

*(KNOWLEDGE FOR DEVELOPMENT)*

**KIBABII UNIVERSITY**

**(KIBU)**

**UNIVERSITY EXAMINATIONS**

**2022/2023 ACADEMIC YEAR**

**YEAR THREE SEMESTER TWO EXAMINATIONS**

**FOR THE BACHELORS DEGREE**

**COMPUTER SCIENCE**

**COURSE CODE: CSC 354E**

**COURSE TITLE: SIGNALS AND SYSTEMS II**

**DATE: 18/04/2023**

**TIME: 2.00PM-4.00PM**

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**INSTRUCTIONS TO CANDIDATES**

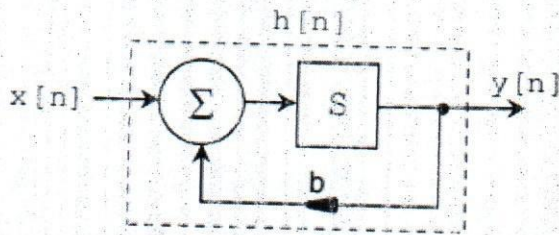
**ANSWER QUESTIONS ONE AND ANY OTHER TWO.**

**QUESTION ONE (COMPULSORY-30 MARKS)**

a) Given the signal  $x(t)=1$ , find its Laplace transform. [5Marks]

b) Given that  $\mathcal{L}(e^t) = 1/(s - 1)$ , find  $\mathcal{L}(e^{at})$ . [5Marks]

c) For the following LTI system with  $x[n]$  causal.



i) Find the difference equation that relates  $y[n]$  and  $x[n]$ . [3Marks]

ii) Determine  $H(z)$  the ROC, and the pole-zero plot. [5Marks]

iii) Determine the impulse response  $h[z]$ . [2Marks]

d) Determine the Inverse Z-Transform of the function  $F(z) = \frac{1}{z-a}$ . [6Marks]

e) Find the Laplace transform of  $x(t) = \sin 2t$ . [3Marks]

**QUESTION TWO (20 marks)**

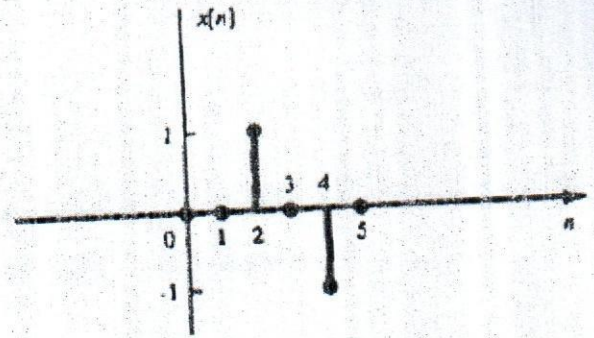
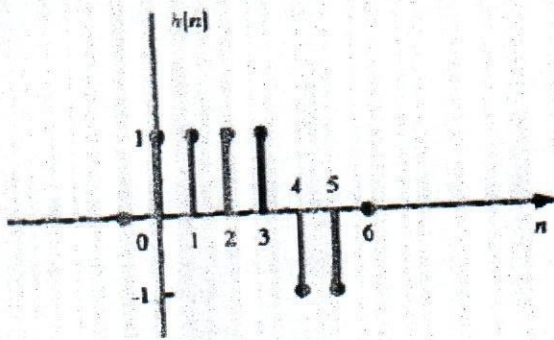
a) Find the Laplace transform of the following step function

$$\begin{cases} 1, & 0 \leq t < 2 \\ t-2, & 2 \leq t \end{cases} \quad [5Marks]$$

b) Given the impulse response  $h[n]$  of a discrete-time LTI system.

i) Determine and sketch the output  $y[n]$  of this system to the input  $x[n]$ . [10Marks]

ii) Without using the convolution technique. [5Marks]



### QUESTION THREE (20 MARKS)

a) Find the Laplace transform of the following functions

i)  $f(t) = t^3 + 3t - 3$

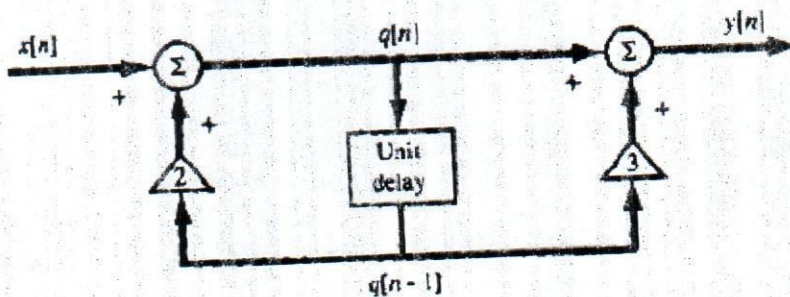
[3Marks]

ii)  $f(t) = e^{3t}(t^3 + 3t - 3)$

[4Marks]

b) Consider the discrete-time system. Write a difference equation that relates the output  $y[n]$  and the input  $x[n]$ .

[13Marks]



### QUESTION FOUR (20 MARKS)

a) Find the inverse Laplace transform of the following transforms

i)  $F(s) = \frac{s+3}{s^2+4}$

[6Marks]

ii)  $F(s) = \frac{s+1}{s^2-9}$

[6Marks]

b) Give the relation between Fourier and Laplace transform.

[3Marks]

c) Draw the block diagram of the LTI system described by  $\frac{dy(t)}{dt} + y(t) = 0.1x(t)$  [5Marks]

### QUESTION FIVE (20 MARKS)

a) Using the Laplace transform find the solution for the following system equation

$$y' - y = e^{3t}, y(0) = 2.$$

[10Marks]

b) For an LTI system, we are given the Z-transform of the input and output Signals.

$$X(z) = \frac{1}{1 + z^{-2} + z^{-4}}, \quad Y(z) = \frac{1}{2} + \frac{1}{4}z^{-1}$$

i) Determine the impulse response and sketch it.

[7Marks]

ii) Determine the DTFT of  $h[n]$ .

[2Marks]

iii) iii) What is the region of convergence of ? Sketch the DTFT on the z-plane [1Mark]