UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DEI 1003
COURSE	: ELECTRICAL TECHNOLOGY
SEMESTER/SESSION	: 1-2021/2022
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) Express the following numbers in **engineering notation** and **metric prefix** form.

0.00000000129 (4 marks)

b) Name three (3) basic **electrical instruments** as you usually used during lab session.

(3 marks)

c) Figure 1 shows a 4 bands resistor.

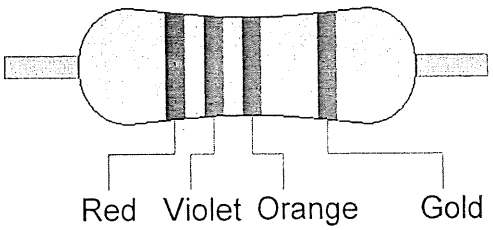

Figure 1

i. State the resistance values and tolerance for the following 4-band resistor.

(2 marks)

ii. Determine the minimum and the maximum resistance within the tolerance limits for the resistor in c) i. (5 marks)

d) For the circuit in Figure 2, find:

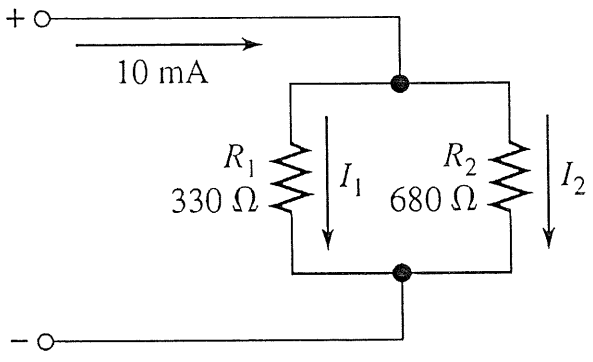

Figure 2

i. Current I_1. (3 marks)

ii. Current I_2. (3 marks)

iii. Voltage drop across R_1. (3 marks)

iv. Voltage drop across R_2. (2 marks)

QUESTION 2

a) For the voltage divider circuit shown in Figure 3, find the **voltage** between points **A and B**.

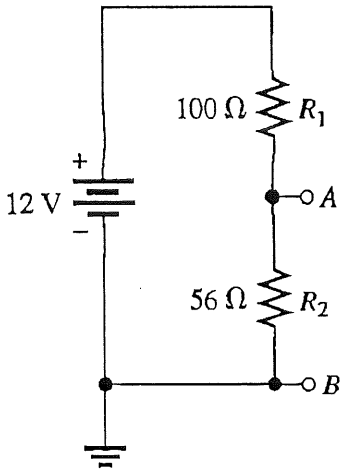

Figure 3

(4 marks)

b) For the circuit in Figure 4;

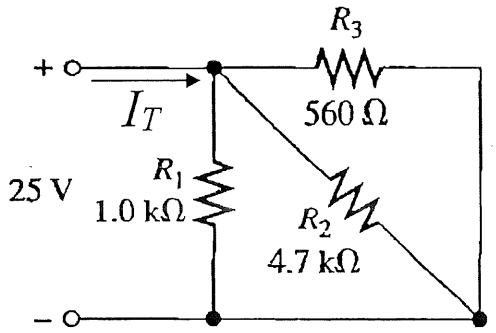

Figure 4

i. Compute total resistance, R_T of the circuit. (3 marks)

ii. Determine total current, I_T. (3 marks)

c) Find the **capacitance** when Q = 50 μC and V = 10 V. (3 marks)

d) Figure 5 shows a parallel connection of capacitors.

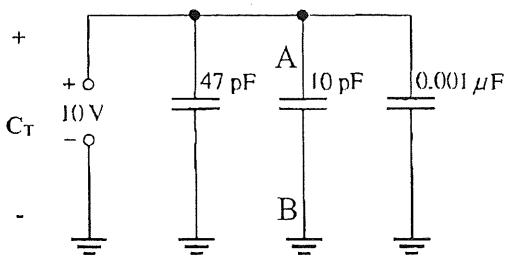

Figure 5

i. Calculate the **total capacitance**, C_T for the circuit. (3 marks)

ii. Determine the voltage across point A and B. (1 mark)

e) Find the amount of **energy** stored in a 4.7 mH inductor when the current is 20 mA.

(2 marks)

f) A student wraps 100 turns of wire on a pencil that is 0.007m in a diameter as shown in Figure 6. The pencil has the same permeability as a vacuum ($4\pi \times 10^{-6}$ H/m). Find the inductance, L of the coil that is formed.

