+8]

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