CBCS SCHEME

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15EE63

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find the 4-point DFT of the sequence, $x(n) = 6 + \sin\frac{2\pi n}{4}$, $0 \le n \le 3$. **(08 Marks)**

b. Given the sequence $x(n) = \cos\frac{\pi n}{2}$ and $h(n) = 2^n$. Compute the 4-point circular convolution. **(08 Marks)**

OR

2 a. State and prove the following properties of DFT i) Periodicity and ii) Linearity. **(06 Marks)**

b. Consider a FIR filter with impulse response h(n) = {3, 2, 1, 1} if the input is x(n) = {1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1}. Find the output y(n), use overlap-add method, assuming the length of block is 7. **(10 Marks)**

Module-2

3 a. Why FFT is needed? What is the speed improvement factor in calculating 04-point DFT of a sequence using direct computation and FFT algorithm? **(06 Marks)**

b. Compute the 8-point IDFT of the sequence $\alpha(k) = \{0, 2 + 2j, -j4, 2 - 2j, 0, 2 + 2j, j4, 2 - 2j\}$ using the inverse radix-2 DIT algorithm. **(10 Marks)**

OR

4 a. What are the differences and similarities between DIT and DIF-FFT algorithm? **(06 Marks)**

b. Using DIF FFT algorithm, compute the sequence x(n) = {1, 2, -1, 2, 4, 2, -1, 2}. **(10 Marks)**

Module-3

5 a. Transform $H(s) = \frac{s+a}{(s+a)^2 + b^2}$ in to a digital filter using impulse invariance technique. **(08 Marks)**

b. Show that the bilinear transformation maps.

i) The $j\Omega$ axis in s-plane on to the unit circle, $|z| = 1$.

ii) The left half s-plane, $Re(s) < 0$ inside the unit circle, $|z| < 1$. **(08 Marks)**

OR

6 a. Mention the difference between Butterworth and Chebyshev filters. **(04 Marks)**

b. Determine the H(z) for a lowest order Butterworth filter satisfying following constraints:

$\sqrt{0.5} \le |H(e^{jw})| \le \quad 0 \le |w| \le \pi/2$

$|H(e^{jw})| \le 0.2 \quad 3\pi/4 \le w \le \pi$, with $T = 1sec$. Apply impulse invariant transformation. **(12 Marks)**

Module-4

7 a. Obtain the cascade realization of system function, $H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-1} + 2z^{-3}$. **(04 Marks)**

b. Design the digital filter using Chehyshev approximation and bilinear transformation to meet the following specifications:

i) Passband ripple = 1dB for $0 \le w \le 0.15\pi$

ii) Stopband attenuation $\ge$ 20dB for $0.45\pi \le w \le \pi$ **(12 Marks)**

OR

8 a. Obtain the direct form-I, direct form – II, cascade and parallel form realization for the following system:

$y(u) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. **(12 Marks)**

b. Obtain the direct form-I structure for the given impulse response of a filter:

$h(u) = \left(\frac{1}{2}\right)^n [u(n) - u(n-3)]$. **(04 Marks)**

Module-5

9 a. The frequency response of a linear phase FIR filter is given by,

$H(e^{jw}) = e^{j3w}[2 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w]$.

Find the impulse sequence of the filter. **(12 Marks)**

b. Mention the advantages and disadvantages of frequency sampling method. **(04 Marks)**

OR

10 a. Compare IIR filter and FIR filter. **(08 Marks)**

b. Design an FIR filter (lowpass) using rectangular window with passband gain of 0dB, cut-off frequency of 200Hz, sampling frequency of 1kHz. Assume the length of the impulse response as 7. **(08 Marks)**

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