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]

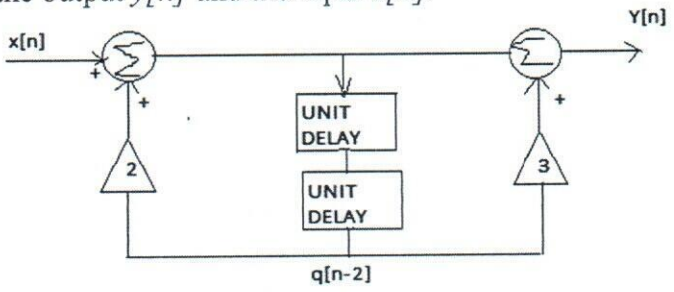


Figure 1c

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(ω_0t), $\omega_0 > 0$, 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]

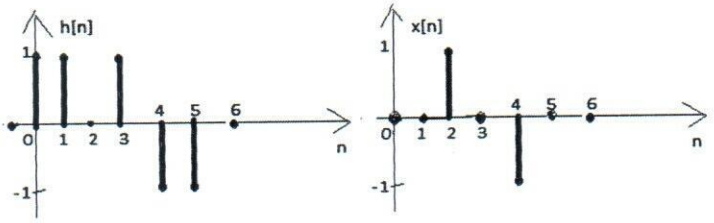
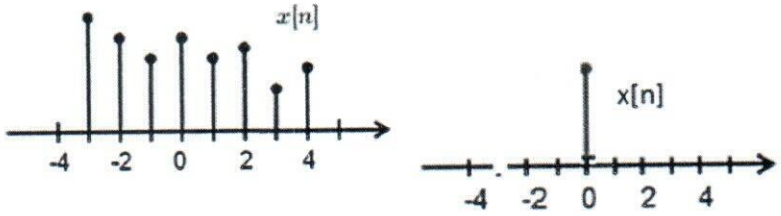


Figure 2c

QUESTION THREE (20 MARKS)

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

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



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]

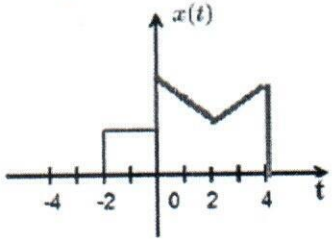


Figure 4d

QUESTION FIVE (20 MARKS)

a) With the aid of diagrams explain the following terms
(i) Continuous time growing exponential signal
(ii) Continuous time decaying exponential signal [6marks]
b) Consider the signal $x(t) = e^{j\omega_0 t}$. Find its Fourier transform [6marks]
c) Determine the fundamental period of the following signals:
(i) $e^{j3\pi t/4}$ ii) $e^{j3\pi n/4}$ [8marks]