

(Knowledge for Development)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

SPECIAL/SUPPLEMENTARY EXAMINATIONS

YEAR THREE SEMESTER ONE EXAMINATIONS

FOR THE BACHELORS DEGREE

COMPUTER SCIENCE

COURSE CODE: CSC 350E

COURSE TITLE: SIGNALS AND SYSTEMS I

DATE: 31/07/2023

TIME: 11.00AM-1.00PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO (2) QUESTIONS

QUESTION ONE (30 MARKS) COMPUSORY

- a) Explain the following terms
 - (i) Continuous time signal
 - (ii) Discrete time System [4marks]
- b) With appropriate examples explain the following terms
 - i) Time invariant system
 - ii) Causal system [6marks]
- c) Consider the discrete-time system shown in figure 3. Determine a difference equation that relates the output $y[n]$ and the input $x[n]$. [4marks]

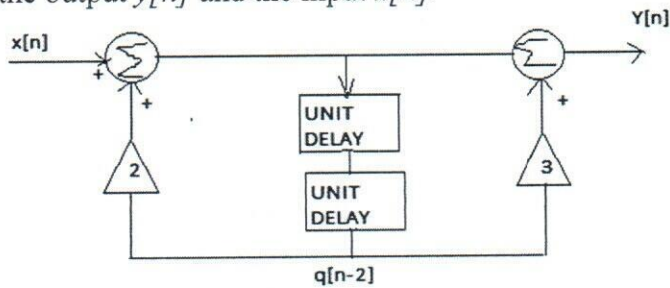


Figure 1c

- d) Determine whether the following system is linear-time-invariant. $y(t) = x(t)m(t)$, where $x(t)$ and $y(t)$ denote the input and output, respectively. [5marks]
- e) Given the signal $x(t) = 2e^{-t}u(t)$, determine
 - a) The Fourier Transform $X(j\omega)$ [5marks]
 - b) The magnitude $|X(j\omega)|$ [3marks]
 - c) The phase $\angle X(j\omega)$ [3marks]

QUESTION TWO (20 MARKS)

- a) Evaluate, the magnitude $|(2 - j3)^2|$ and the angle $\angle (-1 + j)^2$. [8marks]
- b) Show that the signal $x(t) = \sin(\omega_0 t)$, $\omega_0 > 0$, is periodic. [6marks]
- c) Consider the impulse response $h[n]$ of a discrete-time LTI system shown in fig. 2c
 - i) Determine and sketch the output $y[n]$ of this system to the input $x[n]$. [3marks]
 - ii) Without using the convolution technique. [3marks]

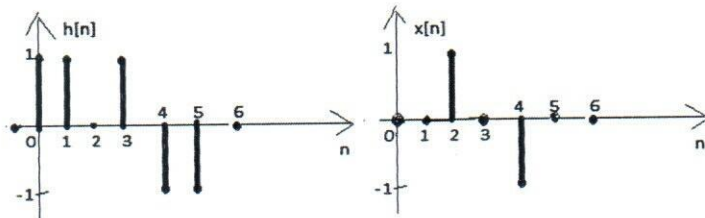
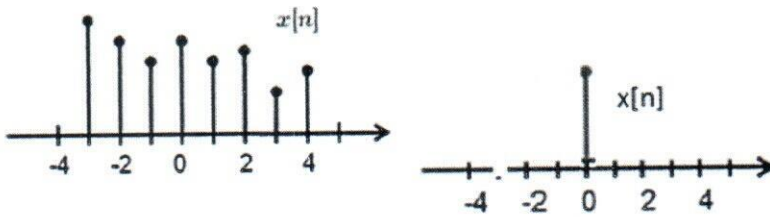


Figure 2c

QUESTION THREE (20 MARKS)

- a) Explain why the understanding of a system is important [2marks]

- b) Sketch the output signal of the following operation $x[4]\delta[n-4]$, where $x[n]$ and $\delta[n]$ are given below [2marks]



- c) Outline three system requirements for linearity. [6marks]
 d) Show that the system $y(t) = 4\pi x(t)$ is linear [5marks]
 e) Consider the signal $x[n] = 2\delta[n] + 5\delta[n-2] - 3\delta[n-3]$. If the impulse response is $h[n] = 2\delta[n] + \delta[n-2]$, using convolution, what would be the output $y[n]$ [5marks]

QUESTION FOUR (20 MARKS)

- a) If the input signal is $x(t) = 2e^{-2t}u(t)$, determine the output $y(t)$ if the impulse response of the system is given by $h(t) = \frac{1}{4}e^{-2t}u(t) + \frac{1}{3}e^{-5t}u(t)$? [6marks]
 b) Explain three general properties of a system [6marks]
 c) Given the function $y(t) = 2x^2(t-1) + x(3t)$ show that it is stable [4marks]
 d) For the signal $x(t)$ shown in Fig. 4d, sketch $x(3t-4)$ [4marks]

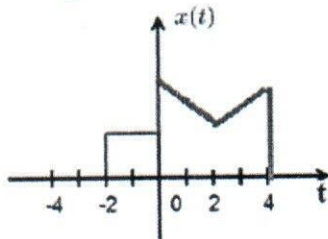


Figure 4d

QUESTION FIVE (20 MARKS)

- a) With the aid of diagrams explain the following terms
 (i) Continuous time growing exponential signal [6marks]
 (ii) Continuous time decaying exponential signal [6marks]
 b) Consider the signal $x(t) = e^{j\omega_b t}$. Find its Fourier transform [6marks]
 c) Determine the fundamental period of the following signals:
 (i) $e^{j3\pi t/4}$ [8marks]
 (ii) $e^{j3\pi n/4}$