

Roll No																			
---------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023**

Semester : Semester VI - 2020

Course Code : ECE3002

Course Name : Sem VI - ECE3002 - Digital Signal Processing

Program : ECM

Date : 16-JUN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
 - (ii) Question paper consists of 3 parts.
 - (iii) Scientific and non-programmable calculator are permitted.
 - (iv) Do not write any information on the question paper other than Roll Number.
-

PART A

ANSWER ALL THE QUESTIONS

(5 X 2 = 10M)

1. The DFT can be used as an intermediate step in signal processing. $x(n)$ is a real sequence and $X(k)$ is its N -point DFT. The 8 point DFT of $x(n)$ is $X(k) = \{28, (-4+9.656j), (-4-4j), (-4+1.656j), (-4), (-4-1.656j), (-4+4j), \underline{\hspace{2cm}}\}$. Fill the blank value.
(CO4,CO3) [Knowledge]
2. In mathematics and signal processing, the Z-transform converts a discrete-time signal, which is a sequence of real or complex numbers, into a complex frequency-domain (z-domain or z-plane) representation.
If $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$ where n varies from (-1) to (6) . It means that $x(0)=1$; Find the Z transform of the finite duration signal $x(n)$.
(CO2) [Knowledge]
3. A particular filter operated over a wide range of frequencies and able to pass the frequency less than given cutoff frequency and attenuating the information of higher frequency. Which is functioning as _____ filter.
(CO4) [Knowledge]
4. A discrete-time signal with length 'L' and another discrete-time signal of length 'M' are linearly convolved and produces a discrete signal of length _____.
(CO1) [Knowledge]
5. Fast Fourier Transform (FFT) algorithm is used to compute a Discrete Fourier Transform (DFT). In FFT algorithm, Number of Addition and Multiplications are reduced. How many complex Additions are needed to compute DFT of a 8 point sequence?
(CO3) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS

(2 X 15 = 30M)

6. Filters are used in a wide variety of applications. Most of the time, the final goal of using a filter is to achieve a kind of frequency selectivity on the spectrum of the input signal. For the given transfer function of the filter $H(z) = (1/2) + 1/3z^{-1} + z^{-2} + (1/4)z^{-3} + z^{-4} + (1/3)z^{-5} + (1/2)z^{-6}$ identify and draw the suitable filter structure.

(CO3,CO4) [Comprehension]

7. $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}$ where n varies from (-2) to (5) . It means that $x(0) = 3$; This sequence is considered as a discrete input signal to a system which produces the output by delaying the input by 2 unit time instant. That system output is considered as $y(n)$. Find the Z Transform of $y(n)$.

(CO1,CO2) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS

(3 X 20 = 60M)

8. The direct computation of DFT requires large number of computations; hence, more processing time is required. Therefore, FFT is used to compute DFT in a faster manner.

i) Compute 4-point DIT-FFT & DIF-FFT for the sequence $x(n) = \{1, 2, 1, 2\}$

ii) Calculate the number of Complex Multiplications and Complex additions needed in Direct DFT and FFT.

(CO3) [Application]

9. The symmetry property of a linear-phase FIR filter can be used to reduce the number of the required multiplications. Draw the Direct Form and linear-phase structure of the following system with impulse response $h(n) = \{1, 2, 3, 4, 3, 2, 1\}$ and compare the Number of multipliers needed by both the structures.

(CO4) [Application]

10. A system is defined as a physical device that can produce an output or response for the given input. Any DT system can be represented by difference equation. Identify at least 5 properties of the system with equation $y(n) = x(-n/2)$.

(CO2,CO1) [Application]