MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES
DEPARTMENT OF MATHEMATICS AND PHYSICAL SCIENCES
BACHELOR OF SCIENCE (PHYSICS)

COURSE CODE: PHY 3115-1
COURSE TITLE: PHYSICS LABORATORY V

DATE: 4/6/ 2023 **TIME: 0830 – 1030 HRS**

INSTRUCTIONS

1 Answer question **ONE** and any other **TWO** questions in **section B**

2 Use of sketch diagrams where necessary and brief illustrations are encouraged.

3 Read the instructions in the answer booklet keenly and adhere to them.

4 *This paper contains **FOUR** printed pages (please turnover).*

SECTION A

QUESTION ONE (20 MARKS)

a) Define the following terms

i) Interference **(1mk)**

ii) Reflection **(1mk)**

b) A common base transistor amplifier has an input resistance of 20 Ω and an output resistance of 100 kΩ. The collector load is 1kΩ. If a signal of 500 mV is applied between the emitter and base, find the voltage amplification. Assume α_{ac} to be 1. **(4mks)**

c) An n-p-n transistor at room temperature has its emitter disconnected. A voltage of 5 V is applied between the collector and base. With collector positive, a current of 0.2 μA flows. When the base is disconnected and the same voltage is applied between the collector and emitter, the current is found to be 20 M when the collector current is 1 mA.

i) α, **(2mks)**

ii) I_E **(2mks)**

iii) I_B **(2mks)**

d) In the Michelson interferometer, three conditions are essential to obtain interference fringes. State them. **(3mks**)

e) Through what distance must the movable mirror of a Michelson interferometer be displaced for 4500 fringes of red cadmium line to cross the center of the field of view given that the wavelength of the source is 6550×10^{-10} m **(3mks)**

f) State **TWO** conditions for interference **(2mks)**

SECTION B

QUESTION TWO (10 MARKS)

a) State **THREE** applications of JFETs **(3mks)**

b) List **TWO** advantages of FETs over BJTs **(2mks)**

c) With the help of diagrams differentiate between an N-channel and a P-channel JFET. **(2mks)**

d) Explain **THREE** differences between MOSFETs and BJTs **(3mks)**

QUESTION THREE (10 MARKS)

a) An **NPN** transistor is used in a switching circuit as shown in figure 1 below. Given that Beta value=125, $\mathbf{R_L}$ = 700 Ω, $\mathbf{R_B}$= 50 KΩ and $\mathbf{V_{CE}}$= 0.

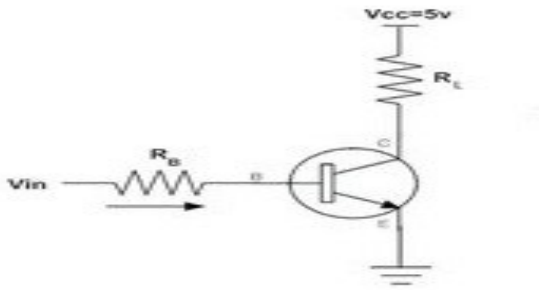

Figure 1

Calculate

i) Collector current $\mathbf{I_C}$ **(2mks)**

ii) Base Current $\mathbf{I_B}$ **(2mks)**

b) With the help of diagrams, briefly describe three types of NPN or PNP transistor configurations. **(6mks)**

QUESTION FOUR (10 MARKS)

a) In a laboratory experiment Gilbert arranged his apparatus as shown in Figure 2 below;

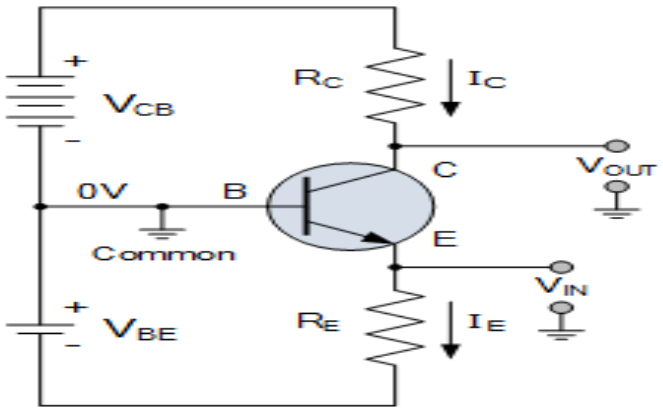

Figure 2.

Study the diagram and answer the questions that follow

i) With a reason name the type of transistor configuration above **(1mk)**

ii) In terms of doping differentiate between the parts labelled **B, E** and **C** **(3mks)**

iii) Gilbert realized that the amplification factor of the circuit above is unity. For a reason explain another transistor configuration connection that you would suggest to him in order to amplify small AC signals better.
(2mks)

b) In a common base connection, the emitter current is 1mA. If the emitter circuit is open, the collector current is 50 μA. Find the total collector current.
Given that $\alpha = 0.92$. **(2mks)**

c) In Young's double-slit experiment, why do we use monochromatic light? if white light is used, how would the pattern change? **(2mks)**

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