GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
DIGITAL SIGNAL PROCESSING
EI403

TIME ALLOTTED: 3 HOURS **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)
Answer any *ten* from the following, choosing the correct alternative of each question: 10×1=10

			Marks	CO No
1.	(i)	The discrete impulse function is defined by a) $\delta(n) = 1, n \geq 0 = 0, n \neq 1$ b) $\delta(n) = 1, n = 0 = 0, n \neq 1$ c) $\delta(n) = 1, n \leq 0 = 0, n \neq 1$ d) $\delta(n) = 1, n \leq 0 = 0, n \geq 1$	1	CO1
	(ii)	If a system do not have a bounded output for bounded input, then the system is said to be _____ a) Causal b) Non-causal c) Stable d) Non-stable	1	CO1
	(iii)	If the Nyquist rate for $x_a(t)$ is Ωs , what is the Nyquist rate for $x_a^2(t)$ a) $\Omega s/4$ b) $\Omega s/2$ c) Ωs d) $2\Omega s$	1	CO1
	(iv)	If x(n) and X(k) are an N-point DFT pair, then X(k+N)=? a) X(-k) b) -X(k) c) X(k) d) None of the mentioned	1	CO3
	(v)	Which of the following is true regarding the number of computations required to compute an N-point DFT? a) N^2 complex multiplications and N(N-1) complex additions b) N^2 complex additions and N(N-1) complex multiplications c) N^2 complex multiplications and N(N+1) complex additions d) N^2 complex additions and N(N+1) complex multiplications	1	CO3
	(vi)	Time reversal of a discrete time signal refers to a) y[n] = x[-n+k] b) y[n] = x[-n] c) y[n] = x[-n-k] d) y[n] = x[n-k]	1	CO1

(vii)	DTFT is the representation of a) Periodic Discrete time signals b) Aperiodic Discrete time signals c) Aperiodic continuous signals d) Periodic continuous signals		1	CO3
(viii)	$W_N^{k+N/2} =$ a) W_N^k b) $-W_N^k$ c) W_N d) None of the mentioned		1	CO3
(ix)	Overlap-Add Method Deals with principles that a) The linear convolution of a discrete-time signal of length L and a discrete-time signal of length M produces a discrete-time convolved result of length L + M + 1 b) The linear convolution of a discrete-time signal of length L and a discrete-time signal of length M produces a discrete-time convolved result of length L + M-1 c) The linear convolution of a discrete-time signal of length L and a discrete-time signal of length M produces a discrete-time convolved result of length 2L + M – 1 d) The linear convolution of a discrete-time signal of length L and a discrete-time signal of length M produces a discrete-time convolved result of length 2L + 2M – 1		1	CO3,CO6
(x)	Determine the convolution sum of two sequences x(n) = {3, 2, 1, 2} and h(n) = {1, 2, 1, 2} a) y(n) = {3,8,8,12,9,4,4} b) y(n) = {3,8,3,12,9,4,4} c) y(n) = {3,8,8,12,9,1,4} d) y(n) = {3,8,8,1,9,4,4}		1	CO6
(xi)	Causal systems are the systems in which a) The output of the system depends on the present and the past inputs b) The output of the system depends only on the present inputs c) The output of the system depends only on the past inputs d) The output of the system depends on the present input as well as the previous outputs		1	CO1
(xii)	FIR filter is also called ____? a) Recursive filter b) Non-recursive c) Higher resistance d) Lower resistance		1	CO4, CO5

GROUP – B
(Short Answer Type Questions)
Answer any ***three*** from the following: **3×5=15**

			Marks	CO No
2.		Find the circular convolution of two finite duration sequences $x_1(n) = \{1,-1,-2,3,-1\}$; $x_2(n) = \{1,2,3\}$.	5	CO6
3.	(a)	What is aliasing effect? How can it be removed?	2	CO1

	(b)	Consider the difference equation y (n) - 2/3 y (n-1) + 1/6 y(n-2) = 1/3 x (n-1) Find the system function and impulse response. Is y(n) recursive?	3	CO2
4.		a) What is a causal system? b) If a system is described by y(n) = x(n) + 3x(n - 4) ,determine whether the system is causal or non-causal	5	CO2
5.		State shifting property of the DFT	5	CO3
6.		By impulse invariant method obtain the digital filter transfer function and the differential equation of the analog filter h(s) =1/s+1	5	CO4

GROUP – C
(Long Answer Type Questions)
Answer any ***three*** from the following: **3×15=45**

			Marks	CO No.
7.	(a)	Compute the FFT for the sequence x(n) = n2 + 1 where N = 8 using DIT algorithm.	8	CO6
	(b)	Calculate 4 point DFT of 4 point sequence x(n)={1 ,2 ,3, 4}	4	CO3
	(c)	Explain twiddle factor?	3	CO2, CO3
8.	(a)	Compute the DFT for the sequence {1, 2, 0, 0, 0, 2, 1, 1}. Using radix -2 DIF FFT Algorithm. Derive the equation to implement a butterfly structure In DITFFT algorithm.	10	CO3
	(b)	State the following properties of DFT (i) Time reversal (ii) Parsavel's theorem	5	CO3
9.	(a)	Obtain the impulse response of digital filter to correspond to an analog filter with impulse Response h_a (t) = 0.5 e-2t and with a sampling rate of 1.0kHz using impulse invariant method.	9	CO4
	(b)	Compare bilinear transformation and impulse invariant mapping.	6	CO4
10.	(a)	Find the output y(n) of a filter whose impulse response is h(n) = {1,1,1} and the input signal x(n) = {3,-1,0,1,3,2,0,1,2,1} using overlap-save method	10	CO5
	(b)	What are the effects of windowing?	5	CO5
11.		Answer any three :-	3x5=15	
	(a)	Frequency domain representation of discrete time signals		CO3
	(b)	List special feature of DSP architecture	5	CO5
	(c)	Circular Convolution	5	CO3
	(d)	BIBO stability	5	CO6
	(e)	Differences and similarities between DIT and DIFPID control action	5	CO3