

LAIKIPIA



UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

**THIRD YEAR EXAMINATION FOR THE DEGREES OF
BACHELOR OF EDUCATION (SCIENCE) AND
BACHELOR OF SCIENCE (GENERAL)**

PHYS 322: ANALOG ELECTRONICS

STREAM: R

TIME: 2 HRS

DAY: WEDNESDAY[2.30P.M – 4.30P.M] DATE: 17/04/2024

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.



INSTRUCTIONS TO CANDIDATES

- Answer question **ONE** and any **TWO** questions
- Question one carries **40 marks** while all other carry **15 marks**

QUESTION ONE (40 MARKS)

(a) Define the following terms:

(i) Biasing

(ii) Heat sinks

(iii) Thermal runaway **(3 Marks)**

(b) (i) Why is a FET known as a unipolar device? **(1 Mark)**

(ii) State **three** differences between FET and BJT. **(3 Marks)**

(iii) Sketch the structure of a p-channel JFET and draw its symbol **(2 Marks)**

(iv) Compare N-channel with P-Channel FET's **(2 Marks)**

(c) What is a load line? Explain the saturation, active and cut off regions by indicating them on the characteristics curve. **(5 Marks)**

(d) (i) Define Modulation and name three types of digital modulation. **(4 Marks)**

(ii) Differentiate between analog and digital signal **(2 Marks)**

(e) (i) What is an integrated circuit? **(1 Mark)**

(ii) Mention three advantages of integrated circuits over discrete components. **(3 Marks)**

(iii) Give three limitations ICs. **(3 Marks)**

(f) Describe two types of voltage regulators **(4 Marks)**

(g) A power supply has an output resistance of 25 m Ω and a full load current of 0.50 A to a 10.0 Ω load.

(i) What is the load regulation? **(2 Marks)**



(ii) What is the no load output voltage.

(2 Marks)

(h) Write three characteristics of an ideal Operational-Amplifier.

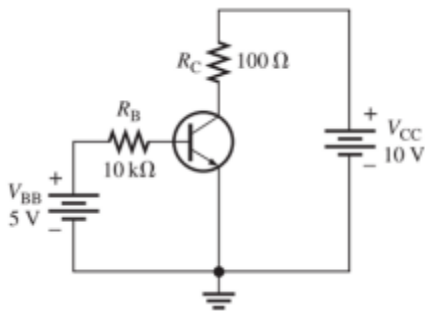
(3 Marks)

QUESTION TWO (15 MARKS)

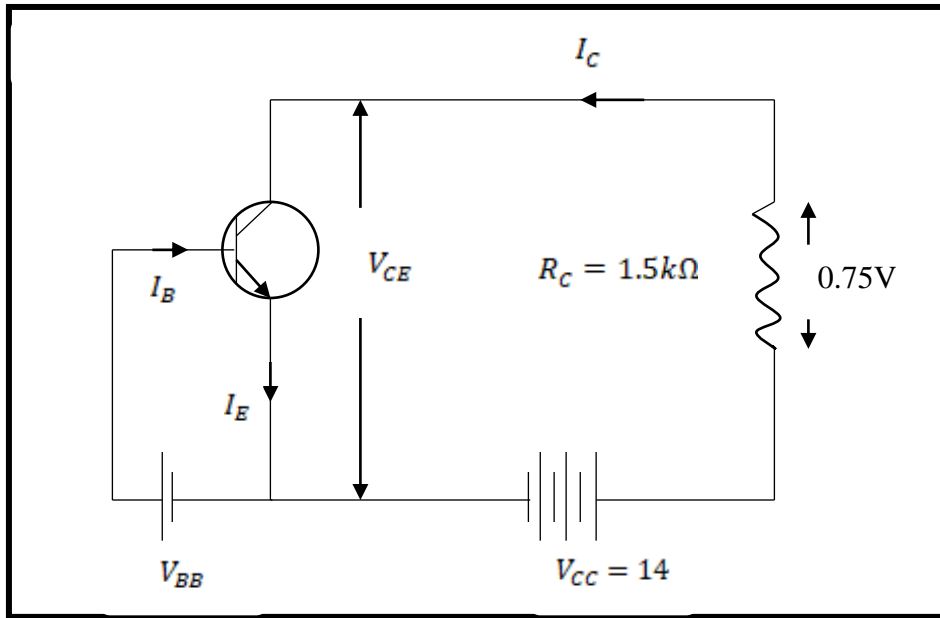
(a) List down the factors to be taken into consideration when choosing an operating point of a transistor (3 Marks)

(b) Determine I_B , I_C , I_E and V_{CE} , in the circuit below .The transistor has a $\beta = 150$ and $V_{BE}=0.7V$.

(7 Marks)



(c) A transistor in common emitter mode has collector supply voltage of 14V and the voltage drop across the 1.5kΩ load resistance is 0.75V. Determine the collector to emitter voltage and the base current if α is 0.96. (5 Marks)



QUESTION THREE (15 MARKS)

- (a) Briefly explain the function of a Modem and name three types of modems that are available today (5 Marks)

- (b) (i) In a radio transmission and reception, what is the main purpose of modulation and demodulation? (2 Marks)

- (ii) With the help of sketches, distinguish between amplitude modulation and frequency modulation. (4 Marks)

- (iii) Give two advantages and two disadvantages of FM transmission over AM transmission (4 Marks)

QUESTION FOUR (15 MARKS)

- (a) (i) Which are the best materials commonly used as heat sinks. (2 Marks)

- (ii) Name any two types of Heat sinks (2 Marks)

- (iii) State two advantages of Heat sink (2 Marks)

- (b) Derive a general relationship between open loop gain and closed loop gains of an negative feedback Amplifier (3 Marks)



- (c) A negative feedback of $\beta = 2.5 \times 10^{-3}$ is applied to an amplifier of open loop gain 1000. Calculate the change in overall gain of the feedback amplifier if the gain of the internal amplifier is reduce by 20%. **(3 Marks)**
- (d) The gain of an amplifier is found to be 750 on test but under conditions of reduced dc supply and external loading, the value reduces to 400. Compare this percentage variation for the amplifier with the corresponding variation if negative feedback of 0.005 is used. **(3 Marks)**

QUESTION FIVE (15 MARKS)

- (a) (i) Describe three main components of a power supply circuit. **(3 Marks)**
- (ii) State two application of a power supply **(2 Marks)**
- (b) (i) Explain the term isolation as used in a power supply. **(2 Marks)**
- (ii) Describe a rack mount power supply. **(2 Marks)**
- (c) (i) What does switching power supply mean? **(2 Marks)**
- (ii) How can the voltage regulation be achieved. **(2 Marks)**
- (iii) Explain the two characteristics of a switching power supply. **(2 Marks)**