



MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT

DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING

SECOND YEAR SECOND SEMESTER 2021/2022

REGULAR EXAM

DME 076: ELECTRONICS

DATE: 22/04/2022

TIME: 8:00-10:00 AM

INSTRUCTIONS

ATTEMPT QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE

- 1a) State any two applications of semi-conductor diodes (2marks)
- b) With an aid of a well labeled diagram, explain the difference between forward and reverse biasing (6marks)
- c) Account for a transistor action in n-p-n transistor (5marks)
- d) A differential amplifier has an open-loop voltage gain of 120. The input signals are 2.45v and 2.35v. Calculate the output voltage of the amplifier. (3marks)
- e) Graph the forward and reverse characteristics of a silicon p-n junction diode (4marks)
- f) With the aid of a well labeled diagram, explain how an op amp can be used as:
- i) Voltage comparator (5marks)
- ii) Differentiator (5marks)

QUESTION 2 (20 MARKS)

- a) State three MAIN applications of OP amps (3marks)
- b) With the aid of a well labeled diagram illustrate three n-p-n transistor connections (6marks)
- c) For an ideal OP amp with an input bias current of $100 \mu\text{A}$ at 20°C , $R_i = 100 \text{ K}\Omega$ and $R_f = 1 \text{ M}\Omega$, calculate:
- i) The voltage gain (3marks)
- ii) The output off set voltage due to the input bias current (3marks)
- iii) How can the effect of input bias current be minimized? (3marks)
- d) Differentiate between inverting input and the non-inverting input in op amp (2marks)

QUESTION 3 (20 MARKS)

By use of simple sketches of operation amplifiers, derive the expression for output voltages V_o in each of the following applications.

- i) Inverter (4mks)
- ii) Adder (4mks)
- iii) Multiplier or divider (4mks)
- iv) Integrator (4mks)
- v) Differentiator. (4mks)

QUESTION 4 (20 MARKS)

- a) State four uses of amplifiers in instrumentation. (4mks)
- b) A linear resistance potentiometer is 50 mm long and has uniformly wound wire having resistance of 10000 ohms. Under normal conditions, the slider is at the centre of the potentiometer. Find the linear displacement when the resistance of the potentiometer is
 - i) 3850 ohms. (6mks)
 - ii) 7560 ohms. (4mks)
 - iii) Are the two displacements in the same direction? (3mks)
 - iv) if it is possible to measure a minimum value of 10 ohms resistance with the above arrangement, find the resolution of the potentiometer in mm. (3mks)

