UNIVERSITY SUPPLEMENTARY/SPECIAL 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: 16/08/2023 TIME: 8.00AM-10AM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO (2) QUESTIONS

QUESTION ONE (3O MARKS COMPULSORY)

a) Given that $x[n]=\delta[n-3]$, find the Z transform $X[Z]$ [3marks]

b) Explain the special feature of z-transforms which is of interest in discrete signals [3marks]

c) Given that $L(e^{t})=\frac{1}{(s-1)}$, find $L(e^{3t})$ [4marks]

d) Outline FOUR Laplace Transform properties for Laplace Transform [8marks]

e) Find Laplace Transform of

i) f(t)=3 [2marks]

ii) $f(t)=2+3e^{2t}$ [2marks]

f) State two useful applications of z-transforms in LTI systems [2marks]

g) Outline two useful properties of z-transforms [6marks]

QUESTION TWO (2O MARKS)

a) Find the Laplace Transform of the following signals

i) Unit impulse, $f(t)=1$ [2marks]

ii) $f(t)=e^{t}$ [3marks]

b) Find the inverse Laplace of $F(s)=\frac{2}{s^2+3s+2}$ [9marks]

c) Find the Laplace transforms of the following functions

i) $f(t)=e^{3t}(t^3+3t-3)$ [3marks]

ii) $f(t)=t^3+3t-3$ [3marks]

QUESTION THREE (2O MARKS)

a) Find the Laplace transform of the following signals

i) $f(t)=3\delta(t)-2e^{t}$ [5marks]

ii) $f(t)=t^3$ [3marks]

b) Find the inverse Laplace transform of $F(s)=\frac{2}{s+4}$ [4marks]

c) Find the output of the two-tap FIR given in figure 3c [8marks]

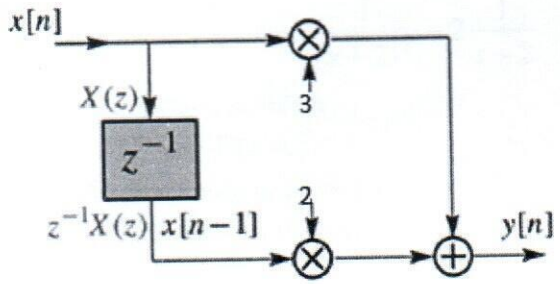

Figure 3c

QUESTION FOUR (2O MARKS)

a) Given that the Laplace transform of $f(t) = \cos \omega t$ is F(s)=$\frac{s}{s^2 + \omega^2}$,find the Laplace of the following signals

i. f(t)=cos4t

ii. f(t)=2cos3t [4marks]

b) Find the inverse Laplace transform of $F(s) = \frac{5}{s^2 - 9^2}$ [6marks]

c) Given that the input and the impulse response of a system are

$$x[n] = \delta[n] - 2\delta[n-2] + 5\delta[n-3]$$

$$h[n] = 3\delta[n] + \delta[n-1] + 2\delta[n-2]$$

Find the output of the system [6marks]

d) Find the input-output equation for the system shown in figure 4d. [4marks]

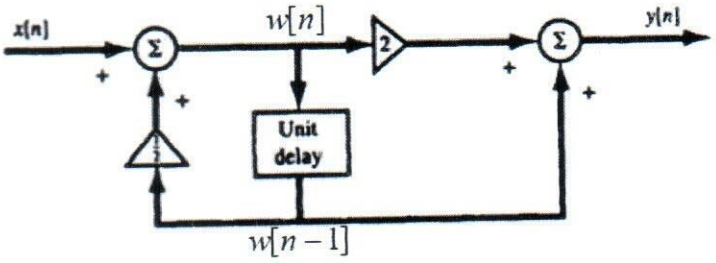

Figure 4d

QUESTION FIVE (2O MARKS)

a) Find the inverse Laplace Transform of the following transforms

I. $F(s) = \frac{3!}{s^4} + 5\frac{1}{s^2} - 2\frac{1}{s}$ [3marks]

II. $F(s)=\frac{3!}{(s-2)^4}+5\frac{1}{(s-2)^2}-2\frac{1}{s-2}$ [3marks]

b) Solve the initial value problem

$y'-3y'-10y=2, \qquad y(0)=1, y'(0)=2$ [7marks]

c) Consider the discrete-time system shown in figure 5c.

i) Write down a difference equation that relates the output y[n] and the input x[n].[3marks]

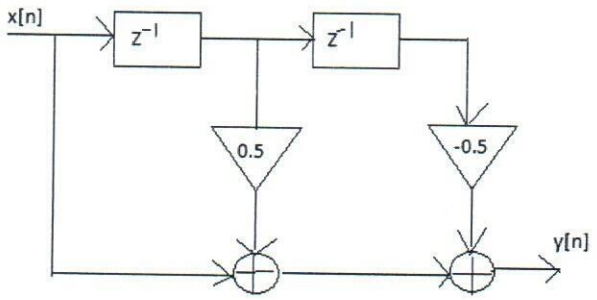

Figure 5c

ii) Given that

$Y(z)=1+2Z^{-1}-Z^{-2}-2Z^{-2}$ and

$X(z)=1-Z^{-1}$

Find the transfer function h[n] of the system. [4marks]