

International Islamic University Chittagong (IIUC)

Department of Computer and Communication Engineering

Midterm Examination

Program: **B.Sc. (Engg.)**
 Course Code: **CCE – 3601**
 Total Marks: **30**

Semester: **Autumn 2022**
 Course Title: **Digital Signal Processing**
 Time: **1 Hours 30 Minutes**

- (i) Answer all the questions. The figures in the right-hand margin indicate full marks.
 (ii) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions							
CLO1	Interpret, represent and process discrete/digital signals and systems						
CLO2	Apply important algorithmic design paradigms and method of analysis in real life design problems.						
Bloom's Levels of the Questions							
Letter Symbols Meaning	R	U	Ap	An	E	C	
	Remember	Understand	Apply	Analyze	Evaluate	Create	
1(a)	Explain the following signals with proper example				2	CLO1	U
	i. Continuous valued versus Discrete valued signals ii. Deterministic versus Random signals						
1(b)	Explain the Nyquist rate. Determine the Nyquist rate for the following signal and Justify your answer briefly				4	CLO2	U, Ap
	$x_a(t_1) = 3 \cos 25\pi t + 10 \sin 150\pi t - \cos 75\pi t$						
1(c)	Consider the following analog signal				4	CLO2	E
	$x_a(t) = 3 \cos 100\pi t$						
	Assume that we sample this signal using a sampling rate $F_s = 75$ samples/s. What is the discrete time signal obtained after sampling and Justify your answer briefly on that obtained discrete time signal?						
2(a)	Explain the following signals with mathematically and make the plot for the following signals and motive your answer briefly on that plot				6	CLO1	E
	I. Unit ramp signal II. Unit sample sequence III. Symmetric and anti-symmetric signal						
2(b)	Examine if the systems described by the following input-output equations are causal or non-causal and Justify your answer briefly on the determined signal				4	CLO2	E
	i. $y(n) = x(n) - x(n - 1)$ ii. $y(n) = x(2n)$ iii. $y(n) = x(n) + 3x(n + 4)$ iv. $y(n) = \sum_{k=-\infty}^n x(k)$						

3.(a) The impulse response of a linear time-invariant(LTI) system is

7 CLO2 E

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

Determine the response of the system by convolution of input signal and **Justify your answer briefly**

$$x(n) = \{1, 2, 3, 1, 5\}$$

3.(b) Examine the response of the following systems to the input signal

3 CLO2 An

$$x(n) = \begin{cases} |n|, & -5 \leq n \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

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

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

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

OR

3.(a) Differentiate between Z transform and Inverse Z transform with example.

4 CLO1 An

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

6 CLO2 E

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

ii) $x(n) = \{2, 5, 9, 7, 0, 1\}$

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