SECTION A (40 MARKS)

*Answer **ALL** the questions in this section in the spaces provided.*

1. Define the unit of measure for each of the following electrical quantities:

   (i) electromotive force; (2 marks)

   (ii) current. (2 marks)

2. Determine the colour code in each case of the following resistors.

   (i) $2.4 \times 10^7\ \Omega$ 10%. (2 marks)

   (ii) $5.3 \times 10^{10}\ \Omega$ 5%. (2 marks)

3. (a) Explain **one** limitation of *excess-3* code as used in computers. (2 marks)

   (b) Convert 24,900 mΩ to ohms. (2 marks)

4. Determine the binary equivalent for each of the following number systems:

(i) 654_8; (1 mark)

(ii) 123_{16}. (1 mark)

(iii) 1004_8; (1 mark)

(iv) $AF9_{16}$. (1 mark)

5. Evaluate each of the following binary arithmetic. Show your working

(i) 1111 0011 + 1011 1010. (2 marks)

(ii) 1011 0001 - 1010 1101. Use the 1's complement. (2 marks)

6. (a) With the aid of a diagram, outline a close circuit showing resistors in parallel and series. (2 marks)

(b) Outline **two** types of resistors used in basic electronics. (2 marks)

7. Explain **two** methods of BCD subtraction. (4 marks)

8. Using two's complement, determine $1000\ 0011_2 - 1010\ 1111_2$. (4 marks)

9. Figure 1 shows the outline of current in a semiconductor material. Identify the parts labelled (i), (ii), (iii) and (iv) (4 marks)

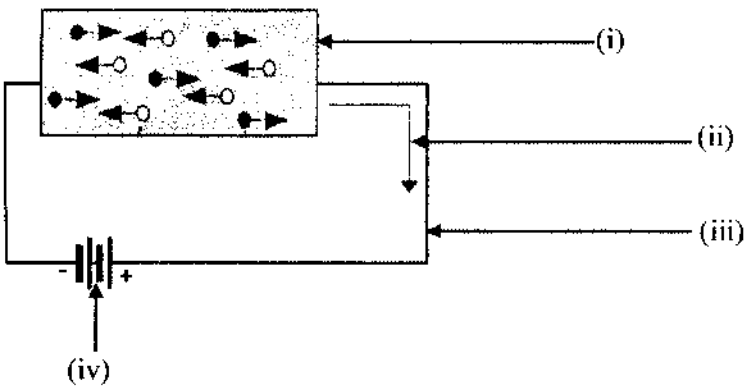

Figure 1

10. With the aid of a diagram in each case, outline the structure of each of the following logic gates:

(i) NOR; (2 marks)

(ii) XOR. (2 marks)

SECTION B (60 MARKS)

*Answer any **FOUR** questions in this section in the spaces provided.*

11. (a) (i) Explain **two** risks of using secondary storage media in computers. (4 marks)

(ii) Differentiate between *optical memory* and *magnetic tapes* as used in computers. (4 marks)

(b) (i) Determine the excess-3 equivalent of the hexadecimal number 7AD. (3 marks)

(ii) A potential difference of 10 V is connected to a uniform resistance wire of length 3 meters and a cross sectional area of 0.09 m^2 with 0.01 A of current flowing in the wire. Determine the resistivity of the material. (4 marks)

12. (a) (i) Comment on the conductivity and resistivity of each of the following materials:

I. metal; (1 mark)

II. glass; (1 mark)

III. semiconductor. (1 mark)

(ii) Explain two characteristics of an extrinsic semiconductor. (4 marks)

(b) (i) Convert each of the following numbers to BCD.

I. 11111010_2; (2 marks)

II. 10000100_2. (1 mark)

(ii) Figure 2 shows an arrangement of logical gates. Use it to answer the question that follows.

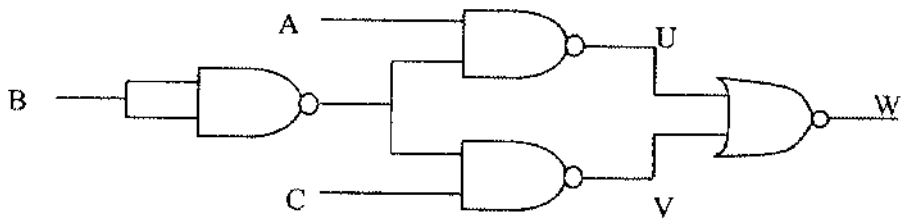

Figure 2

Construct a truth table showing the outputs U, V and W. (5 marks)

13. (a) (i) Perform each of the following BCD arithmetic:

I. 111011010 + 1100101; (2 marks)

II. 10101100 + 10000001. (2 marks)

(ii) Figure 3 shows three capacitors with capacitance C_1 (4 μ F), C_2 (12 μ F), and C_3 (24 μ F) connected across a 480V d.c supply. Use it to answer the question that follows.

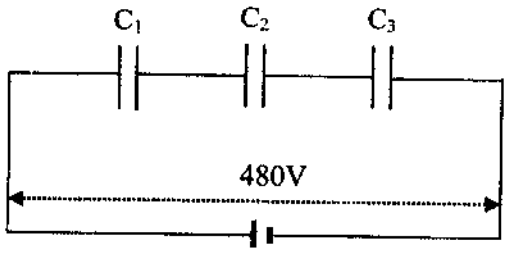

Figure 3

Determine the:

I. total capacitance in farads (F); (2 marks)

II. p.d across capacitors C_1 and C_3. (3 marks)

(b) Determine the following binary arithmetic operations giving your answer in hexadecimal.

(i) 1100 1011 + 1000 1101; (3 marks)

(ii) 1110 1111 – 1111 1001; (3 marks)

14. (a) (i) Outline **three** opportunities created by emerging trends of electronics components. (3 marks)

(ii) Differentiate between *forward bias* and *reverse bias* junction diodes. (4 marks)

(b) (i) Using laws of Boolean algebra, evaluate the function:

$\sum m (1, 3, 5, 7, 9, 11, 13, 15)$. (5 marks)

(ii) Using the k-map, simplify the Boolean expression:

$\bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + \bar{A}\bar{B}\bar{C}D + AB\bar{C}D + A\bar{B}\bar{C}D$. (3 marks)

15. (a) (i) Outline **three** characteristics of an electron. (3 marks)

(ii) Figure 4 shows a simple electric circuit with three resistor of R_1 (50 Ω), R_2 (40 Ω) and R_3 (60 Ω) and voltage of 450 V. Use it to answer the questions that follow.

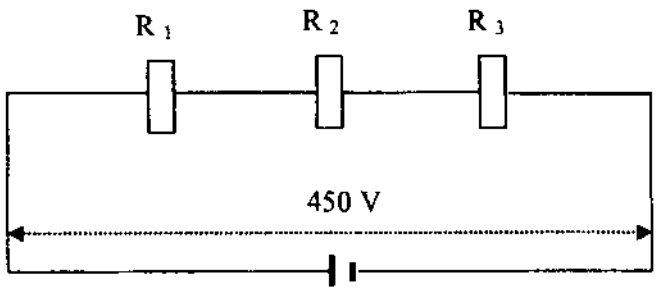

Figure 4

Determine the:

I. total resistance; (2 marks)

II. current across the resistors. (2 marks)

(b) (i) With the aid of a diagram, outline the structure of a computer magnetic disk. Showing the track and sectors. (3 marks)

(ii) A water tap is controlled by three switches. The warm water flows whenever switches X, Y and Z are in the same position. When X and Y are in different positions, warm water flows on condition that switch Z is low.

Draw a truth table to represent this information. (5 marks)