



UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BMT 1033
COURSE	: ELECTRICAL TECHNOLOGY
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 3 HOURS

Instructions:

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

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

THIS BOOKLET CONTAINS 8 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- a) Draw a symbol of an ideal current source. (2 marks)
- b) Answer the following question:
- Differentiate **two (2)** types of current by definition. (4 marks)
 - Illustrate the types of current to support your answer in b) i. (2 marks)
- c) Identify the placement of an ammeter and a voltmeter to measure the current and the voltage across resistor, R_3 in Figure 1. (2 marks)

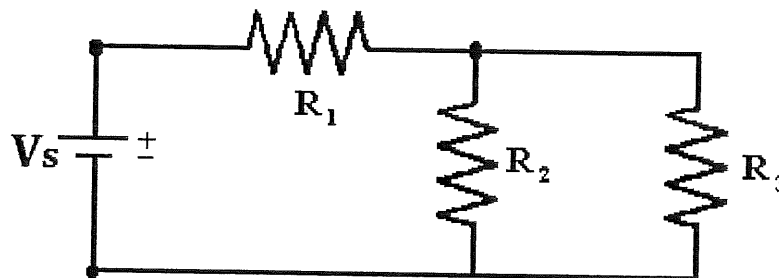


Figure 1

- d) Figure 2 shows a 4 bands resistor.

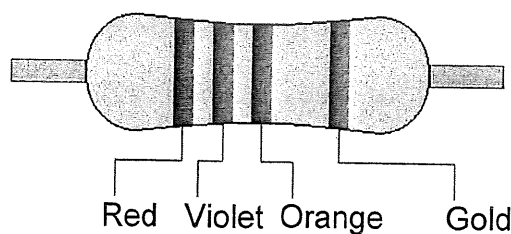


Figure 2

- State the resistance values and tolerance for the following 4-band resistor. (2 marks)
- Determine the minimum and the maximum resistance within the tolerance limits for the resistor in Figure 2. (5 marks)

iii. You were measuring the resistor in Figure 2 using a multimeter. The measuring value showed on the multimeter was $25.5\text{k}\Omega$.

Choose the **condition of the resistor** with GOOD or BAD condition. (1 marks)

GOOD	
BAD	

e) There are various types of variable resistor.

i. List TWO (2) types of common variable resistor. (2 marks)

ii. Explain ONE (1) function for each resistor stated in e) i. (4 marks)

f) Calculate the total inductance, L_T of the following capacitive circuit in Figure 3.

(6 marks)

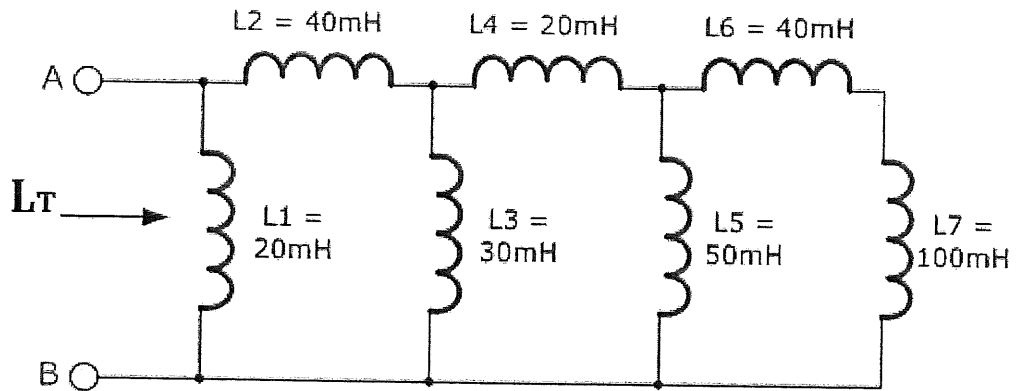


Figure 3

QUESTION 2

- a) Figure 4 shows a circuit with a voltage source and resistors.
- i. Show all nodes and loops in the circuit. (5 marks)
 - ii. Describe the number of nodes and loops in the circuit. (4 marks)

