UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 1023
COURSE	: ELECTRICAL & ELECTRONICS TECHNOLOGY
SEMESTER / SESSION	: 01 - 2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL**.
2. All answers should be written in the answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hand and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) When a capacitor is connected to a circuit with a DC supply, two processes called charging and discharging occur.

i) Draw suitable circuit diagrams of the charging process of a capacitor. (4 marks)

ii) Explain the charging process of a capacitor based on each diagram. (6 marks)

b) Based on the capacitor circuit as shown in **Figure 1**:

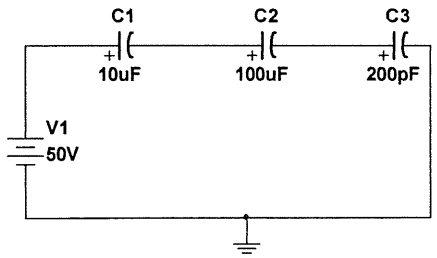

Figure 1

i) State the type of circuit arrangement. (1 mark)

ii) Determine the total capacitance of the circuit. (3 marks)

c) An inductor is an electrical component that stores electrical energy in the magnetic field.

i) Draw suitable diagrams of the basic operation of an inductor. (2 marks)

ii) Describe the basic operation of an inductor. (8 marks)

d) Based on the inductor circuit as shown in **Figure 2**:

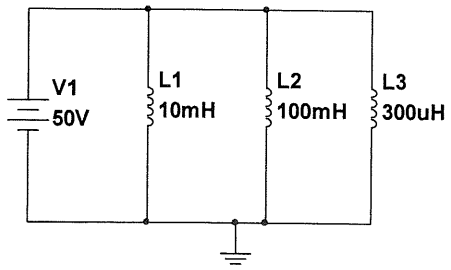

Figure 2

i) State the type of circuit arrangement. (1 mark)

ii) Determine the total inductance of the circuit. (3 marks)

QUESTION 2

a) Explain six (6) advantages of three-phase AC power over single-phase AC power. (6 marks)

b) A balanced three-phase resistive load having an impedance Z = 5 Ω in each phase is supplied from 480 V, balanced three-phase alternator, as shown in **Figure 3**:

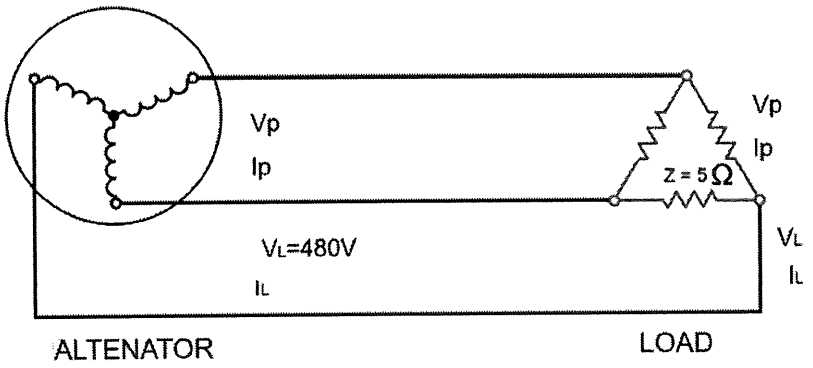

Figure 3

i) State the connection of the supply. (1 mark)

ii) State the connection of the load. (1 mark)

iii) Determine the value for the phase current of the load, $I_{P(LOAD)}$. (3 marks)

iv) Determine the value for the load current of the load, $I_{L(LOAD)}$. (3 marks)

c) Discuss the properties of N-type semiconductors. (7 marks)

d) Based on the p-n junction diode circuit as shown in **Figure 4**:

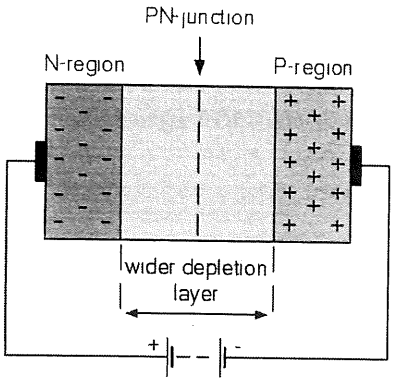

Figure 4

i) State the type of diode biasing. (1 mark)

ii) Describe the bias characteristics of the p-n junction diode. (6 marks)

QUESTION 3

a) Describe the free electron behavior of an NPN BJT using a suitable diagram and description. (7 marks)

b) Based on the NPN BJT circuit as shown in **Figure 5**:

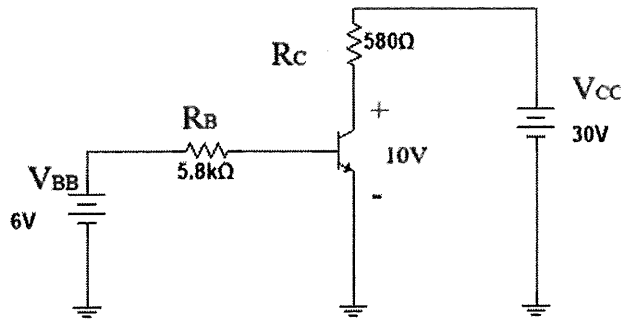

Figure 5

i) State the biasing of the BE junction. (1 mark)

ii) Determine the base current, I_B of the circuit. (3 marks)

iii) Determine the collector current, I_C of the circuit. (3 marks)

c) List four (4) advantages of the digital system. (4 marks)

d) Convert the binary number $\mathbf{110011_2}$ to its decimal number equivalent using the sum of weight method. (3 marks)

e) Convert the decimal number $\mathbf{60_{10}}$ to its binary number equivalent using the repetitive division method. (3 marks)

QUESTION 4

a) Based on the digital circuit as shown in **Figure 6**:

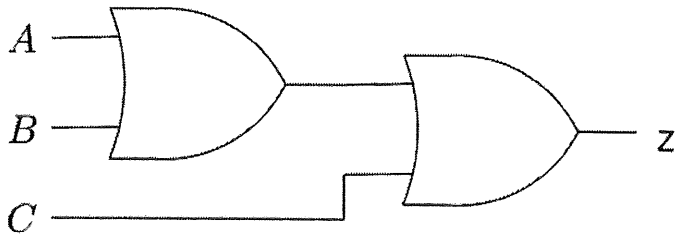

Figure 6

i) Name the logic gate used in the circuit. (1 mark)

ii) Determine the Boolean expression of the circuit. (2 marks)

iii) Determine the complete truth table of the circuit. (8 marks)

b) Based on the digital circuit as shown in **Figure 7**:

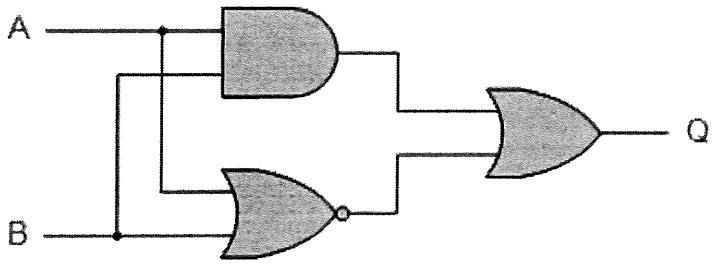

Figure 7

i) Name the logic gates used in the circuit. (3 marks)

ii) Determine the Boolean expression of the circuit. (2 marks)

iii) Determine the complete truth table of the circuit. (4 marks)

----------End of Questions----------