ONE TIME EXIT SCHEME

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10EC52

Fifth Semester B.E. Degree Examination, April 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Standard notations are used.***
3. ***Missing data be suitably assumed.***
4. ***Draw neat diagram, wherever necessary.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.

PART – A

1 a. Compute the 8-point DFT of the sequence,
$x(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$. **(08 Marks)**

b. Compute the circular convolution of the sequences, $x_1(n) = \{2, 1, 2, 1\}$ & $x_2(n) = \{1, 2, 3, 4\}$ using DFT and IDFT method. **(12 Marks)**

2 a. State and prove Time Reversal property of DFT. **(08 Marks)**

b. State and prove circular Time shifting property of DFT. **(08 Marks)**

c. State and prove circular frequency shift property of DFT. **(04 Marks)**

3 a. Develop decimation in frequency algorithm with all necessary steps and neat signal flow diagram used in computing N-point DFT X(K) of a N-point sequence x(n). **(10 Marks)**

b. Use Signal flow graph compute the DFT of a sequence, $x(n) = \{1, -1, 1 -1, 1\}$ of length fine. **(10 Marks)**

4 a. Find the DFT of the sequence $x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$ using the decimation in time FFT algorithm and draw the signal flow. Also show all intermediate values. **(10 Marks)**

b. Write a note on Goertzel algorithm. **(05 Marks)**

c. Write a note on Chirp Z-transform algorithm. **(05 Marks)**

PART – B

5 a. Determine H(z) for a butterworth filter satisfying the following constraints:

$$\sqrt{.5} \le |H(e^{j\omega})| \le 1, \; 0 \le \omega \le \frac{\pi}{2}$$

$$|H(e^{j\omega})| \le 0.2, \; \frac{3\pi}{4} \le \omega \le \pi$$

with T = 1 seconds. Apply impulse invariant transformations. **(14 Marks)**

b. Design a bandreject filter for N = 7, $W_{C_1} = 1$ radians/second, $W_{C_2} = 2$ radians/second. Use rectangular window function. Also determine the frequency response $H(e^{j\omega})$ if the designed filter. **(06 Marks)**

6 a. Explain the structures Direct form – I , Direct form – II, cascade form and parallel form used for realizing digital filter by illustrations. (10 Marks)

b. Realize the following system function using Direct form – I, Direct form – II, cascade form and parallel form:

$$H(z)=\frac{0.7\left(1-0.36z^{-2}\right)}{1+0.1z^{-1}-0.72z^{-2}}$$ (10 Marks)

7 a. A lowpass filter is to be designed with the following frequency response,

$$H_d(e^{j\omega})=\begin{cases} e^{-j2\omega}, & -\frac{\pi}{4}\le\omega\le\frac{\pi}{4} \\ 0, & \frac{\pi}{4}<|\omega|\le\pi \end{cases}$$

Determine the filter co-efficients $h_d(n)$ if the window function is defined as,

$$\omega(n)=\begin{cases} 1, & 0\le n\le 4 \\ 0, & \text{Otherwise} \end{cases}$$

Also determine the frequency response $H(e^{j\omega})$ of the designed filter. (10 Marks)

b. Explain the Gibb's phenomenon. List and explain different types of window functions. (10 Marks)

8 a. Explain how an analog filter is mapped on to a digital filter using backward difference method. Use this technique convert the analog filter with system function $H(s)=\frac{1}{s+2}$ into a digital filter. (14 Marks)

b. Convert the analog filter into a digital filter whose system function is,

$$H(s)=\frac{2}{(s+1)(s+3)}$$

using bilinear transformations with T = 0.1 seconds. (06 Marks)

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