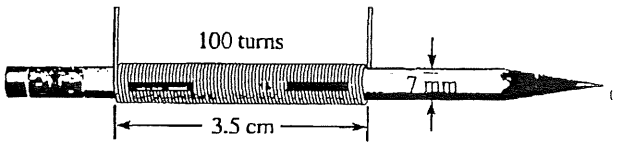

Figure 6

(3 marks)

g) Compute the total inductance, L_T for Figure 7.

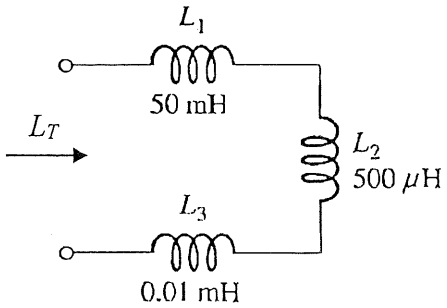

Figure 7

(2 marks)

QUESTION 3

a) For the sine wave in Figure 8, calculate the;

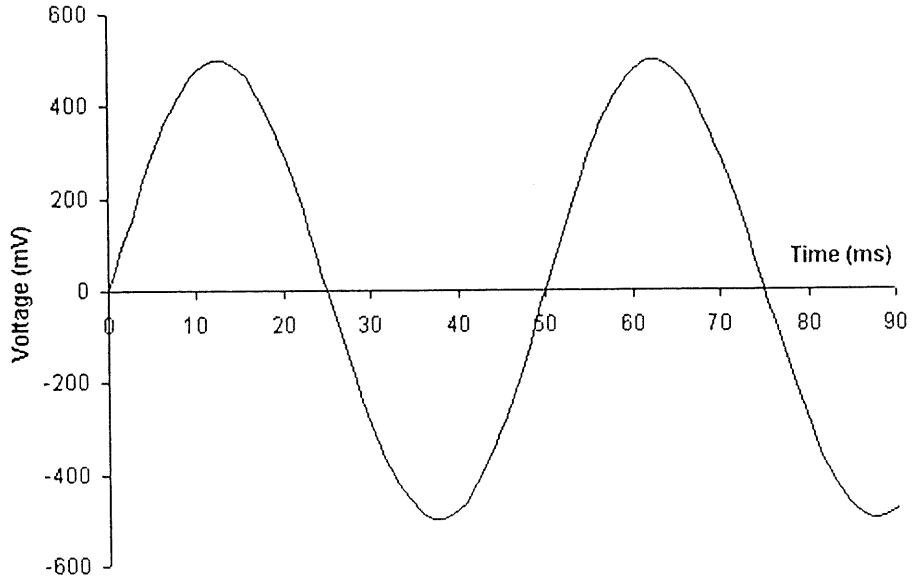

Figure 8

i. Frequency, f (3 marks)

ii. Peak voltage, V_p (2 marks)

iii. rms voltage, V_{rms} (3 marks)

b) A sine voltage is applied to the resistive circuit in Figure 9. Determine the;

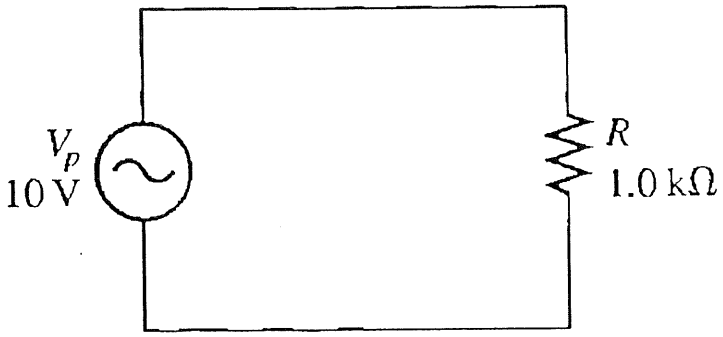

Figure 9

i. Peak current, I_{peak} (2 marks)

ii. rms current, I_{rms} (2 marks)

iii. Average current, $I_{average}$ (2 marks)

c) In a certain magnetic field the cross-sectional area is 0.5 m^2 and the flux is 1500 μWb. Find the flux density. (3 marks)

d) At a given location, assume the earth's magnetic is 0.6 gauss. Express this flux density in unit of tesla (T). (3 marks)

e) Determine the reluctance ($\mathcal{R}$) of a material with a length of 0.28 m and a cross-sectional area of 0.08 m^2 if the absolute permeability is 150×10^{-7} Wb/At.m. (3 marks)

f) Find the magnetomotive force (mmf) in a 50 turn coil of wire when there are 3 A of current through it. (3 marks)

g) Given a magnetic device as shown in Figure 10.

