

International Islamic University Chittagong

Department of Electronics and Telecommunication Engineering

Mid Term Examination, Spring-2022

Course Code: ETE-4743/ETE4703

Course Title: Digital Signal processing

Full Marks: 30

Time: 1.5 hours

[Answer any three from the following questions]

- 1(a) Explain the Analog to Digital signal conversion process with proper block diagram 5 CO1
and **motive your answer briefly.** 5 CO2

- 1(b) Consider the analog signal

$$x_a(t) = 3 \cos 50 \pi t$$

Determine the minimum sampling rate required to avoid aliasing. Suppose that the signal is sampled at the rate $F_s = 25$ Hz. What is the discrete time signal obtained after sampling and **Justify your answer briefly**

- 2(a) Determine the response of the following systems to the input signal $x(n)$ 5 CO2

$$x(n) = \begin{cases} |n|, & -3 \leq n \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

i. $y(n) = x(n-1)$

ii. $y(n) = x(n+1)$

iii. $y(n) = \frac{1}{3}[x(n+1) + x(n) + x(n-1)]$

- 2(b) Determine if the systems described by the following input-output equations are causal or non-causal. **Justify your answer briefly** 5 CO2

i. $y(n) = x(n) - x(n-1)$

ii. $y(n) = \sum_{k=-\infty}^n x(k)$

iii. $y(n) = x(n^2)$

iv. $y(n) = x(2n)$

v. $y(n) = x(n) + 3x(n+4)$

- 3(a) Determine the system's response $Y(n)$ graphically and analytically for the following signals using the convolution method. 5 CO2

$$h(n) = \{1, 2, 1, -3, \}$$

$$x(n) = \{1, 3, 4, 1, \}$$

Where $h(n)$ is the impulse response of the LTI system, $X(n)$ is the input signal and **Justify your answer briefly.**

- 3(b) Provide an analytical and graphical explanation of the following signals, and **Justify your answer in a few words.** 5 CO1

I. Unit Sample sequence

II. Energy signal and power signal

III. Unit step signal

IV. Exponential Signal

- 4(a) Provide the definition of the Z-transform of a sequence $X(n)$. Explain the shifting and time reversal properties of Z-transform. 5 ~CO1

- 4(b) Determine the Z-transform and their ROC of the following discrete time signals and **Justify your answer briefly** 5 CO2

i) $X(n) = \{0, 0, 1, 2, 5, 7, 0, 1\}$

ii) $X(n) = \{2, 4, 5, 7, 3\}$