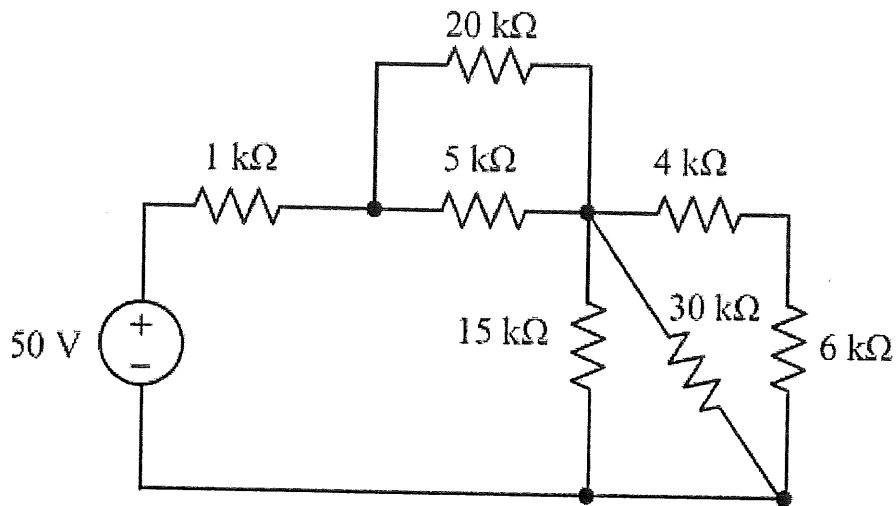


Figure 4

- b) Referring to the circuit in Figure 5,
- i. Calculate the current I_1 , I_2 and I_3 by using Kirchoff's laws. (11 marks)
 - ii. Calculate the voltage, V at each resistor by using Ohm's law. (3 marks)

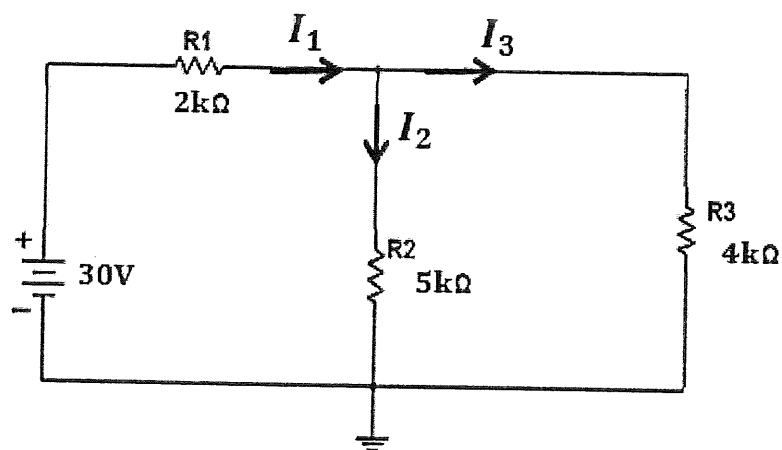


Figure 5

- c) Analyze the circuit of Figure 6 to obtain V_1 , V_2 and V_3 using voltage divider.

(7 marks)

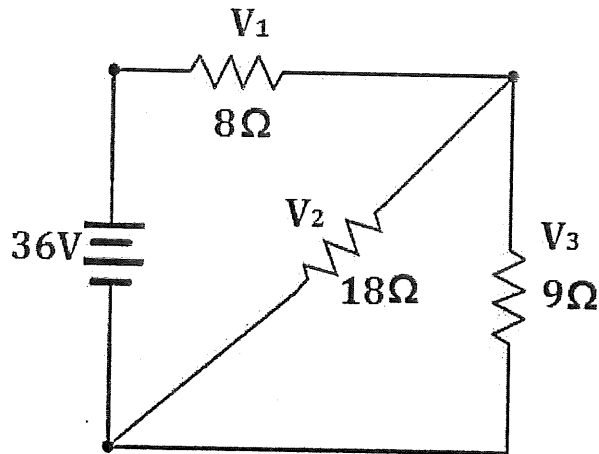


Figure 6

QUESTION 3

Define the following terms:

- a)
- i. Electric power transmission. (2 marks)
 - ii. Electric power distribution (2 marks)
- b) Differentiate **five (5)** comparisons of single phase and three phase system. (10 marks)
- c) A Y-connected supplies is connected to Y-connected loads as shown in Figure 7. Given the impedance per phase of the load is $5 + j2\Omega$, analyze:
- i. Voltage (V_{an}, V_{bn}, V_{cn}) (3 marks)
 - ii. Current (I_a, I_b, I_c) (3 marks)

