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GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, December – 2020

(Fifth Semester)

BECPC5020 / BEIPC 5020 – DIGITAL SIGNAL PROCESSING

(AE&IE and ECE)

Time: 2 hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 = 10 Marks)**

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. The first six points of the 8-point DFT of a real valued sequence are 5, 2-j4, 1-j3, 3-j4, 0 and 3+j4. The last two points of the DFT are respectively CO1 PO1

(i) 2-j4, 1-j3 (ii) 1+j3, 2+j4

(iii) 1+j3, 5 (iv) 1-j3, 2-j4

b. Direct computation of the N-point inverse DFT /FFTwould require complex multiplications are CO1 PO1

(i) $N^2/2$ and $N\log_2 N$ (ii) N^2 and N(N-1)

(iii) N(N-1) and $N/2\log_2 N$ (iv) None

c. The 4 point DFT of a discrete time sequence {1, 2, 3, 4} is CO2 PO1

(i) [10, -2,+2j, 2, -2-2j] (ii) [10, -2+2j, -2, -2-2j]

(iii) [10,1-3j, 2, 1+3j] (iv) [10, -1+3j, 0, -1-3j]

d. Two discrete time system with impulse response $h_1(n) = \delta[n-1]$ and $h_2[n] = \delta[n-2]$ are connected in cascade. The overall impulse response of the cascaded system is CO2 PO2

(i) δ[n-1]+δ[n-2] (ii) δ[n-3]

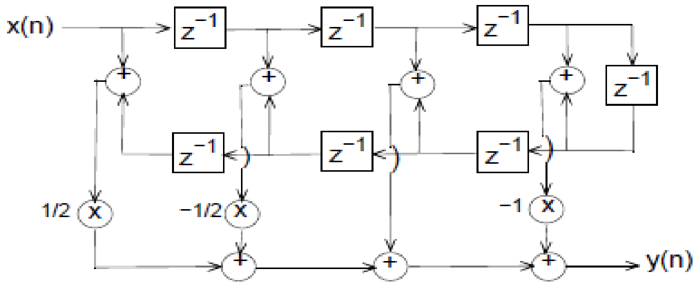
(iii) δ[n-1]δ[n-2] (iv) δ[n-4]

e. A sequence x(n) of length 32 is given and it is required to compute its 32 point DFT by using FFT (decimation-in-time) algorithm. In the revised order data vector at the FFT input, determine the position of x(24), CO2 PO2

(i) 12 (ii) 3

(iii) 8 (iv) 6

f. For the digital filter shown in figure, find the frequency response $H(e^{jw})$ CO3 PO2



(i) 1, -1, 2, -2, -2, 2, -1, 1 (ii) ½, -1/2, 1, -1

(iii) ½, -1/2, 1, -1, -1, 1, -1/2, ½ (iv) 0, 0, 0, 0, ½, -1/2, 1, -1

g. What is the condition for linear phase FIR filter for Symmetry condition CO3 PO1

(i) h(n) = +h(M-1-n) (ii) h(n) = -h(M-1-n)

(iii) h(n) = +h(M+1-n) (iv) h(n) = -h(M+1-n)

h. A low pass filter is described by the following difference equation: y(n) = 0.5x(n)+0.1x(n-1). The filter is converted into a high pass filter by giving π right shift to $H(e^{jw})$. The input-output relation of the high pass filter is given by CO4 PO2

(i)y(n) = 0.5x(n)-0.1x(n-1). (ii) y(n) = 0.5x(n)+0.1x(n-1).

(iii)y(n)= -0.5x(n)-0.1x(n-1). (iv)y(n)=-0.5x(n)+0.1x(n-1).

i. Given analog filter $H_a(s)=\frac{s+2}{(s+2)^2+16}, \operatorname{Re}(s)>-1$ Determine the digital filter H(z) is designed from $H_a(s)$ using impulse invariant method. Assume sampling period T. CO4 PO2

(i) $\frac{1-e^{T}\sin(2T)z^{-1}}{1-2e^{-T}\sin(2T)z^{-1}+e^{-2T}z^{-2}}, |z|<e^{-T}$ (ii) $\frac{1-e^{-2T}\cos(4T)z^{-1}}{1-2e^{-2T}\cos(4T)z^{-1}+e^{-4T}z^{-2}}, |z|<e^{-2T}$

(iii) $\frac{1-e^{-2T}\sin(4T)z^{-1}}{1-2e^{-T}\sin(2T)z^{-1}+e^{-2T}z^{-2}}, |z|>e^{-T}$ (iv) $\frac{1-e^{-T}\cos(2T)z^{-1}}{1-2e^{-T}\cos(2T)z^{-1}+e^{-2T}z^{-2}}, |z|>e^{-T}$

j. An IIR filter is designed from a prototype causal and stable analog filter $H_a(s)=\frac{1}{(s+2)(s+3)}$ by the impulse invariant method. Determine the IIR filter poles of H(z) CO4 PO1

(i) e^{T} and e^{2T} (ii) e^{-2T} and e^{-3T}
(iii) e^{-T} and e^{2T} (iv) e^{2T} and e^{-3T}

PART – B: (Short Answer Questions) (2 x 5 = 10 Marks)

Q.2. Answer ***ALL*** questions

	Question	[CO#]	[PO#]
a.	**Give** the relationship between Z-Transform and DFT	CO1	PO1
b.	How many multiplication and additions are required for 16 point in DFT and FFT	CO2	PO1
c.	Determine the transversal structure of the system function $H(z) = 1+2z^{-1}-4z^{-3}$	CO3	PO2
d.	State the necessary condition for Asymmetry linear phase FIR filter?	CO3	PO1
e.	An impulse response, h(t) = exp(-2t) u(t) of certain LTI system. Find the H(z) by using impulse invariant technique. Assume T = 0.1 sec.	CO4	PO2

PART – C: (Long Answer Questions) (6 x 5 = 30 Marks)

Answer ***ANY FIVE*** questions

	Question	Marks	[CO#]	[PO#]
3.	State and prove the circular shift theorem of DFT	(6)	CO1	PO1
4.	Find the output of a filter whose impulse response is h(n)={1,2,2} and input signal x(n) = {3,-1,0,1,3,2,0,1,2,1} using Overlap-save method	(6)	CO1	PO1
5.	The DFT of x(n) is described as X(K)={0,-1-i,6,-1+i}. Find the DFT of $x^2(n)$?	(6)		
6.	Design a FIR filter using Hamming window of length 5 if the desired frequency response is $H_d(\omega) = e^{-j2\omega}$ for $-\pi/4\le\omega\le\pi/4$; $= 0$ Otherwise	(6)		
7.	Find the FFT of the sequence x(n) = {1,2,3,4,1,2,3,4} using DIT algorithm and demonstrate radix-2 DIT FFT algorithm	(6)	CO2	PO2
8.	Find the 8-point DFT using DIF-FFT algorithm if x(n)={1,2,2,3,1,4}	(6)		
9.	Obtain the Direct Form-II, Parallel realization of the system described by y(n) = -0.1 y(n-1) + 0.72 y(n-2) + 0.7 x(n) -0.252 x(n-2)	(6)	CO4	PO2
		(6)		
10.	**Apply** the impulse invariant method $H_a(s)=\frac{10}{(s+2)(s+5)}$ and find the corresponding digital filter transfer function for sampling frequency of 0.1 samples/second.	(6)	CO4	PO2