



**UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
END OF SEMESTER ONE EXAMINATIONS**

ACADEMIC YEAR 2024/2025

DEPARTMENT: ICT

SEMESTER: ONE

**PROGRAMME(S): DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING (DEEE)
DIPLOMA IN ELECTRONICS COMMUNICATIONS ENGINEERING (DECE)**

YEAR OF STUDY: ONE

COURSE: PRICIPLES OF ELECTRONICS

COURSE CODE : EEE111

DATE: SATURDAY 13TH, DECEMBER 2024

TIME: 9:00 AM – 12:00 NOON

DURATION: 3 HOURS

INSTRUCTIONS:

- (i) This paper contains two Sections: A (40 marks) & B (60 marks).**
- (ii) Attempt ALL questions in Section A, and ONLY THREE questions in Section B.**
- (iii) All questions in Section B carry equal marks.**
- (iv) Credit will be given for use of relevant examples and illustrations.**
- (v) Begin each number in Section B on a new page of the answer sheet.**
- (vi) DO NOT write on this question paper.**

SECTION A [40 MARKS]

Attempt **ALL** the Questions in this Section.

For questions 1 to 10 write the correct alternative in the answer booklet

provided

(2 marks

@)

Question 1

1.	The two inputs of an Operational Amplifier are: _____. A. Cascaded and Common C. Inverted and Non-inverted	B. Positive and Common D. None of the above
2.	The open loop voltage gain of the operational amplifier can be as high as: A. 40,000 B. 1.000	C. Mid-range D. 10k Ω
3.	Zener diodes operate in: _____ bias mode. A. Cool temperature environment	B. Reverse C. 0.7V D. Cut-off
4.	An NPN transistor amplifier in saturation mode has: _____. A. $V_{BE} = 0.7V$ and $V_{CB} = 10V$ C. $V_{BE} = 0.7V$ and $V_{CB} < 0.7V$	B. $V_{CE} = V_{CC}$ D. PN junction saturated
5.	The barrier potential of a PN junction is also known as: _____. A. PNP B. Donor atom	C. Depletion layer D. Junction potential
6.	The V_{CE} voltage of a transistor conducting in saturation is practically: _____. A. Less than 0.2V B. V_{CC}	C. Non-linear D. Maximum voltage
7.	The output voltage of the transistor amplifier in cut-off modes is: _____. A. High B. 0.2V	C. V_{CC} D. Linear and Cut-off
8.	The bypass capacitor of a transistor amplifier: _____. A. Has no polarity C. Provides short-circuit path for the signal	B. Can be short-circuited D. Prevents the DC voltage
9.	Field Effect Transistors are: _____. A. Forward bias mode devices C. Unijunction devices	B. Operated with low voltages D. Low current devices
10.	A CMOS transistor consists of _____. A. It is fully biased C. CMOS batteries	B. Memory D. Two similar transistors of opposite polarities
11.	Valence electrons _____. A. Are not ionized C. Are a maximum of 2	B. Orbit the K-shell D. Are contained in the outermost shell

