

International Islamic University Chittagong
Department of Electrical and Electronic Engineering

B.Sc. Engineering in EEE

Midterm Examination, Spring 2024

Course Code: **EEE 3603**

Course Title: **Digital Signal Processing I**

Time: 1 hour 30 minutes

Full Marks: 30

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.

(ii) Course Outcomes (COs) and Bloom's Levels (BL) are mentioned in additional Columns.

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions		
CO	CO Statements	PO
CO1	Learn about mathematical representation of analog signals in digital domain, manipulate signals using analytical techniques and familiarize with discrete time signal & systems.	POa
CO2	Interpret the information of discrete time signals by means of frequency domain analysis using mathematical tools such as Z-transform, Discrete Fourier Transform (DFT), Fast Fourier Transform etc.	POd
CO3	Design and realize the responses of discrete-time systems like FIR and IIR Filter etc.	POc

Bloom's Levels (BL) of the Questions						
Letter Symbols	C1	C2	C3	C4	C5	C6
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

- 1) a) Discuss about advantages of digital signal processing. A signal $x(n) = 102.3 \cos(\frac{\pi}{10} n)$ is quantized with a resolution of 0.2. Determine the required number of bits in this process. CO1 C2, C5 5
- 1) b) Let $x(t) = 3 \cos(4000\pi t) + 5 \cos(6000\pi t)$
Determine the minimum sampling rate.
If it is sampled at a frequency of 8000 Hz, determine the discrete time signal?
Decide the signal $x(t)$ can fully be reconstructed or not? CO1 C5 5
- 2) a) Sketch an approximate plot of the following signal:
 $x(n) = a^n u(n)$ CO1 C3 C5 4
Where $a = \frac{M}{N}$, Take M and N from your matric ID (ET-XXXXMN)
Also, determine the power and energy of $x(n)$ and make a comment on whether the signal is an energy signal or a power signal.

- 2) b) A discrete time signal $x(n]$ is shown in Fig. 2(b). Sketch and label each of the following signals

CO1 C3 6

$$x(-n + 2)$$

$$x(2n)$$

Even part of $x(n]$ and
Odd part of $x(n]$

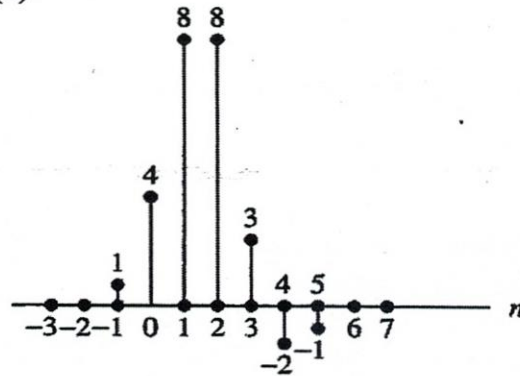


Fig. 2(b)

OR

- 2) a) Discuss about elementary signals.

CO1 C2 5

- 2) b) Determine whether each of the following systems is Linear & causal
(i) $y(n) = x(n) + x(n+4)$.
(ii) $y(n) = x(n^2)$.

CO1 C5 5

- 3) a) i) Explain the concept of resolving a discrete time sequence as a weighted sum of unit sample (impulse) sequence.
ii) Determine the output $y(n]$ of a relaxed linear time-invariant system with impulse response

CO1 C3 3

CO1 C3 3

$$h(n) = a^n u(n), |a| < 1$$

When the input is a unit step sequence, that is, $x(n) = u(n)$

- 3) b) What does correlation mean? Provide an example of how correlation is utilized in the field of digital communication.

CO1 C2 4