BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF PHYSICS AND ENGINEERING

BSc HONS DEGREE IN ELECTRONIC ENGINEERING

EEE2102: NETWORK THEORY

MAY 2024

DURATION: 2 HOURS 30 MINUTES **TOTAL MARKS: 100**

INSTRUCTION TO CANDIDATES

The paper consists of **five (5)** questions, candidates are expected to answer **all** questions.

Question 1

a. Explain how sampling frequency is determined when converting a continuous time signal to a discrete time signal? **[2]**

b. Illustrate the architecture of a Digital signal processor. **[6]**

c. A signal, given by $x(t) = e^{-t}$, is sampled at a frequency of 20 Hz, starting at time $t = 0$. Find the first **four** samples of the sequence. **[8]**

d. Explain any **two** differences between analog, and digital signal processing **[4]**

Question 2

a. Write the system equation for the system represented by signal flow diagram in Figure 1. **[8]**

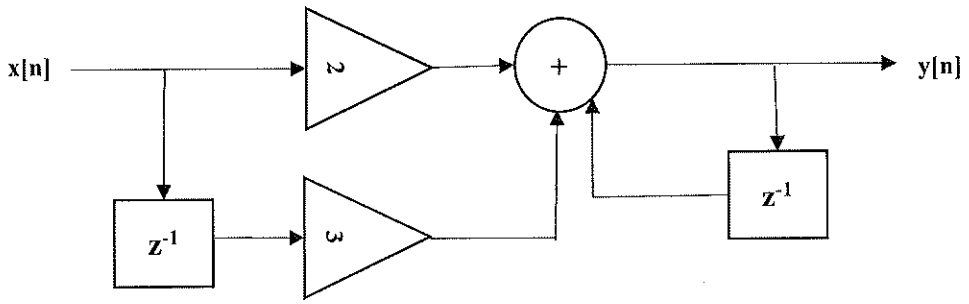

Figure 1: Signal flow diagram

b. Consider a system represented by the system equation: $y[n] = 2e^{x[n]}$,

Determine if the system is:

i. Linear, [6]

ii. Stable, and [3]

iii. Causal. [3]

Question 3

a. Given the following system equations, find the impulse response:

(i) $y[n] = \frac{1}{2}(x[n] + x[n-1])$ [5]

(ii) $y[n] = x[n+1] - 2x[n] + x[n-1]$ [5]

b. Explain why signals from a DSP will need to go through a reconstruction filter after passing through a digital to analog converter (DAC). [4]

c. Describe the signal reconstruction process in DSP. [6]

Question 4

a. Explain any **three (3)** advantages of between FIR filters compared to IIR filters. [6]

b. Determine the output $y(n)$ of a LTI system with impulse response $h(n) = [1\ 3\ 2\ 2]$ and the input $x(n) = [0\ 2\ 4\ 2\ 1]$. [10]

c. Give any **four** benefits of convolution in digital signal processing. [4]

Question 5

a. Write down a difference equation which describes the following sequences

(i) 3 5 7 9 11 [6]

(ii) 1 2 5 14 41 [8]

b. Find the solution to the ordinary differential equation $y' = x^2 - 2$ [6]

****** END OF PAPER******