Knowledge for Development

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

YEAR THREE SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF (COMPUTER SCIENCE)

COURSE CODE: CSC 350E

COURSE TITLE: SIGNALS AND SYSTEMS I

DATE: 16/05/2022 TIME: 09.00 A.M – 11.00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO (2) QUESTIONS

QUESTION ONE (COMPUSORY) [30 MARKS]

a) Describe the following terms: -

   i) Signal [2marks]

   ii) System [2marks]

b) Differentiate between the following terms: -

   i) Periodic and non-periodic signals. [4marks]

   ii) Continuous-time signal x(t) and Discrete-time signal x[n] [6marks]

   iii) Even and odd signals. [4marks]

c) Explain any **THREE** operations performed on a signal. [6marks]

d) Given the signal $x(t) = e^{-3t}u(t)$, determine

   i) The Fourier Transform $X(j\omega)$

   ii) The magnitude $|X(j\omega)|$

   iii) The phase $\angle X(j\omega)$ [6marks]

QUESTION TWO [20 MARKS]

a) Convert the following complex numbers from Cartesian to polar form

   i) 1+j;

   ii) 1-2j. [4marks]

b) Static linearity and sinusoidal fidelity are concepts used in linear systems. Explain these concepts with the aid of diagrams [4marks]

c) Show that the following system linear-time-invariant

   y(t) = x(t)g(t), where x(t) and y(t) denote the input and output, respectively. [3marks]

d) Differentiate between energy and power signal. [4marks]

e) Show that the discrete time system described by the input-output relationship y[n] =nx[n] is linear. [5marks]

QUESTION THREE [20 MARKS]

a) Differentiate between a continuous and discrete time signals. [4marks]

b) Is a discrete time signal described by the input output relation $y[n]= r^n x[n]$ time invariant. [4marks]

c) Evaluate, the magnitude $|(2-j2)^3|$ and the angle $\angle(-1-j)^2$. [8marks]

d) For the signal x(t) shown in Fig. 3d, sketch x(2t-1). [4marks]

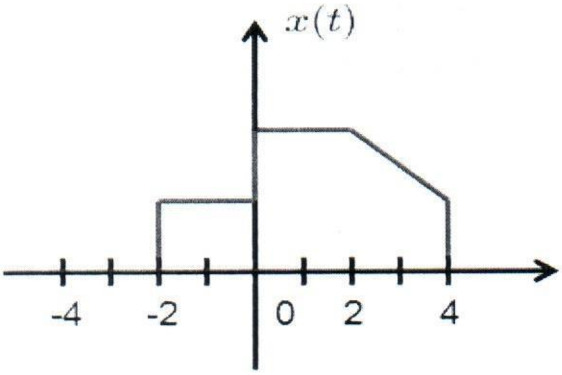

Figure 3.1

QUESTION FOUR [20 MARKS]

a) Determine if the following signals are periodic. For those that are periodic, what is the fundamental period?

i) $x[n] = e^{j\frac{4}{\pi}n}$ [2marks]

ii) $x[n] = e^{j\frac{2}{8}\pi n}$ [2marks]

b) Describe a time invariant systems [4marks]

c) Compute the polar form of the complex signals [6marks]

i) $e^{j(1+j)}$

ii) $(1+j)e^{-j\pi/2}$.

d) Compute the rectangular form of the complex signals [6marks]

i) $2e^{j5\pi/4}$

ii) $e^{-j\pi} + e^{j6\pi}$.

QUESTION FIVE [20 MARKS]

a) Consider the system shown in Figure 5a. Determine whether it is (i) memoryless, ***(ii)***causal, ***(iii)*** linear, ***(iv)*** time-invariant, or ***(v)*** stable. [6marks]

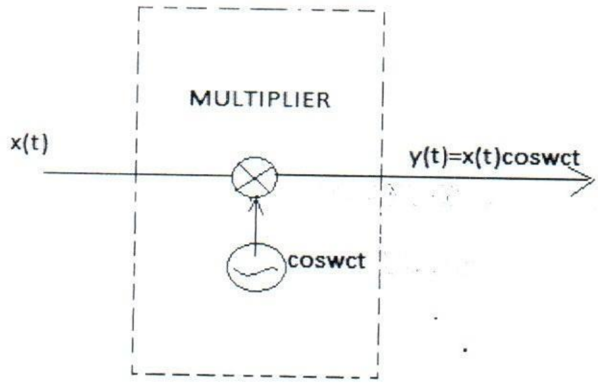

Figure 1

b) Outline the properties of a system. [4marks]

c) Suppose *x[n]* is a discrete-time signal, and let *y[n]=x[2n]*.

i) If *x[n]* is periodic, is *y[n]* periodic? If so, what is the fundamental period of *y[n]* in terms of the fundamental period of x*[n]*? [3marks]

ii) If *y[n]* is periodic, is *x[n]* periodic? If so, what is the fundamental period of *x[n]* in terms of the fundamental period of *y[n]*? [3marks]

d) Sketch the signals

i) u[n-3] [2marks]

ii) u[2n-3] [2marks]