PRINCIPLES OF ELECTRONICS

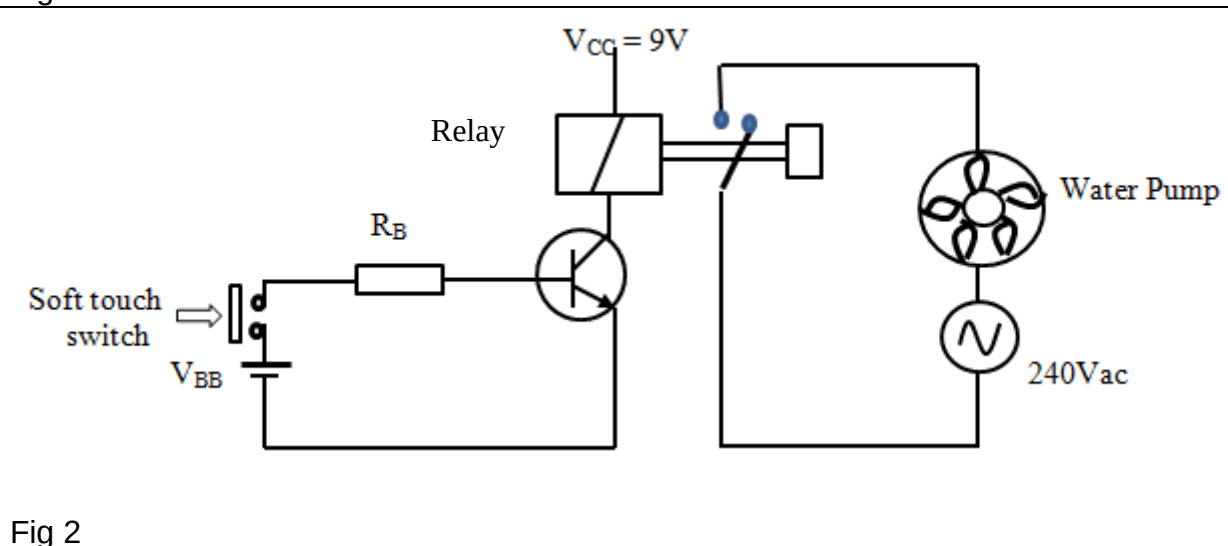
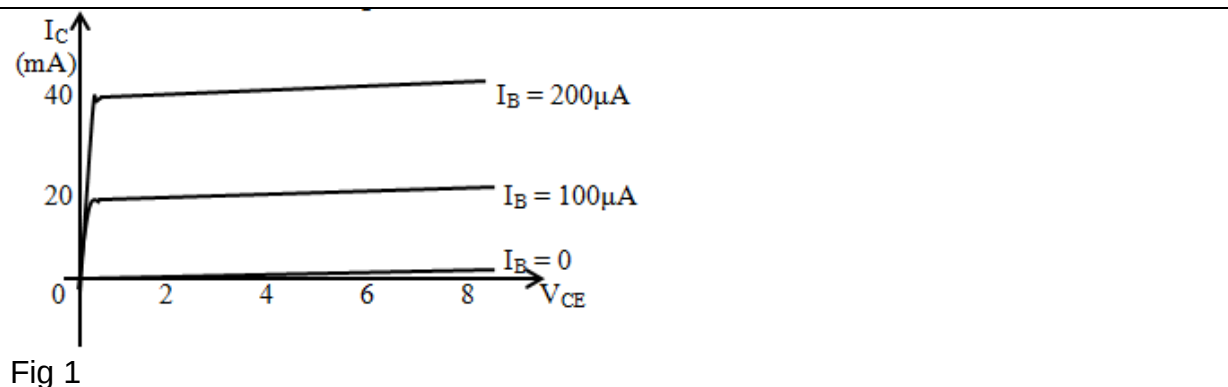
12.	On measuring the V_{CE} voltage of a BJT transistor, it was found to be 0V. The conclusion is that the transistor is: A. Dead B. Cut-off C. In Saturation D. Negative
13.	The sharing of valence electrons by atoms is called: A. Electron pair B. Ionization C. Ions D. Covalent bonding
14.	The depletion layer in the PN junction contains: A. Electrons B. Holes C. Positive and Negative ions D. High energy
15.	Recombination occurs when; A. Conduction band electron loses energy and falls back into the hole in the valence band B. Electron loses energy and falls back into a hole closer to the nucleus. C. Electrons and holes are in depletion region or layer. D. None of the above.
16.	An atom is the smallest particle of _____ that retains the characteristics of that element A. Electron B. Proton C. Semiconductor D. An electron
17.	The depletion layer in the PN junction contains: A. High energy B. Positive and Negative ions C. Holes D. Electrons
18.	Silicon doped with the following materials produces n-type material A. Has a narrow-forbidden region B. Boron, carbon, arsenic C. Arsenic, gallium D. Has a moderate forbidden region
19.	The efficiency of class A and class AB amplifiers are; A. 60% - 65 and 50% - 55% respectively B. 25% - 30% and 50% - 60% respectively C. 10% - 15% and 20% - 25% respectively D. None of the above
20.	The Q point of class C amplifier is, A. In the cut off region B. At the Centre of the loadline C. Above the Centre of the loadline D. None of the above

SECTION B [60 MARKS]

Attempt **ONLY THREE** Questions in this Section.

