(University of Choice)
MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATIONS

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

COURSE CODE: ECE 412

COURSE TITLE: ELECTRONIC CIRCUIT DESIGN

DATE: Monday, 03rd October, 2022   **TIME: 11.00a.m - 02.00 p.m**

INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO (2) questions

Marks will be awarded for correct working even if the answer is wrong

## MMUST observes ZERO tolerance to examination cheating

Question One

a. What is an integrated circuit? Discuss the relative advantages and disadvantages of ICs over discrete assembly. **(8marks)**

b. How will you make a monolithic IC? **(8marks)**

c. Explain how,

      i. A diode **(1mark)**

      ii. A transistor **(1mark)**

      iii. A resistor and **(1mark)**

      iv. A capacitor **(1mark)**

    can be constructed in a monolithic integrated circuit.

d. Define the following basic fabrication processes of an integrated circuit:

      i. Photolithography **(2marks)**

      ii. Oxidation **(2marks)**

      iii. Diffusion **(2marks)**

      iv. Ion Implantation **(2marks)**

      v. Deposition **(2marks)**

Question Two

a. The inverting amplifier makes use of negative feedback to the negative input terminal. The negative terminal also receives the source signal which is inverted at the output. Consider the circuit in Figure below (arrows indicate assumed current flow): Using **KCL** describes the characteristics of the amplifier.
    (8marks)
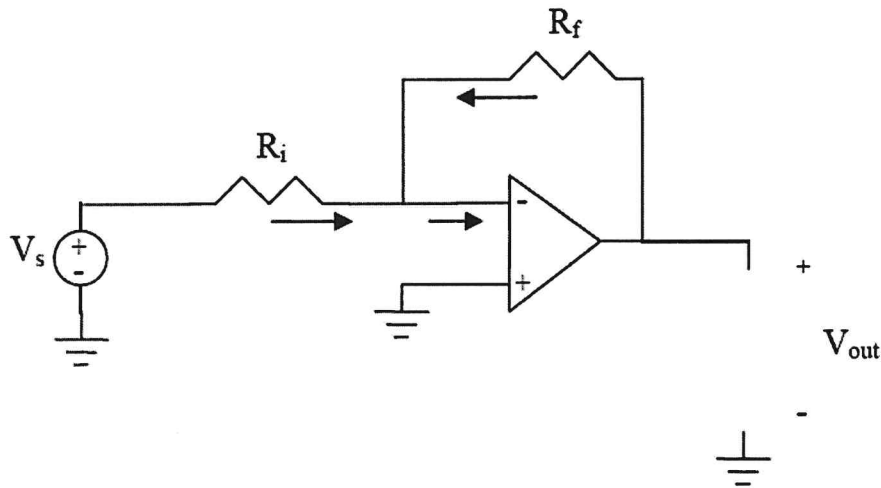
b. An amplifier with gain of 200 has a 10% variation in gain over a certain frequency range. Using negative feedback, what value of β should one use to reduce the gain variation to 1%?

(4marks)

c. The open-loop low-frequency gain of an op-amp is 100 dB. At a frequency of $f = 10^4$ Hz, the magnitude of the open-loop gain is 38 dB. The op-amp has a dominant-pole open-loop response. Determine the frequency of the dominant pole and the unity-gain bandwidth. **(8marks)**

Question Three

a. What is a **phase-locked loop**? **(4marks)**

b. How do you estimate accumulated phase error? **(6marks)**

c .Explain the cycle-skip phenomenon and its effect in PLL performance
   with at least two examples? **(10marks)**

Question Four

a. What is analog circuit design? **(8marks)**

b. Analog design is normally done in a non-hierarchical manner and
   makes little use of repeated blocks. As a consequence, analog design
   can become quite complex and challenging. How do you handle the complexity? **(5marks)**

c. How can the analog IC designer enhance creativity and solve new problems
   in today's industrial environment? **(7marks)**

Question Five

a. What is frequency Modulation? **(4marks)**

b. Explain the Narrow Band FM **(5marks)**

c. Give Five (5) advantages and three (3) disadvantages of FM **(8marks)**

d. Give three (3) Applications of FM **(3marks)**