MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2023/2024 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: MONDAY 18/12/2023 **TIME: 3:00 PM – 5:00PM**

INSTRUCTIONS TO CANDIDATES

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

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

QUESTION 1

(a) Using relevant equivalent circuits and mathematical derivation describe

(i) Voltage amplifier [4mks]

(ii) Current amplifier [3mks]

(b) (i) state any two applications of analogue multipliers [2mks]

(ii) Show how multipliers can be configured to be used in AC power measurement [5mks]

(c) Using a block diagram and relevant circuit based on operational; amplifier explain triangular waveform generator [5mks]

(d) Explain the two categories of etching process as they are applied to the integrated circuit fabrication [3mks]

(e) (i)Define the term telemetry [2mks]

(ii) Draw and explain the functional representation of telemetering system [4mks]

(f) An OP amplifier based three stage RC phase shift oscillator is required to produce a sinusoidal output frequency of 5000Hz. I f 3.3 nF capacitors are used in the feedback circuit, calculate the value of the frequency determining resistors [2mks]

QUESTION 2

(a) (i) By showing how seconds minutes and hours can be obtained draw a digital clock [3mks]

(ii) Draw the waveforms that result into a digital clock [3mks]

(b) (i) Explain what's meant by a phase locked loop(PLL) circuit [2mks]

(ii) Draw a block diagram of a PLL and explain in detail the function of each block [11mks]

QUESTION 3

(a) Explain the operation of an automatic gain controller (AGC) that utilizes JFET [6mks]

(b) Using relevant diagram explain how amplitude variations in Wien bridge oscillator is achieved [6mks]

(c) Using an equivalent circuit of RC oscillator bellow show that the frequency of oscillation is given as: [8mks]

$$W_o^2 = \frac{1}{6C\text{^}2R\text{^}2}$$

QUESTION 4

(a) (i) Explain why frequency conversion is necessary for radio broadcasting purposes [3mks]

(ii) Describe the basic principle of heterodyning action [6mks]

(b) Highlight any three advantages of FM over AM [3mks]

(c) Define the term analogue multiplier [2mks]

(d) Using relevant diagrams and mathematical derivations show how a multiplier can be configured to perform [7mks]

(i) Analogue division

(ii) Square root extraction between the inputs

(e) Differentiate between two quadrant and four quadrant multiplier [2mks]

QUESTION 5

(a) Explain the main advantage of instrumentation amplifier [3mks]

(b) Describe the difference between a precision rectifier and a normal rectifier [2mks]

(c) (i) Using a well labeled diagram explain the operational of a chopper amplifier [8mks]

(ii) Explain any two applications that makes use of chopper operation amplifier [4mks]

(d) Describe the application of an automatic gain control (AGC) in radar systems [3mks]