KISII UNIVERSITY

UNIVERSITY EXAMINATIONS
SPECIAL EXAMINATION
SECOND YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE/BACHELOR OF SCIENCE COMPUTER SCIENCE/INFORMATION TECHNOLOGY
FIRST SEMESTER 2021/2022
(JULY, 2022)

PHY 213: INTRODUCTORY ELECTRONICS

STREAM: Y2 S1   **TIME: 2 HOURS**

DAY: THURSDAY, 3:00 PM – 5:00 PM   **DATE: 28/07/2022**

INSTRUCTIONS:

1. *Do not write anything on this question paper.*
2. *Answer Question ONE (Compulsory) and any other TWO questions.*

QUESTION ONE   (30 MARKS)

a) Explain the structure of the following materials using energy band theory.

   i) Insulators

   ii) Conductors

   iii) Semiconductors   (6 marks)

b) With a well labeled circuit diagram, explain how a bridge rectifier works.

   Sketch its   output when connected to a C.R.O with and without the capacitor across the load.

                                                                                      (6 marks)

c) A differential amplifier has an open-loop voltage gain of 120 and a common input signal

   of 3.0 V to both terminals. An output signal of 24 mV is obtained. Calculate the common-mode gain

   and the CMRR.   (5 marks)

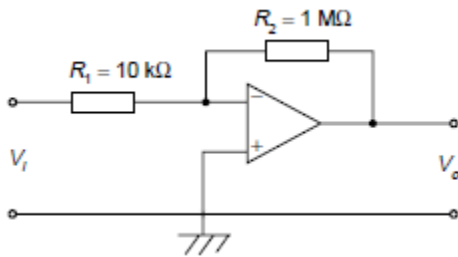d) Distinguish between forward and reverse biasing of a p-n junction   (6 marks)

e) Explain using diagrams the three Bipolar transistor configurations　　　　(7 marks)

QUESTION TWO

a) Why does a pure semiconductor behave like an insulator at absolute zero temperature (3 marks)

b) The op amp shown in Figure below has an input bias current of 100 nA at 20°C.

Calculate

　　i) the voltage gain, and　　　　　　　　　　　　　　　　　　　　(2 marks)

　　ii) The output offset voltage due to the input bias current.　　　　　　(2 marks)

　　iii) How can the effect of input bias current be minimized?　　　　　　(3 marks)

c) Discuss how a transistor can be used as a current amplifier.　　　　　　(6 marks)

d) Explain using a sketch the operational amplifier as an integrator　　　　(4 marks)

QUESTIONS THREE

a) Describe how p – type and n – type semiconductors are formed　　　　　(6 marks)

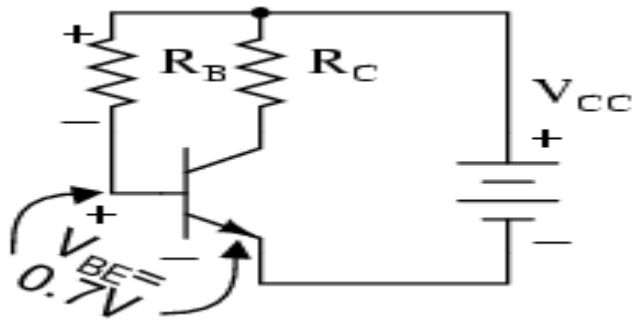b) Describe the following types of diodes and state their applications

　　i) Zener diode　　　　　　　　　　　　　　　　　　　　　　　　(3 marks)

　　ii) Light emitting diode

　　iii) Photo diode　　　　　　　　　　　　　　　　　　　　　　　(3 marks)

c) Study the following circuit and derive the following:

    i) I_B

    ii) I_E (5 marks)

QUESTION FOUR

a) Define the following terms:

    i) Slew rate

    ii) Output impedance   (6 marks)

b) Design a circuit incorporating an Operational amplifier as an inverting and a non-inverting amplifier.   (6 marks)

c) Determine the common-mode gain of an op amp that has a differential voltage gain of

    150×10^3 and a CMRR of 90 dB.   (5 marks)

d) Distinguish between the FET and the BJT   (3 marks)

QUESTION FIVE
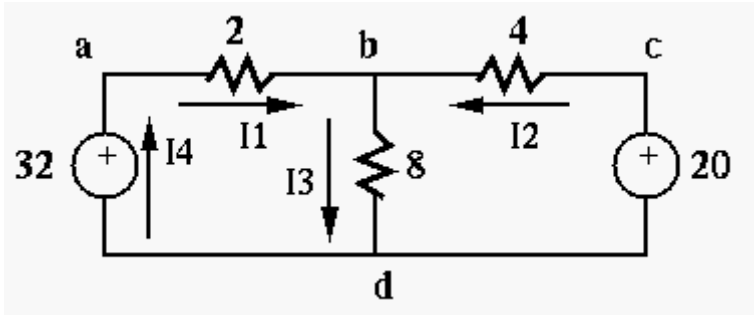
a) Define Kirchhoff's law   (2 marks)

b) Discuss the curve characteristics of electric filters   (3 marks)

c) Find the three unknown currents (I_1, I_2, I_3) and three unknown voltages (V_{ab}, V_{bd}, V_{cd}) in the circuit below:

d) When a reverse gate voltage is 12V, the gate current is 1.6×10^{-3}mA. Find the resistance between gate and source (5 marks)

e) Determine the value of g_{fs} for a FET if the drain current changes from 2mA to 2.2mA when gate source voltage is changed from -3V to -2.7V. (5 marks)

f) Explain the structure and functions of depletion mode MOSFET (5 marks)