Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF INFORMATION SCIENCE
MID TERM EXAMINATION - APR 2023

Semester : Semester IV - 2021
Course Code : CSA3056
Course Name : Sem IV - CSA3056 - DE: Intelligent Signal Processing
Program : BCV

Date : 13-APR-2023
Time : 2:00PM - 3:30PM
Max Marks : 50
Weightage : 25%

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. An analog signal is a voltage, current, or physical quantity that continuously and infinitely varies in accordance with some time-varying parameter. For example, radio waves, television waves, or sound waves are all examples of analog signals. If we start with the analog signal, which three operations so we use to convert it to the digital 'equivalent'?

(CO1) [Knowledge]

2. A truth table is a breakdown of all the possible truth values returned by a logical expression. Write out the Truth Table for AND, OR and XOR gate

(CO1) [Knowledge]

3. In signal processing, sampling is the reduction of a continuous-time signal to a discrete-time signal. If I want to convert a 100 kHz analog signal into a digital signal, what is the minimum sampling frequency to avoid aliasing?

(CO1) [Knowledge]

4. The resolution of Digital to Analog Converter is given by the number of bits, N. The resolution is the smallest increment of output that the DAC can produce. For a range of 0-5V, and a 3-bit resolution, what is the binary value for 5.5 V?

(CO2) [Knowledge]

5. In mathematics (in particular, functional analysis), convolution is a mathematical operation on two functions (f and g) that produces a third function, that expresses how the shape of one is modified by the other. Write the expression for convolution operation.

(CO2) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **(4 X 5 = 20M)**

6. A discrete time signal is a signal having amplitudes at only discrete points of time. For the following discrete time signal

$$x[n]= \{ 2, \underset{\uparrow}{3}, 3, 0, 3, 2, 1\}$$

Draw (i) x [0.75n],
(ii) x [n+1]

(CO1) [Comprehension]

7. A discrete time signal cannot take real values of time. It can only take discrete values of time.

For the signal x[n] = {2, -3, 1, 0, 1, -3, 2}

Draw (i) x [3n]
(ii) x [n-2]
(iii) x [-n]

(CO1) [Comprehension]

8. Convolution is a mathematical tool to combining two signals to form a third signal. Therefore, in signals and systems, the convolution is very important because it relates the input signal and the impulse response of the system to produce the output signal from the system. Find the result of convolution between $x[n] = 2\delta[n+2] + \delta[n]$ and $h[n] = 2\delta[n] - 3\delta[n-2]$

(CO2) [Comprehension]

9. One of characteristics of signal is symmetry that may be useful for signal analysis. Even signals are symmetric around vertical axis, and Odd signals are symmetric about origin. Even Signal. For the signal $x[n] = 2\delta[n+2] + 3\delta[n+1] - 3\delta[n-1] - 2\delta[n-2]$ and $h[n] = 2\delta[n+1] + 3\delta[n+1] + 3\delta[n-1] + 2\delta[n-1]$,
find $x_o[n] + h_e[n]$, where $x_o[n]$ is the odd symmetric signal of x[n] and $h_e[n]$ is the even symmetric signal of h[n]

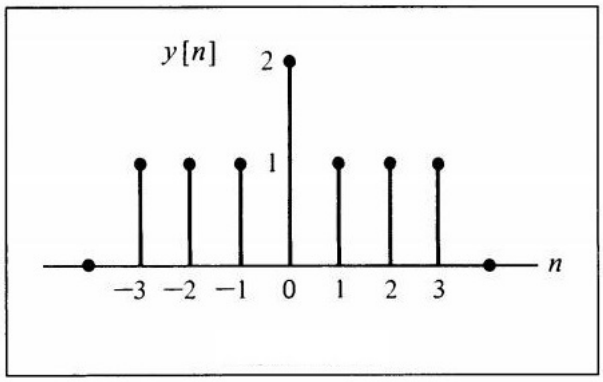
(CO2) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(2 X 10 = 20M)**

10. In mathematics, even functions and odd functions are functions which satisfy particular symmetry relations, with respect to taking additive inverses.

Consider the signal $y[n]$ in Figure



Find

1. Ye [n]+ Yo[n]
2. Ye [n]- Yo[n]

Where Ye [n] is the even symmetric signal and Yo[n] is the odd symmetric signal of y[n]

(CO1) [Application]

11. You have a -5 to 5V signal. Separate the voltage range such that it fits into a 4-bit number. Draw the table for Discrete Voltage Ranges (V) for the sixteen output states and the corresponding Output Binary Equivalent

(CO2) [Application]