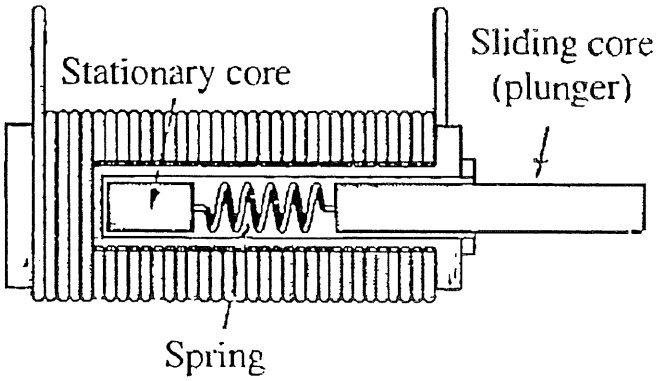

Figure 10

i. Name the device. (1 mark)

ii. Describe **ONE (1)** application which uses the device in g) i. (1 mark)

iii. Give another **ONE (1)** device that used the same principle as the device in Figure 10. (1 mark)

QUESTION 4

a) For the transformer in Figure 11;

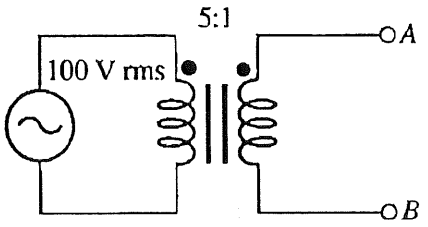

Figure 11

i. Find the rms value in secondary voltage, $V_{rms(sec)}$. (2 marks)

ii. Calculate the peak voltage at secondary, $V_{p(sec)}$. (3 marks)

iii. Draw the secondary voltage waveform, $V_{p(sec)}$ (show the amplitude value). (3 marks)

b) There are two types of three phase connection. Draw that **TWO (2)** forms of the connection. (4 marks)

c) A wye-connected three-phase alternator supplies power to a delta-connected resistive load as in Figure 12. The alternator has a line voltage of 360 V. Each resistor of the delta load has 6 Ω of resistance. Find the following values;

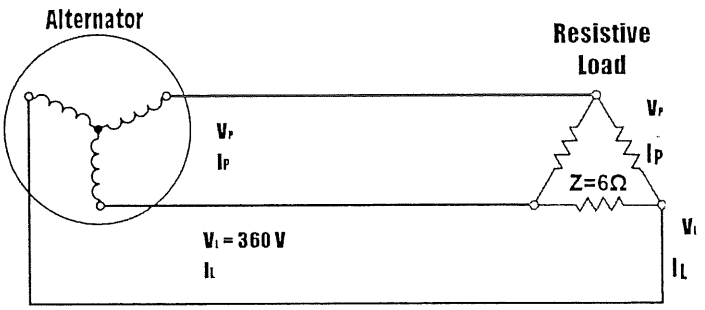

Figure 12

i. Phase voltage of the alternator, $V_{PHASE(Alt)}$ (3 marks)

ii. Line voltage of the load, $V_{LINE(Load)}$ (1 mark)

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

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

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

APPENDIX

1. $V_x = \left(\frac{R_x}{R_T}\right) V_S$

2. $I_x = \left(\frac{R_T}{R_x}\right) I_T$

3. $W = \frac{1}{2} LI^2$

4. $L = \frac{N^2 \mu A}{l}$

5. $V_{rms} = 0.707 V_p$

6. $V_{avg} = = 0.637 V_p$

7. $v = V_p \sin \theta$

8. $v = V_p \sin (\theta \pm \emptyset)$

9. $v = V_p \sin 2\pi ft$

10. $B = \frac{\emptyset}{A}$

11. $\mu_r = \frac{\mu}{\mu_0}$

12. $\mathcal{R} = \frac{l}{\mu A}$

13. $F_m = NI$

14. $\varphi = \frac{F_m}{\mathcal{R}}$

15. $n = \frac{N_{sec}}{N_{pri}} = \frac{V_{sec}}{V_{pri}} = \frac{I_{pri}}{I_{sec}}$

16. $L_M = k\sqrt{(L_1 L_2)}$

17. $k = \frac{\emptyset_{1-2}}{\emptyset_1}$

18. $A = \pi r^2$

19. $\eta = \left(\frac{P_{out}}{P_{in}}\right) 100\%$

20. Wye

$$V_\phi = \frac{V_L}{1.732}$$

21. Delta

$$I_\phi = \frac{I_L}{1.732}$$

22. $VA = 3 \times V_\emptyset \times I_\emptyset$