

BANGLADESH UNIVERSITY OF BUSINESS AND TECHNOLOGY (BUBT)
Faculty of Engineering and Applied Sciences
Department of Electrical and Electronic Engineering
Program: B.Sc. in EEE
EEE 313: Digital Signal Processing I
(Section: 1 & 2; Shift: Day; Intake: 25, 26)

Class Test – 1

Fall 2021-22

Total Marks: 15

Time: 30 min.

Course Instructor: Sk. Hasibul Alam

Instructions:

- Answer all questions.
- The marks on the right-hand side in square brackets indicate marks for that question only.

CO1: Interpret discrete-time signals & systems, and apply convolution and difference equation solving techniques to calculate system outputs. [PO1]

Q1. Find the five basic properties of the following discrete-time systems. To check linearity, you may use $[-4 \ 2 \ 7]$ and $[5 \ -1 \ 3]$. To check time-invariance, you may use $[... \ 4 \ -2 \ 7 \ -1 \ 0 \ 3 \ -8 \ ...]$.

(a) $y[n] = -5 \cos(x[n])$ [5]

(b) $y[n] = -3 |x[n]|$ [5]

(c) $y[n] = x[n] + 2nx[n + 1]$ [5]

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Program: B.Sc. in EEE
EEE 313: Digital Signal Processing I
(Section: 01; Shift: Evening; Intake: 24)

Class Test – 1

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
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- Attach your answer script in PDF format in Google Classroom.

CO1: Interpret and describe discrete-time signals, systems mathematically and graphically and apply convolution and difference equation solving techniques to calculate system outputs. [PO1]

1. If $x[n] = [4 \quad \underline{8} \quad a \quad b \quad 3]$, determine $\rho_{xx}[n]$. Here, 'a' to 'b' are the last two digits of your student ID, respectively. [5]
2. If $x[n] = [9 \quad 4 \quad \underline{a} \quad b \quad 7]$ and $h[n] = [3 \quad \underline{6} \quad 4]$, determine $y[n] = x[n] * h[n]$. Here, 'a' to 'b' are the last two digits of your student ID, respectively. [5]
3. A system is described by: $y[n] = (a + 2)x[n] + (b + 5)x^3[n]$, where 'a' to 'b' are the last two digits of your student ID, respectively. Find out about its memory and causality. [5]

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Class Test – 2

Fall 2021-22

Total Marks: 15

Time: 30 min.

Course Instructor: Sk. Hasibul Alam

Instructions:

- Answer all questions.
- The marks on the right-hand side in square brackets indicate marks for that question only.

CO2: Perform z-transform and Fourier transform to analyze signals and systems. [PO2]

Q1. Find the DTFT of the sequence, $x[n] = 5u[n] - 5u[n - 4] + 4\delta[n] - 5\delta[n - 4]$. [5]

Q2. Find the IDTFT of the following: [5]

$$X(\omega) = \begin{cases} 4, & -\frac{\pi}{5} \leq \omega \leq \frac{\pi}{5} \\ 0, & \text{otherwise} \end{cases}$$

Q3. Find the IDTFT of the following: [5]

$$X(\omega) = \begin{cases} e^{-4j\omega}, & \frac{\pi}{2} \leq \omega \leq \pi \\ e^{-4j\omega}, & -\pi \leq \omega \leq -\frac{\pi}{2} \\ 0, & \text{otherwise} \end{cases}$$

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Class Test – 2

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
- The marks on the right-hand side in square brackets indicate marks for that question only.
- Attach your answer script in PDF format in Google Classroom.

CO2: Perform z-transform and Fourier transform to analyze signals and systems. [PO2]

1. Determine 4-point DFT of $x[n] = [4 \ a \ b \ 8]$. Here, 'a' to 'b' are the last two digits of your student ID, respectively. [5]

2. Determine the IDTFT of the following. Here, 'M' is the last digit of your student ID. [5]

$$X(\omega) = \begin{cases} 2, & \frac{-\pi}{M+5} \leq \omega \leq \frac{\pi}{M+5} \\ 0, & \text{otherwise} \end{cases}$$

3. Determine the IDTFT of the following. Here, 'M' is the last digit of your student ID. [5]

$$X(\omega) = \begin{cases} e^{-j\omega(M+3)}, & \frac{\pi}{2} \leq \omega \leq \pi \\ e^{-j\omega(M+3)}, & -\pi \leq \omega \leq \frac{-\pi}{2} \\ 0, & \text{otherwise} \end{cases}$$

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Class Test – 3

Fall 2021-22

Total Marks: 15

Time: 45 min.

Course Instructor: Sk. Hasibul Alam

Instructions:

- ‘ a ’ & ‘ b ’ are the last two digits of your student ID, respectively.
- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
- The marks on the right-hand side in square brackets indicate marks for that question only.
- Upload your answer script in PDF format in Google Classroom.

CO3: Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters to meet expected system specifications. [PO2]

- Q1.** Determine the 4-point DFT of $x[n] = [5 \ a \ b \ -9]$. You must show the details of your calculation. [10]
- Q2.** Find if the z-transform exists for $x[n] = (15 + a)^n u[n] - (5 + b)^n u[-n - 1]$. If it exists, draw its ROC. If it doesn't exist, explain why. [5]

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Class Test – 3

Summer 2021

Total Marks: 15

Time: 1.5 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- ‘M’ is the last digit of your student ID.
- Answer all questions.
- Keep your pages neat and clean. Insert page number for each page.
- The marks on the right-hand side in square brackets indicate marks for that question only.
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CO2: Perform z-transform and Fourier transform to analyze signals and systems. [PO2]

1. Draw the pole-zero plot of $x[n] = (M + 2)^n u[-n - 1]$. Also shade the ROC on that plot. [5]
2. Using the time-shifting property of z-transform, determine $y[n] = x[n + 4]$. Assume, $x[n] =$ [5]
[-9 4 0 5 M 7 -2].
3. Assume, $x[n] = k^n u[n] - (M + 3)^n u[-n - 1]$, and ‘k’ is a positive integer. Find all [5]
possible values of ‘k’ if $X(z)$ exists.