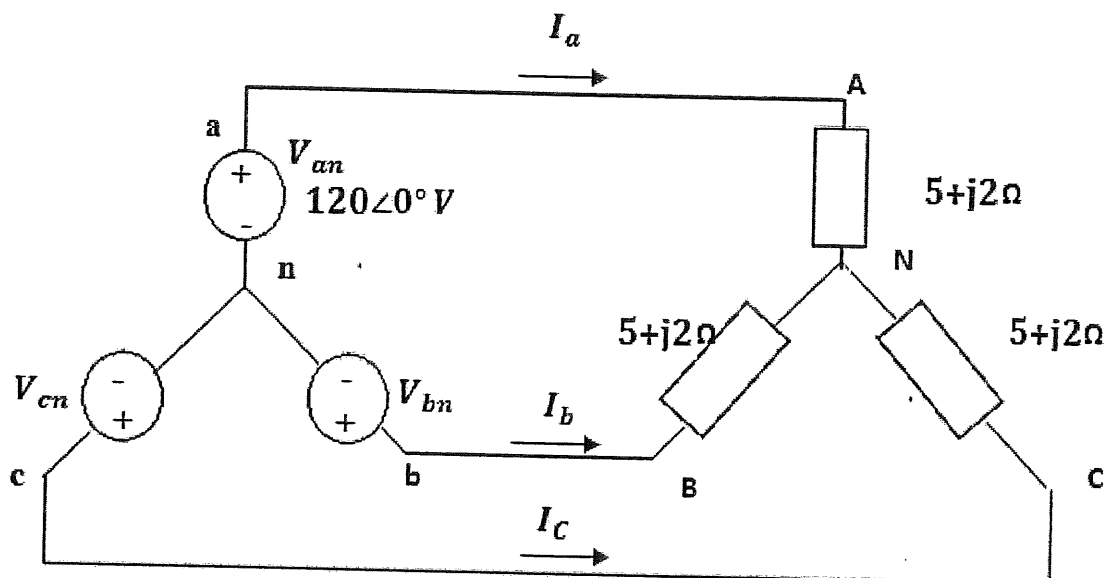


Figure 7

QUESTION 4

- a) A single phase transformer has 480 turns on the primary winding and 30 turns on the secondary winding. The maximum value of the magnetic flux density is 1.1T when 2200 volts, 50Hz is applied to the transformer primary winding. Calculate:
- The transformer ratio, a . (2 marks)
 - The maximum flux in the core, Φ_{max} . (3 marks)
 - The cross-sectional area of the core, A . (3 marks)
 - The secondary induced emf, V_s (3 marks)

- b) Figure 8 shows a single phase transformer.

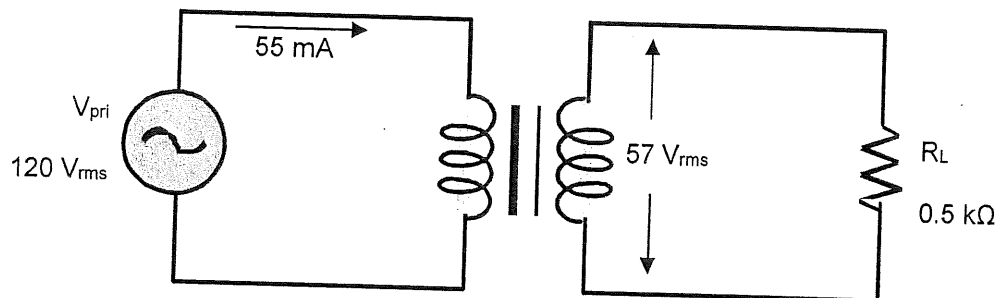


Figure 8

By referring to Figure 8, determine:

- P_{in} (2 marks)
 - P_{out} (2 marks)
 - Efficiency of the transformer, η (2 marks)
- c) A single-phase transformer has an energy component, I_E of 250 mA and a magnetizing component, I_M of 600 mA. Calculate the unloaded current, I_0 . (3 marks)

-----End of question-----

ELECTRICAL TECHNOLOGY (BMT 1033)

FORMULA SHEET

Three Phase System (Y-connected)	$V_{an} = V_P \angle 0^\circ V$ $V_{bn} = V_P \angle -120^\circ V$ $V_{cn} = V_P \angle -240^\circ V$ $I_{an} = \frac{V_{an}}{Z_Y} A$ $I_{bn} = \frac{V_{bn}}{Z_Y} A$ $I_{cn} = \frac{V_{cn}}{Z_Y} A$
Transformer	$a = \frac{N_P}{N_S} = \frac{V_P}{V_S}$ $E_{rms} = \frac{N\omega}{\sqrt{2}} \Phi_{max}$ $\Phi_{max} = \beta \times A$ $\eta = \frac{N_P}{N_S} \times 100\%$