

**GURU NANAK INSTITUTE OF TECHNOLOGY**  
**An Autonomous Institute under MAKAUT**  
**2020-2021**  
**DIGITAL SIGNAL PROCESSING**  
**EC503**

**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**

			<b>Marks</b>	<b>CO No</b>
1	(i)	DIT algorithm divides the sequence into a) Positive and negative values b) Even and odd samples c) Upper higher and lower spectrum d) Small and large samples	1	CO2
	(ii)	Which of the following is used in the realization of a system? a) Delay elements b) Multipliers c) Adders d) All of the mentioned	1	CO2
	(iii)	if $x(n)=(1,0,0,1)$ , the DFT value of $x(0)$ is a) 2 b) $1+j$ c) 0 d) $1-j$	1	CO2
	(iv)	FIR filter is a) Recursive and linear b) Non-recursive and linear c) Recursive and non-linear d) Recursive.	1	CO5
	(v)	How many complex multiplications are need to be performed for each FFT algorithm? a) $(N/2)\log N$ b) $N\log 2N$ c) $(N/2)\log 2N$ d) None of the mentioned	1	CO2
	(vi)	What is the circular convolution of the sequences $x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$ ? a) $\{14,14,16,16\}$ b) $\{16,16,14,14\}$ c) $\{2,3,6,4\}$ d) $\{14,16,14,16\}$	1	CO1

(vii)	The impulse response of ideal filter is a) Causal b) Non Causal c) Non Causal and finite d) none	1	CO5
(viii)	To reduce side lobes, in which region of the filter the frequency specifications has to be optimized? a) Stop band b) Pass band c) Transition band d) None of the mentioned	1	CO5
(ix)	How many memory locations are used for storage of the output point of a sequence of length M in direct form realization? a) M+1 b) M c) M-1 d) None of the mentioned	1	CO5
(x)	In IIR Filter design by the Bilinear Transformation, the Bilinear Transformation is a mapping from a) Z-plane to S-plane b) S-plane to Z-plane c) S-plane to J-plane d) J-plane to Z-plane	1	CO5
(xi)	In Overlap save method of long sequence filtering, what is the length of the input sequence block? a) L+M+1 b) L+M c) L+M-1 d) None of the mentioned	1	CO3
(xii)	Gibb's phenomenon occurred due to a) Linear phase b) Truncation of infinite Fourier series c) Window method d) Nonlinear phase	1	CO5

**GROUP – B**

**(Short Answer Type Questions)**

Answer any *three* from the following: **3×5=15**

		<b>Marks</b>	<b>CO No</b>
2.	Compute the circular convolution of the sequences $x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$ using concentric circular method.	5	CO3
3.	(a) What is Butter fly diagram? Explain with net sketch diagram.	3	CO2
	(b) What is bit reversal technique?	2	CO2

4.	For the analog filter with the transfer function $H(s) = \frac{1}{(s+1)(s+2)}$ . Determine $H(z)$ using impulse invariant method with $T=1$ sec.	5	CO5
5.	Compute the DFT of the sequence whose values for one period is given by $x(n) = \{1, 1, -2, -2\}$	5	CO1
6.	(a) What do you mean by Input Quantization Error, explain with an example?	3	CO4
	(b) Define “dead band” of the filter.	2	CO4

**GROUP – C**

**(Long Answer Type Questions)**

Answer any *three* from the following:  $3 \times 15 = 45$

		<b>Marks</b>	<b>CO No</b>
7.	(a) Why FFT is needed?	2	CO2
	(b) Compute the 8-point DFT of the sequence $x(n) = \{1, 2, 2, 1, 0, 1, 2, 3\}$ using DIT FFT algorithm.	8	CO2
	(c) Show that multiplication of two DFTs $X_1(k)$ and $X_2(k)$ is equal to the IDFT of circular convolution	5	CO1
8.	(a) Find the output $y(n)$ of a filter whose impulse response is $h(n) = \{1, 0, 1\}$ and input signal $x(n) = \{1, 2, 0, 2, -1, 2, 1, 1, 3, -2, 0, 1, 2\}$ using overlap add method and overlap save method.	12	CO1, CO4
	(b) Find the system transfer function for the following difference equation $y[n] - 3y[n-1] + 2y[n-2] = x[n] - x[n-1]$	3	CO5
9.	(a) Convert the following analog filter with $H(s) = \frac{s+0.1}{(s+0.1)^2 + 16}$ into a digital IIR filter by means of bilinear transformation. The digital filter is to have a resonant frequency $\omega_r = \pi/4$ .	6	CO5
	(b) Design the Analog Butterworth filter that has a -2dB passband attenuation at 20rad/sec and -10dB stop band attenuation at 30 rad/sec.	9	CO5
10.	(a) Obtain the Direct Form I, Direct Form II and Cascade Form realization for the system $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$	12	CO5
	(b) What is warping effect?	3	CO5
11.	Write short notes on ( <i>any three</i> )	3x5	
	(a) TMS 320 C 5416 architecture	5	CO4
	(b) Design of FIR filter using windows	5	CO4
	(c) Zero input limit cycle oscillation	5	CO4
	(d) Bilinear transformation	5	CO5
	(e) Gibb’s Phenomenon	5	CO5