UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DEE 1113 311
COURSE	: ELECTRICAL TECHNOLOGY I
SEMESTER / SESSION	: 02 - 2024/2025
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 9 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) State the definition of electric charge.

(2 marks)

b) State the definition of electric current.

(2 marks)

c) State the definition of electric voltage.

(2 marks)

d) Determine the number of electrons needed to carry 250 mC of charge.

(3 marks)

e) Determine the amount of work (Joules) required to carry 6 coulombs of charge in a 12 V battery.

(3 marks)

f) Determine the battery voltage value when it takes 10 Joules to move 15 coulombs of charge through the conductor.

(3 marks)

g) Given bulb resistance of 300 Ω and current flow through is 100 mA. Find the power dissipated on the bulb.

(3 marks)

h) Find the current through a wire if 25 coulombs of charge flow past a given point in 2s.

(3 marks)

i) Determine the resistor color code for the following resistors. The tolerance is 10%.

i. 12 kΩ

(2 marks)

ii. 4.7 MΩ

(2 marks)

j) Determine the expected value for the resistors with the following color codes.

i. red/red/black/gold

(2 marks)

ii. grey/red/yellow/silver

(2 marks)

k) Calculate the total resistance, R_T based on **Figure 1** from point A to point B.

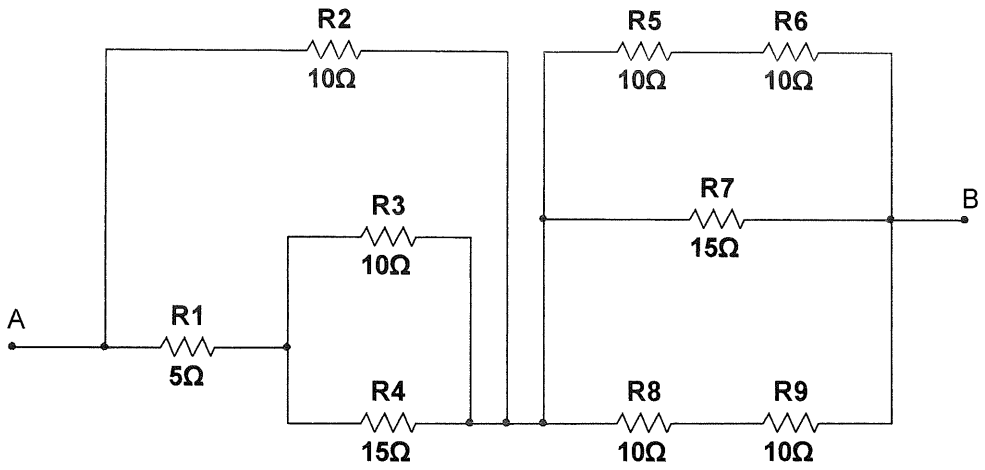


Figure 1

(6 marks)

QUESTION 2

a) Describe the behaviour of current and voltage drop in a series circuit.

(2 marks)

b) Describe Kirchoff's Voltage Law (KVL). Support your answer with an illustration.

(3 marks)

c) Determine the voltage drop across resistors R_1, R_2 and R_3 in **Figure 2**.

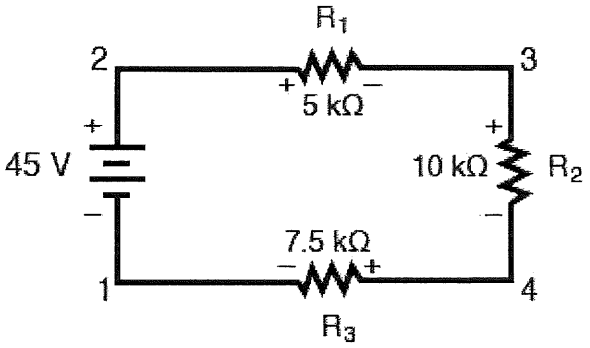


Figure 2

(6 marks)

d) Describe the behaviour of current and voltage drop in a parallel circuit.

(2 marks)

e) **Figure 3** shows a parallel circuit.

i. Determine the total resistance, R_T of the circuit.

(3 marks)

ii. Determine the total current, I_{total} flow through the circuit.

(3 marks)

iii. Determine the current I_{R1}, I_{R2} and I_{R3} flowing through resistors R_1, R_2 and R_3.

(6 marks)

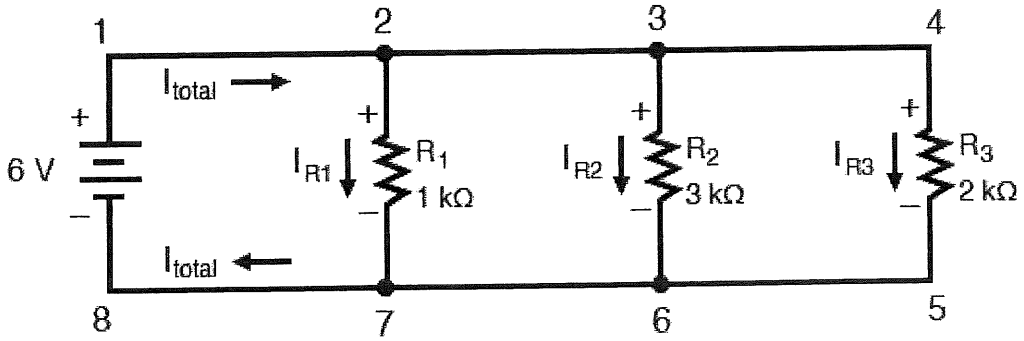


Figure 3

f) **Figure 4** shows resistors parallel to a current source.

i. Calculate the current I_{R1}, I_{R2} and I_{R3} flowing through resistors R_1, R_2 and R_3. Show all calculations.

