USN | | | | | | | | | | **10EE64**

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

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. (i) If DFT $[x(n)] = X(K)$, then show that DFT $[x((c-n))_N] = X((c-K))_N$.

(ii) DFT $[x^*(n)] = X^*(n-K)$

(iii) DFT $[x(n)e^{j2\pi ln/N}] = X((K-l))_N$. **(12 Marks)**

b. Find DFT of the sequence, $x(n) = \begin{cases} 1; & 0 \le n \le 2 \\ 0; & \text{Otherwise} \end{cases}$ for N = 4, plot $|X(K)|$ and $\underline{|X(K)}$. **(08 Marks)**

2 a. Make a comparison between circular convolution and linear convolution. Given $x_1(n) = \{1, -1, -2, 3, -1\}$ and $x_2(n) = \{1, 2, 3\}$. Find the circular convolution of $x_1(n)$ and $x_2(n)$. **(10 Marks)**

b. What are the two methods of sectional convolution? Explain them. **(10 Marks)**

3 a. Let x(n) be a finite length sequence with $X(K) = (10, -2+j2, -2, -2-j2)$. Using the properties of DFT find the DFT's of the following sequence:
(i) $x_1(n) = x((n+2))_4$ and (ii) $x_2(n) = x(4-n)$ **(08 Marks)**

b. If $x(n) = \{1, 2, 0, 3, -2, 4, 7, 5\}$, evaluate the following :

(i) X(0) (ii) X(4) (iii) $\sum_{K=0}^{7} X(K)$. (iv) $\sum_{K=0}^{7} |X(K)|^2$ **(08 Marks)**

c. What are the difference and similarities between DIT and DIF-FFT algorithms? **(04 Marks)**

4 a. Compute the 8-pt DFT of the sequence, $x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$ using the inplace radix-2 DIT algorithm. **(10 Marks)**

b. Derive the Radix-2 DIF-FFT algorithm to compute the DFT of a N = 8 pt. sequence and draw the complete signal flow graph. **(10 Marks)**

PART – B

5 a. Develop a transformation for the solution of a first order linear constant coefficient difference equation by using trapezoidal approximation for the internal approximation. High light the features of transformation. **(08 Marks)**

b. Design a digital LPF with a passband magnitude characteristic that is constant within 0.75 dB for frequencies below $w = 0.2613\pi$ and stop band attenuation of atleast 20 dB for frequencies between $w = 0.4018\pi$ and π. Determine the transfer function H(z) for the lowest order butterworth design which meets the specifications. Use bilinear transformation. Assume T = 2 sec. **(12 Marks)**

6 a. The transfer function of analog filter is given by $H_a(s) = \frac{1}{(s+1)(s+2)}$. Find H(z) using impulse invariance method, if $F_S = 5$ samples / sec. **(06 Marks)**

b. Distinguish between butterworth and chebyshev (Type I) filters. **(04 Marks)**

c. Describe the transformation relation used for converting an analog LPF into, (i) LPF (ii) HPF (iii) BPF (iv) BSF both in Analog domain and Digital domain. **(10 Marks)**

7 a. What are the advantages and disadvantages with the design of FIR filters using window function? **(06 Marks)**

b. The frequency response of a FIR filter is given by, $H(e^{jw}) = jw;\ -\pi \le w \le \pi$.
Design the filter, using a rectangular window function. Take N = 7. **(08 Marks)**

c. The frequency response of a linear phase FIR filter is given by, $H(e^{jw}) = e^{j3w}\left[2 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w\right]$. Find the impulse response sequence of the filter. **(06 Marks)**

8 a. Let the coefficients of a three stage FIR lattice structure be $K_1 = 0.1$, $K_2 = 0.2$, $K_3 = 0.3$. Find the coefficients of direct form FIR filter and draw its block diagram. **(08 Marks)**

b. A discrete time system H(z) is expressed as,

$$H(z) = \frac{10\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{2}{3}z^{-1}\right)\left(1 + 2z^{-1}\right)}{\left(1 - \frac{3}{4}z^{-1}\right)\left(1 - \frac{1}{8}z^{-1}\right)\left[1 - \left(\frac{1}{2} + j\frac{1}{2}\right)z^{-1}\right]\left[1 - \left(\frac{1}{2} - j\frac{1}{2}\right)z^{-1}\right]}.$$

Realize parallel and cascade forms using second order sections. **(12 Marks)**

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