Question 1

After collecting enough data for his project to design a Water pump transistor switch that operates on 240Vac the next step was to analyze the output characteristics of the BJT transistor which his friend gave him as below, in Fig 1, and then design the circuit as in Fig 2. . The pump will start when the soft switch is pressed ON.



Provided are: $V_{CC} = 9V$, $V_{BB} = 3V$, BJT, Relay of 9V and 40mA, Water pump 240Vac and Soft touch switch.

Calculate:

- The α current ratio of the BJT transistor (5 marks)
- The β current gain of the BJT transistor (5 marks)
- The value of R_B that will successfully operate the pump. (10 marks)

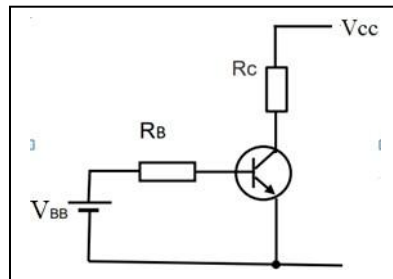
Question 2

- Explain the structure of an atom in terms of energy levels (3 marks)
- What are valence electrons (2 marks)
- Explain the term ionization (2 marks)

- d) Explain the term covalence as is applicable to silicon **(5 marks)**
- e) Using energy band diagrams demonstrate key differences between conductors, insulators and semi-conductors **(5 marks)**
- f) Explain the term doping with relevant examples **(3 marks)**

Question 3

- a) Considering the circuit diagram below, students were given a practical exercise for transistor amplifier with given values of, $V_{CC} = 30V$, $V_{BB} = 5V$, $\beta = 160$, $R_C = 340\Omega$, $R_B = 30k\Omega$. Students were tasked to;

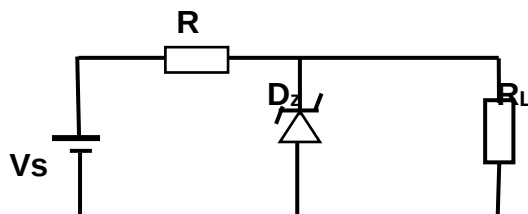


Determine:

- i) The current flowing in collector. **(5 marks)**
- ii) V_{CE} voltage. **(5 marks)**
- b) CMOS devices are popularly used in digital circuits, explain how you would build a CMOS inverter from MOSFET transistors. **(5 marks)**
- c) Draw and explain the CMOS inverter transfer characteristics. **(5 marks)**

Question 4

- a) Refer to the diagram below, given: $V_s = 10V$, $V_z = 5V$, $R_z = 5\Omega$, $I_{zmin} = 1mA$, $I_{zt} = 30mA$, $I_{zmax} = 59mA$, $R_L = 1K$. Answer the questions that follow.



Determine:

- i) The current through R_L if the current in the zener is test current, I_{zt} **(5 marks)**
- ii) The value of R **(5 marks)**
- iii) The maximum Zener voltage **(5 marks)**
- b) Using a graph explain the (I vs V) characteristics of a diode **(5 marks)**

Question 5

A certain secondary school received a pack of transistors for their newly established Electronics laboratory. Their first assignment was to design and construct a one transistor input amplifier for the guitar of the school's music club. A variety of resistors and capacitors were made available.

Determine:

- i) What class is the amplifier to be constructed? **(3 marks)**
- ii) What is the efficiency of the amplifier? **(2 marks)**
- iii) Draw the AC loadline and mark the Q-point of the amplifier. **(5 marks)**
- iv) Draw a sketch circuit diagram of the amplifier. **(5 marks)**
- v) Describe the operation of the amplifier. **(5 marks)**