(8 marks)

ii. Calculate the power dissipation in resistor R_1.

(2 marks)

iii. Calculate the power dissipation in resistor R_2.

(2 marks)

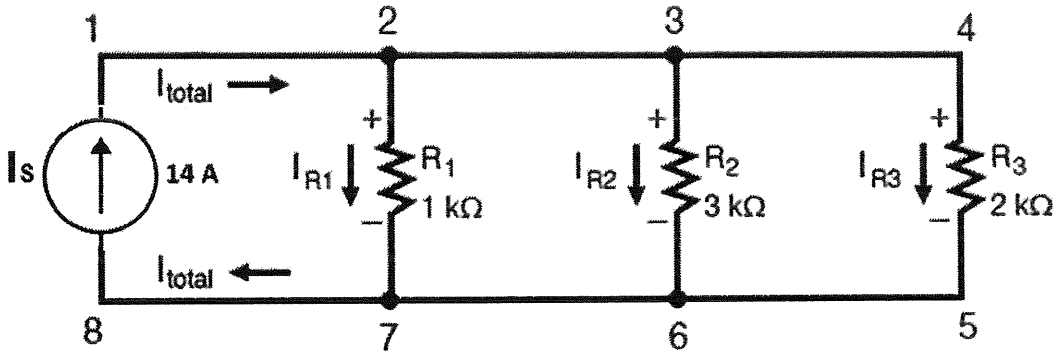


Figure 4

QUESTION 3

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) Determine the total capacitance, C_T for the circuit in **Figure 5**.

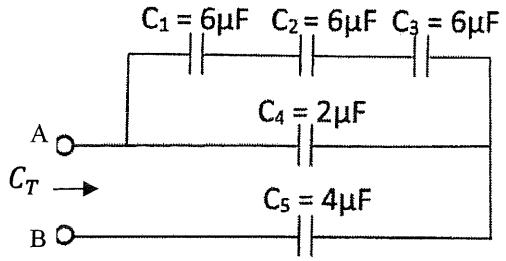


Figure 5

(4 marks)

QUESTION 4

a) 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)

b) Determine the total inductance, L_{Total} for the circuit in **Figure 6**.

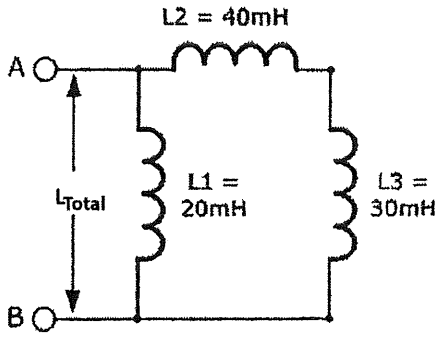


Figure 6

(4 marks)

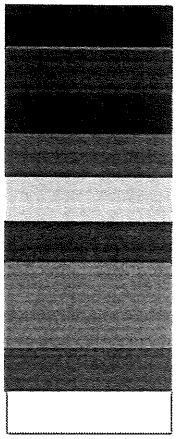
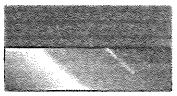
----------End of Questions----------

APPENDIX I

1.	Charge	$Q = \frac{number\ of\ electrons}{6.25 \times 10^{18}\ e/C}$
2.	Voltage	$V = \frac{W(Joules)}{Q(Coulombs)}$
3.	Current	$I = \frac{Q}{t}$
4.	Resistor value	$= AB\ x\ 10^{C} \pm \%D\ \Omega$
5.	Ohm's Law	$V = IR$
6.	Power	$P = VI = I^2R = \frac{V^2}{R}$
7.	Series Capacitor	$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_N}}$
8.	Parallel Resistor	$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N}}$
9.	Parallel Inductor	$L_T = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \cdots + \frac{1}{L_N}}$
10.	Voltage Divider	$V_x = \frac{R_x}{R_T} V_S$
11.	Current Divider	$I_x = \frac{R_T}{R_x} I_T$ Where $R_T = R_1 \| R_2 \| \ldots \| R_n$

APPENDIX II

The color code of resistors

	Color	Digit	Multiplier	Tolerance
Resistance value, first three bands: **First band–1st digit** **Second band- 2nd digit** ***Third band- multiplier (number of zeros following the 2nd digit)**				
	Black	0	10^0	
	Brown	1	10^1	1% (five band)
	Red	2	10^2	2% (five band)
	Orange	3	10^3	
	Yellow	4	10^4	
	Green	5	10^5	
	Blue	6	10^6	
	Violet	7	10^7	
	Gray	8	10^8	
	White	9	10^9	
Fourth band- tolerance				
	Gold	±5%	10^{-1}	5% (four band)
	Silver	±10%	10^{-2}	10% (four band)
	No band	±20%		

* For resistance values less than 10Ω, the third band is either gold or silver. Gold is for a multiplier of 0.1 and silver is fo a multiplier of 0.01.