CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ELETRICAL AND ELECTRONICS ENGINEERING

EENG 393: ANALOGUE ELECTRONICS

STREAMS: BSC EENG **TIME: 2 HOURS**

DAY/DATE: FRIDAY 20/12/2024 **8.30 A.M – 10.30 A.M.**

SECTION A:

ANSWER ALL QUESTIONS

QUESTION1

a) Explain briefly what doping is and its importance in semiconductors. **(2 marks)**

b) In a differential amplifier with two input resistors (Rin) of 4.7 kΩ each, two collector resistors (RC) of 10 kΩ each, and a transconductance (gm) of 2 mS, calculate the voltage gain (Av) for a differential input voltage (Vd) of 1V. **(3 marks)**

c) Explain the two types of bias used in semiconductor. **(4 marks)**

d) In an inverting amplifier circuit with an op-amp, a feedback resistor (Rf) of 10kΩ, and an input Resist or (Rin) of 2kΩ, calculate the voltage gain (Av) and the output voltage (Vo) when the input voltage (Vin)is2V. **(4 marks)**

e) Explain the difference between open-loop gain and closed-loop gain in amplifier systems? **(4 marks)**

f) In a differential amplifier, if the input to one of the input terminals is 2 mV and the input to the other input terminal is 3 mV, calculate the differential output voltage if the

differential gain (AD) is 200. **(3marks)**

g) In a common base connection, α=0.95. The voltage-drop a cross 2 Kω resistance which is connected in the collector is 2V. Draw the circuit and calculate the base current.
(5 marks)

g) An op-a mph as again-b and width product (GBW) of 1MHz. Calculate the bandwidth (BW) of an inverting amplifier with a voltage gain of 10. (1 mark)

h) Explain one advantage and one disadvantage of using coupling capacitors in the transist or circuit design for DC operation. (**4 marks**)

a) Using a V-I graph, explain the concept of a valanche breakdown. Use the Zener diode circuit to explain how the avalanche breakdown is stopped by the Zener diode and act as a voltage regulator. **(11 marks)**

b) There are factors that contribute to operational amplifiers from not being idea. Analyze the effects of the following terms that make it impossible for operational amplifiers to work at the ideal state. **(9 marks)**

i. Offsetvoltage, V_{os}
ii. Biascurrent, I_{bias}
iii. Offsetcurrent, I_{os}

QUESTION3

a) Using circuit diagrams, illustrate the differences between an inverting amplifier and a non-inverting amplifier that are ideal. Derive the equations of Gain (G) that govern the two types of amplifiers. **(10 marks)**

b) Operational amplifiers (op-amps) and differential amplifiers are both essential components in analog electronics, but they serve different purposes and have distinct characteristics. Explain five differences between the mop-amps and differential amplifiers.

(10 marks)

QUESTION4

a) Explain the four modes of operation of an BJT transistor. **(12 marks)**

b) Explain in details four applications of p-n junction diode. **(8 marks)**
