UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 1033
COURSE	: ELECTRICAL TECHNOLOGY
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands 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) State the definition of current. (1 mark)

b) Name the component that stores energy in its electric field. (1 mark)

c) Given bulb resistance of 330Ω and current flow through is 100mA. Find the power dissipated on the bulb. (3 marks)

d) Find the current through a wire if 22 coulombs of charge flow past a given point in 2s. (3 marks)

e) Find the resistance and tolerance of the 4-band resistors with the color code below.

i. Red, green, black and silver. (2 marks)

ii. Black, brown, white and gold. (2 marks)

f) Based on the circuit in Figure 1, find the total resistance, R_{TOTAL}. (7 marks)

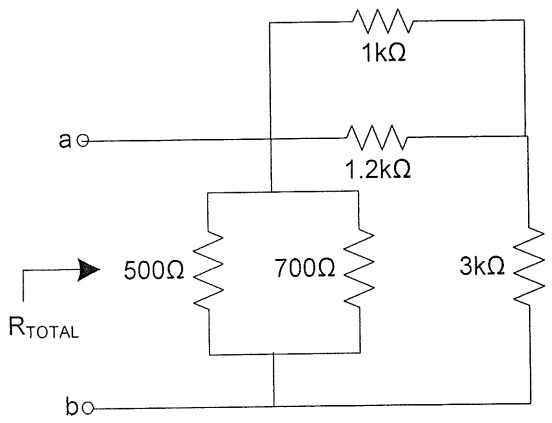

Figure 1

g) Three capacitors, C1 = 5μF, C2 = 10μF, and C3 = 20μF are connected in series across a 150V source. Find the total capacitance. (3 marks)

QUESTION 2

a) Define the following terms.

i. Node (1 mark)

ii. Loop (1 mark)

b) Define Kirchoff Voltage Law (KVL). Support your answer with an illustration. (3 marks)

c) Find the voltage of **V1**,**V2** and **V3** in the Figure 2. (6 marks)

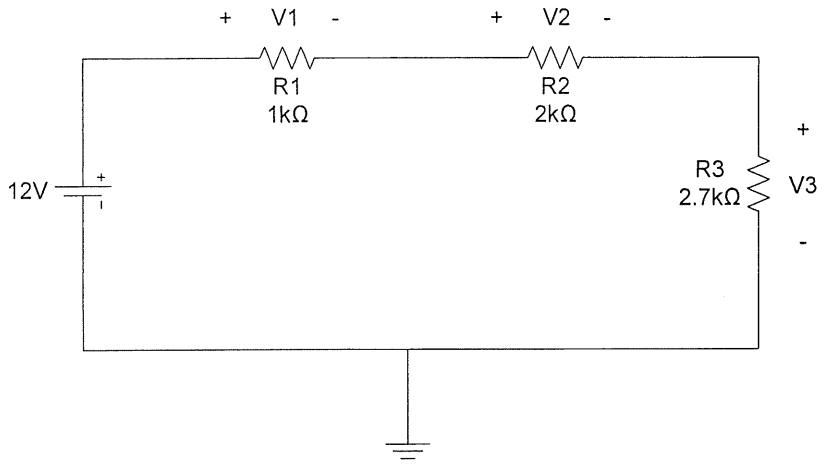

Figure 2

d) Figure 3 shows a parallel circuit. Find:

i. Total resistance of the circuit. (2 marks)

ii. Total current, I_{TOTAL} flow through the circuit. (2 marks)

iii. The current I_1, I_2 and I_3. (6 marks)

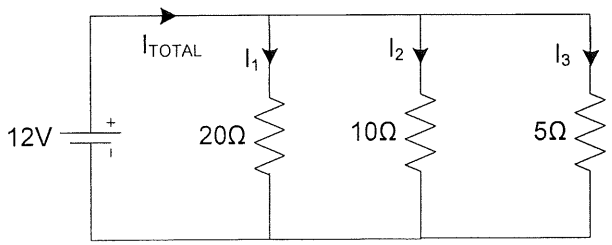

Figure 3

e) Given a sinusoidal of $v(t) = 10\,cos(\,20t + 50^o)V$. Find the following:

i. Amplitude, $V(m)$. (1 mark)

ii. Phase, $\emptyset$. (1 mark)

iii. Angular Frequency, ω. (1 mark)

iv. Period, T. (2 marks)

