(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN ELECTRICAL AND COMMUNICATIONS ENGINEERING

COURSE CODE: ECE 412

COURSE TITLE: ELECTRONIC CIRCUIT DESIGN

DATE: WEDNESDAY, APRIL 20TH, 2022   **TIME:** 8:00 - 10:00 AM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE

a) (i) Explain why an Amplifier can be regarded as a transconductance Amplifier

(1 mark)

   (ii) Using relevant thevenin equivalent circuits derive the gain of a transconductance Amplifier

(5 marks)

b) Using a block diagram explain the operation of an automatic gain control (AGC)

(6 marks)

c) Explain the following terms as they are used in Analog multipliers

   (i) One quadrant multiplier

   (ii) Two quadrant multiplier

   (iii) Four quadrant multiplier

(4.5 marks

d) Using relevant circuit and derivation show how an analog multiplier can be used as a frequency doubler

(6.5 marks)

e) i) Draw diode and explain its transfer characteristics

(4 marks)

   ii) Describe a digital clock

(3 marks)

QUESTION TWO

(a) State the special features of a precision rectifier when compared with an ordinary rectifier circuit

(2 marks)

b) Using relevant mathematical derivations show how an operational amplifier can be used as a differentiator

(5 marks)

c) Using block diagrams explain the following

(i) Frequency synthesizers

(6marks)

(ii) Frequency heterodying

(7 marks)

QUESTION THREE

(a) Define the following as they are applied to the performance parameters of analog multipliers

(i) Feed through voltage

(2 marks)

(ii) Zero trim

(1 mark)

(iii) Linearity

(1mark)

(b) Using relevant diagram and derivation show how an analog multiplier can be used as a squaring circuit

(5 marks)

(c) With the aid of a block diagram explain how a JFET (Junction Field Effect Transistor) can be used as an automatic gain control (AGC) circuit

(6 marks)

(d) Show how an operational amplifier can be used to perform the function of subtraction of two input signal

(5 marks)

QUESTION FOUR

a) Using a relevant block diagram explain the importance of frequency heterodying

(5 marks)

(b) (i) state the main use of instrumentation Amplifiers

(2 marks)

(ii) List any two main characteristics of instrumentation Amplifiers

(1 marks)

(iii) Derive the transfer function of an instrumentation Amplifier

(8 marks)

(c) Define the term telemetry giving relevant application areas in electrics

(4 marks)

QUESTION FIVE

(a) (i) Explain how phase locked loop (PLL) operates in three models

(ii) State any two applications of PLL

(3 marks)

(b) (i) Define the term frequency multiplier and how it arises

(3 marks)

(ii) Explain how PLL can be modelled as a frequency multiplier

(3 marks)

(c) (i) Describe using a diagram a chopper stabilized amplifier   (4.5 marks)

(ii) Explain the main advantages of a chopper stabilized amplifier over a regular operational amplifier   (2 marks)