

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: 26)

Mid Term

Fall 2021-22

Total Marks: 30

Time: 2 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- 'M' is the last digit of your student ID.
- Answer all questions. Q1 includes five short questions in total with two marks each.
- 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.
- Do not forget to rename your file as: **ID.pdf**
(Example: 16173208999.pdf)
- Capture your answer script in portrait orientation.

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

- Q1.** (a) The signal $50 \cos(50t)$ was sampled in such a way that the discrete-time frequency became $1/(M + 10)$. Find the sampling frequency. [2]
- (b) Determine if the system is stable or not: $y[n] = (M + 10)/x[n]$. [2]
- (c) Determine if the system is causal or not: $y[n] = x[n] + 2x[n - M + 4]$. [2]
- (d) During uniform rounding quantization, maximum error was found to be $(M+0.1)$. Find the step size used for the quantization. [2]
- (e) A discrete-time sequence consisting of only positive real number is being quantized by integer truncation. Determine the range of error sequence. [2]
- Q2.** (a) Determine the five properties for the following system: $y[n] = (M + 5)e^{x[n]}$. For checking linearity, you may use $x_1[n] = [-4 \ 3 \ -1]$, $x_2[n] = [5 \ -2 \ 3]$. For checking time invariance, you may use $x[n] = [7 \ 2 \ -2 \ 4 \ 3 \ -5 \ 6]$. [5]
- (b) Find the homogeneous solution of a system described by the following LCCDE: [5]
- $$y[n] - 10y[n - 1] + (M + 10)y[n - 2] = x[n]$$

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

- Q3. (a)** Find $y[n]$, if $x[n] = [4 \ \underline{a} \ b \ 7]$ and $h[n] = [6 \ \underline{5} \ -2]$. Here, 'a' to 'b' are the last two [5]
digits of your student ID, respectively.
- (b)** Find $\rho_{pq}[n]$, if $p[n] = [4 \ \underline{a} \ b \ 7]$ and $q[n] = [6 \ \underline{5} \ -2]$. Here, 'a' to 'b' are the last [5]
two digits of your student ID, respectively.

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EEE 313: Digital Signal Processing I
(Section: 01; Shift: Evening; Intake: 24)

Mid Term

Summer 2021

Total Marks: 30

Time: 2 hrs.

Course Instructor: Sk. Hasibul Alam

Instructions:

- 'M' is the last digit of your student ID.
- Answer all questions. Q1 includes 5 (five) short questions in total with 1 (one) mark each.
- 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.
- Do not forget to rename your file as: **ID.pdf**
(Example: 16173208999.pdf)
- Capture your answer script in portrait orientation.

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

- Q1. (a)** An analog signal has the following frequency components: $(M+2)$ kHz, $(M+4)$ kHz and $(M+12)$ kHz. What is the minimum sampling frequency that will not distort its underlying information? [1]
- (b)** A system is described by $y[n] = 7x[n + M - 4]$. Find whether the system is anti-causal or not. [1]
- (c)** If $r_{xx}[n] = [(M + 1) \quad \underline{20} \quad (M + 1)]$, find $\rho_{xx}[n]$. [1]
- (d)** An LTI system has $h[-5] = (M + 5)$. Find whether the system is causal or not. [1]
- (e)** Find the order of the following LCCDE: $y[n] - (M + 2)y[n - 1] - y[n - M - 3] = x[n]$ [1]
- Q2. (a)** Determine the five properties for the following system: $y[n] = |(M + 1)x[n]|$. For checking linearity, you may use $x_1[n] = [\underline{-4} \quad 3]$, $x_2[n] = [5 \quad -2]$. For checking time invariance, you may use $x[n] = [2 \quad -2 \quad \underline{4} \quad 3 \quad -5]$. [5]
- (b)** A sinusoidal signal has an amplitude of $(M+10)$. An ADC uses 8-bit uniform rounding quantization for this signal. Find the SQNR(dB) and average power of error. [5]
- (c)** Find the homogeneous solution of a system described by the following LCCDE: [5]
- $$y[n] - 4y[n - 1] = x[n]; y[-1] = M + 5$$

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

- Q3. (a)** Find if the DTFT exists for $x[n] = (0.21 \times M + 0.1)^n u[n]$. If it exists, compute it. If it doesn't exist, explain why. [5]
- (b)** Find $\rho_{pq}[n]$, if $p[n] = [7 \ \underline{a} \ b \ 3]$ and $q[n] = [3 \ \underline{2} \ 4]$. Here, 'a' to 'b' are the last two digits of your student ID. [5]