QUESTION 3

a) State the unit of magnetic flux. (1 mark)

b) Given the voltage of $v(t) = 20\,cos(10t + 20^o)V$ is applied. Find the current through a 10 mF capacitor. (5 marks)

c) Given the current of $i(t) = 45\,cos(100t + 50^o)A$ flow through a circuit. Find the voltage across a 1mH inductor. (5 marks)

d) Answer the following question:

i. Find the flux density in a rectangular core that is 10.0 mm by 5.0 mm if the flux is 10 μWb. (4 marks)

ii. Express the obtained flux density in gauss. (2 marks)

e) Find flux is in a core that is wrapped with a 100 turn coil with a current of 50 mA if the reluctance of the core is 2.5 x 10^7 A-t/Wb. (4 marks)

f) Find the magnetomotive force if a 300 turn coil has 3mA of current. (3 marks)

QUESTION 4

a) List **two (2)** possible connections for the three-phase system. (2 marks)

b) A wye-connected three-phase alternator supplies power to a delta-connected resistive load in Figure 4 below. The alternator has a line voltage of 220 V. Each resistor of the delta load has 10 Ω of resistance. Find:

i. Line voltage of the load, $E_{L(Load)}$ (2 marks)

ii. Phase voltage of the load, $E_{P(Load)}$ (2 marks)

iii. Phase current of the load, $I_{P(Load)}$ (3 marks)

iv. Line current to the load, $I_{L(Load)}$ (3 marks)

v. Line current delivered by the alternator, $I_{L(Alt)}$ (2 marks)

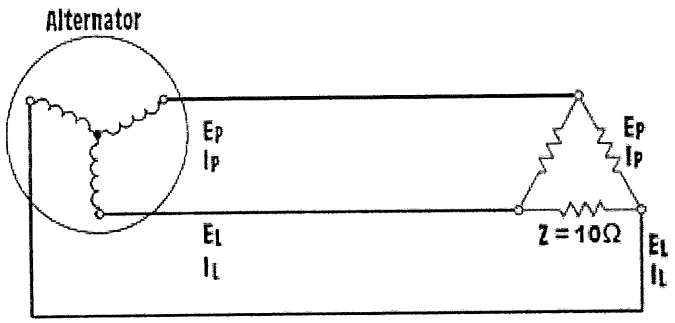

Figure 4

c) A transformer has 500 turns on the primary and a turns ratio of 0.3. Find the number of turns on the secondary transformer. (3 marks)

d) Based on the transformer circuit as shown in Figure 5, find:

i. Transformer turn ratio. (3 marks)

ii. Power of primary winding. (4 marks)

iii. The efficiency of the transformer. (4 marks)

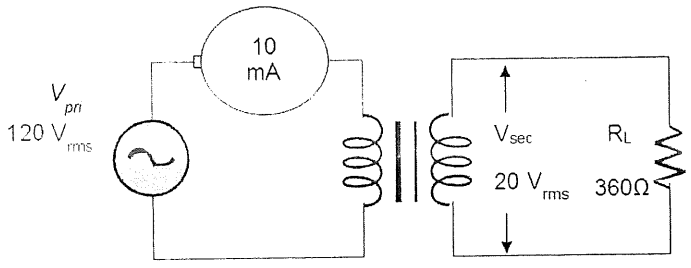

Figure 5

----------End of Question----------

APPENDIX 1

1.	Current	$I = \frac{Q}{t}$
2.	Voltage	$V = \frac{W\ (joules)}{Q\ (coulombs)}$
3.	Ohm's Law	$V = IR$
4.	Power	$P = VI$
5.	Series Capacitor	$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + ... + \frac{1}{C_N}$
6.	Parallel Capacitor	$C_{eq} = C_1 + C_2 + ... + C_N$
7.	Voltage Divider	$V_x = \frac{R_x}{R_T} V_S$
8.	Current Divider	$I_x = \frac{R_T}{R_X} I_T$ Where $R_T = R_1 \| R_2 \| ... \| R_n$
9.	Energy stored in capacitor	$W = \frac{1}{2} CV^2$
10.	AC Circuit	$T = \frac{2\pi}{\omega}$ $z = \frac{1}{j\omega C}$ $z = j\omega L$
11.	Flux Density	$B = \frac{\varphi}{A}$
12.	Magnetomotive force	$F_m = \phi R$ $F_m = NI$
13.	Wye Connection	$I_{Line} = I_{Phase}$ $E_{Line} = E_{Phase}\ x\ 1.732$
14.	Delta Connection	$I_{Line} = I_{Phase}\ x\ 1.732$ $E_{Line} = E_{Phase}$
15.	Transformer turn ratio	$n = \frac{N_{sec}}{N_{pri}}$
16.	Transformer efficiency	$n = \frac{Pout}{Pin} x100$ @ $n = \frac{VL^2/RL}{Vpri\ x\ Ipri} x100$