CBCS SCHEME

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15EE63

Sixth Semester B.E. Degree Examination, July/August 2021
Digital Signal Processing

Time: 3 hrs. Max. Marks:80

Note: ***Answer any FIVE full questions.***

1 a. Define DFT and IDFT. State and prove linearity property. **(05 Marks)**

b. Find the 4 point DFT of the sequence $x(n) = \cos\left(\frac{n\pi}{4}\right)$. **(06 Marks)**

c. Determine the IDFT of 4 point sequence $X(k) = [4, -j2, 0, j2]$. **(05 Marks)**

2 a. Find the output y(n) of filter whose impulse response is h(n) = [1, 1, 1] and the input signal to the filter is x(n) = [3, –1, 0, 1, 3, 2, 0, 1, 2, 1] using overlap save method. **(08 Marks)**

b. The two response $x_1(n)$ and $x_2(n)$ are given as follows $x_1(n) = [\underset{\uparrow}{2}, 1, 2, 1]$ and $x_2(n) = [\underset{\uparrow}{1}, 2, 3, 4]$ find out the sequence $x_3(m)$ which is equal to circular convolution of above two sequences $x_3(m) = x_1(n) \textcircled{N} x_2(n)$. **(08 Marks)**

3 a. Develop an 8 point DIT-FFT algorithm using signal flow graph for the following sequence x(n) = [1, 1, 1, 1, 0, 0, 0, 0], show all the intermediate results on the signal flow graph. **(10 Marks)**

b. Explain Radix-2 DIF-FFT algorithm. **(06 Marks)**

4 a. The DFT X(K) of sequence is given as $X(K) = \{0, 2\sqrt{2}(1-j), 0, 0, 0, 0, 0, 2\sqrt{2}(1+j)\}$. Determine the corresponding time sequence x(n) and write its signal flow graph. **(10 Marks)**

b. Explain computational efficiency. **(06 Marks)**

5 a. The system function of an analog filter is given as $H_a(s) = \frac{1}{(s+1)(s+2)}$. Obtain H(z) using impulse invariant method. Take sampling frequency of 5 samples /sec. **(08 Marks)**

b. Design an analog filter with maximally flat response in the passband and an acceptable attenuation of -2dB at 20 radians/sec. The attenuation in the stop band should be more than 10dB beyond 30 radians/sec. **(08 Marks)**

6 a. Distinguish between Butterworth and Chebyshew filter. **(04 Marks)**

b. Compare impulse in variance and Bilinear transformation method. **(04 Marks)**

c. Design a unit band width 3dB digital Butterworth of filter of first order by using bilinear transformation. **(08 Marks)**

7 a. Determine the order of a Chebyshew digital lowpass filter to meet the following specifications. In the passband extending from 0 to 0.25π, a ripple of not more than 2dB is allowed. In the stopband extending from 0.4π to π attenuation can be more than 40dB. Use bilinear transportation method. **(08 Marks)**

b. Explain direct form structure for IIR systems and cascade form structure for IIR systems. **(08 Marks)**

8 a. A difference equation describing a filter is given below :

$$y(n) - \tfrac{3}{4}y(n-1) + \tfrac{1}{8}y(n-2) = x(n) + \tfrac{1}{2}x(n-1)$$

Draw direct form I and direct form II structures. **(08 Marks)**

b. Realize the following system function :

i) $H(z) = \left(\tfrac{1}{2} + z^{-1} + \dfrac{z^{-2}}{2}\right)\left(1 + \dfrac{z^{-1}}{3} + z^{-2}\right)$ by cascade realization.

ii) $H(z) = 3 + \dfrac{4z}{z - \tfrac{1}{2}} + \dfrac{2}{z - \tfrac{1}{4}}$ by parallel realization. **(08 Marks)**

9 a. Explain different types of windows. **(08 Marks)**

b. Realize a linear phase FIR filter with the following impulse response give necessary equations : $h(n) = \delta(n) + \tfrac{1}{2}\delta(n-1) - \tfrac{1}{4}\delta(n-2) + \delta(n-4) + \tfrac{1}{2}\delta(n-3)$. **(08 Marks)**

10 a. Design linear phase FIR filters using windows. **(08 Marks)**

b. Bring out the comparison between IIR and FIR filters. **(08 Marks)**

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