071305T4EOP

ELECTRICAL OPERATION LEVEL 5

ENG/OS/PO/CR/04/5

Demonstrate Understanding of Electronics

March/April 2025

TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

WRITTEN ASSESSMENT
Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections: **A** and **B**.
2. Marks for each question are indicated in the brackets.
3. Candidates are provided with a separate answer booklet.
4. **DO NOT** write on this question paper.

This paper consists of FOUR (4) printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A (40 MARKS)

Answer ALL the questions in this section.

1. Bipolar junction transistors are used in design of various electronic circuits. Name **three** terminals of a transistor. (3 marks)
2. Extrinsic semiconductors are those semiconductors made by addition of impurities. Differentiate between N-type and P-type extrinsic semiconductors stating their majority charge carriers. (4 Marks)
3. Outline **two** properties of semiconductors. (4 marks)
4. Define the following terms as used in rectifier circuits. (4 marks)
   a) Forward current;
   b) Peak inverse voltage.
5. In a common base connection I_E = 1 mA, I_C = 0.95 mA. Calculate the value of I_B and the current amplification factor α. (4 marks)
6. A silicon control rectifier (SCR) is a semiconductor device that act as a true switch. Define the following terms as used in describing SCR.
   c) Break over voltage; (2 Marks)
   d) Holding current. (2 Marks)
7. Electrical conductivity of a variations. Outline effects of temperature on semiconductors on the following conditions.
   a) At absolute zero; (2 marks)
   b) Above absolute zero (2 marks)
8. Light Emitting Diode is a bidirectional semiconductor greatly used with DC devices. State **four** major application of light emitting diode in electronics. (4 Marks)
9. In the realm of semiconductor physics and electronics engineering, explain the rectifying principle of a crystal diode. (4 marks)
10. Bipolar Junction Transistors have been classified into NPN and PNP transistors. Differentiate between NPN and PNP transistors. (2 Marks)
11. Solid materials are categorized into conductors, semiconductors and insulators based on their electrical conducting properties. State **two** examples of each category. (3 Marks)
    a) Conductors;
    b) Semiconductors;
    c) Insulators.

SECTION B (60 MARKS)

Answer any THREE questions in this section

12. A diode is a two terminal device consisting of a PN junction made of germanium or silicon.
    a) With the aid of a diagram, describe the V-I characteristics of PN-junction of an ideal diode. (10 Marks)
    b) Briefly explain **five** applications of unijunction transistor (UJT). (10 Marks)
13. AC supply is converted to DC supply to power DC electronic components in electronic circuits.
    a) With the aid of a circuit diagram, explain the working principle of single phase full-wave bridge rectifier. (12 Marks)
    b) Explain **four** advantages of single-phase full wave rectifier over single-phase half wave rectifier. (8 Marks)
14. a) The study of atomic structure is of considerable importance for electronics engineering. Using a diagram, explain Bohr's atomic model. (6 marks)
    b) A working PN junction gives satisfactory performance when operated within the recommended values. Explain **three** limiting values of a PN junction. (6 marks)
    c) A PN junction is a two of a diagrams, explain **two** biasing conditions of a PN junction diode. (8 Marks)
15. a) Figure 1 below shows a circuit used to determine the amount of voltage that will turn the Zener diode on. Calculate:
    i. The output voltage; (2 marks)
    ii. The voltage drop across series resistance; (2 marks)
    iii. The current through Zener diode. (2 marks)

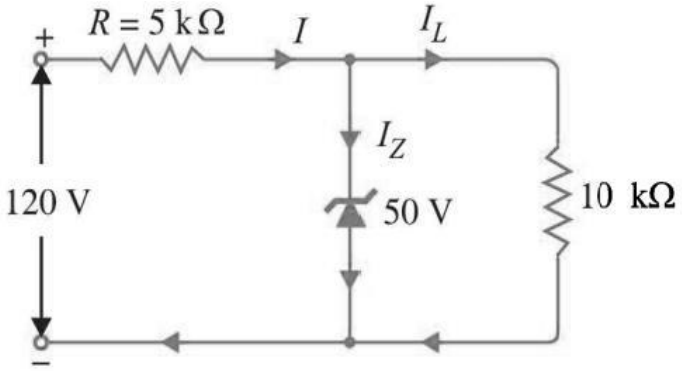

Figure 1

b) With the aid of well labelled diagram, explain the configuration of Metal Oxide Semiconductor Field Effect Transistor (MOSFET). (10 Marks)

c) Electrical symbols have been greatly used for communication between engineers and designers. Draw the symbols for the following semiconductors.

i. Photo diode; (2 marks)

ii. Unijunction Transistor (UJT). (2 marks)