MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
FIRST YEAR SECOND SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTHY SCIENCES
MASTER OF SCIENCE IN PHYSICS (ELECTRONICS)

COURSE CODE: PHY 8210
COURSE TITLE: INTEGRATED LECTRONICS

DATE: 19/4/2023 **TIME: 1100-1400 HRS**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **Two** questions

*This paper consists of **four** printed pages. Please turn over.*

Question one [30 Marks]

(a) Define the following terms [5marks]
   i. Noise
   ii. 555 timers
   iii. An analog circuit
   iv. An active filter
   v. An instrumentation amplifier

(b) Draw a circuit diagram of a basic diode-based log amplifier. [4marks]

(c) Explain the main drawback of the analog circuits. [2marks]

(d) Draw a well labelled circuit of basic Sample-and-Hold amplifier. [4marks]

(e) State three applications of a high-speed analog-to-digital converter. [3marks]

(f) Differentiate between digital to analog converters and analog to digital converters. [4marks]

(g) State four analog physical quantities found in nature. [4marks]

(h) State and explain two sources of electronic noise. [4marks]

QUESTION TWO [20 MARKS]

(a). (i) State two examples of digital computer circuits [2marks]
(ii) Discuss the operation of a digital circuit. [4marks]

(b) Explain two advantages of digital circuit over analog circuit. [4marks]

(c) State and explain three differences between analog and digital circuits. [6marks]

(d) With suitable circuit diagrams, differentiate between a low pass filter and a high pass filter [4marks]

QUESTION THREE [20MARKS]

(a) Explain two advantages of a binary system [4marks]

(b) Draw a well-labelled diagram of:
(i) the block diagram of a counter-ramp and a successive approximation A–D converter. [4marks]
(ii) the analog waveforms in a counter-ramp A–D converter. [3marks]

(iii) the analog waveforms in a successive approximation A–D converter. [3marks]

(c) Describe the operation of an analog comparators. [4marks]

(d) Differentiate between neural systems and fuzzy logic systems [2marks]

QUESTION FOUR [20MARKS]

(a) Find the network function V_2 / V_1 in the circuits shown in Fig.
(i) 1 (a) [3marks]
(ii) 1 (b) [3marks]

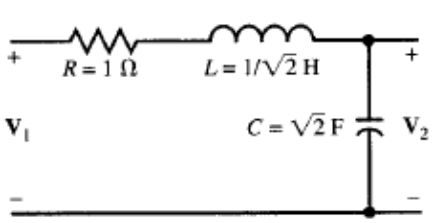

Fig 1 (a)

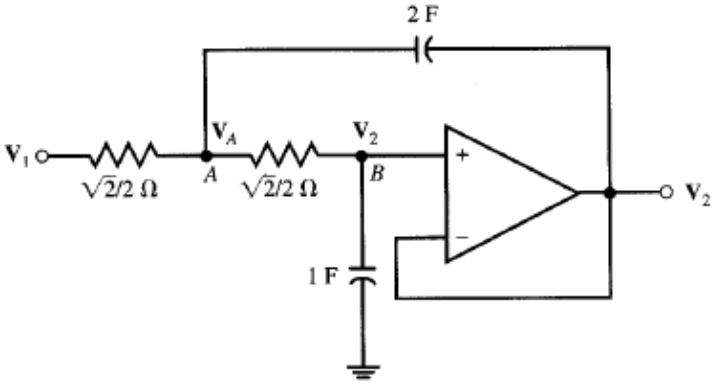

Fig. 1 (b)

(b) State and explain the successive approximation A–D converter [4marks]
(c) Discuss two applications of DACs and ADCs [4marks]
(d) Draw a block diagram of a triangular wave generator. Explain how it works. [4marks]

(e) State two noncomputer applications of digital circuits [2marks]

QUESTION FIVE [20MARKS]

(a) Draw a circuit diagram of a Schmitt trigger [3marks]

(b) What is an Analog comparator? Explain its working principle. [5marks]

(c) A sample of Si is doped with 10^{16} phosphorus atoms/cm^3. Find the Hall voltage in the sample with W=500 μm, A=2.5×10^{-3} cm^2, I=1 mA, and $B_z = 10^{-4}$ Wb/cm^2. [4marks]

(d) Briefly explain the basic operation of a Sample and Hold Amplifier. [4marks]

(e) Explain two advantages of implementing a lock–in amplifier using digital technologies [4marks]