

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	:	DEE 1123
COURSE	:	ELECTRICAL TECHNOLOGY II
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 6 PRINTED PAGES INCLUDING COVER PAGE**

**QUESTION 1**

a) Based on the sinusoidal waveform as shown in Figure 1:

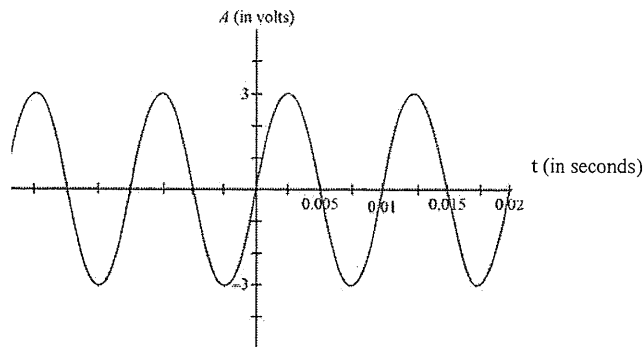


Figure 1

- i) Define the period,  $T$ . (2 marks)
  - ii) State the value of the period,  $T$ . (1 mark)
  - iii) State the peak voltage,  $V_p$ . (1 mark)
  - iv) Write the sinusoidal waveform equation. (4 marks)
- b) A coil of resistance  $10 \Omega$  and inductance  $100 \text{ mH}$  in series with capacitor  $100 \mu\text{F}$  is connected across  $200 \text{ V}$ ,  $50 \text{ Hz}$  power supply as in Figure 2.

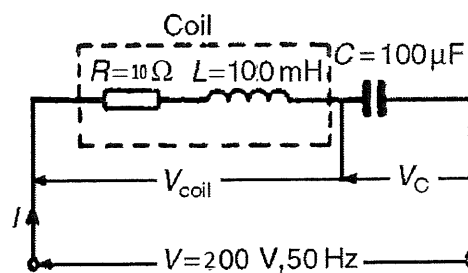


Figure 2

- i) State the circuit impedance,  $Z$ . (3 marks)
- ii) Determine the circuit current,  $I$ . (3 marks)
- iii) Determine the phase angle,  $\theta$ . (1 mark)
- iv) Determine the voltage across the inductor,  $V_L$ . (2 marks)
- v) Determine the voltage across the capacitor,  $V_C$ . (2 marks)

- c) Refer to Figure 3, derive the equations for node voltages  $V_1$  and  $V_2$  using (10 marks) nodal analysis.

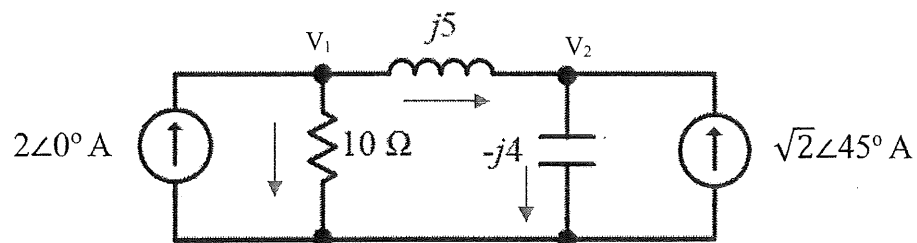


Figure 3

**QUESTION 2**

- a) Define the principle of magnetism. (2 marks)
- b) List FIVE (5) characteristics of magnetic field/flux lines. (5 marks)
- c) Describe the Faraday's First Law and Faraday's Second Law. (4 marks)
- d) Draw the magnetic field that exists when two conductors where:
- i) current flows in the same direction on both conductors. (4 marks)
  - ii) current flows in the opposite direction between both conductors. (4 marks)
- e) A conductor 350 mm long moves at a uniform speed of 4 m/s at right angles to a uniform magnetic field of flux density 1.5 T. Determine the current flowing in the conductor when:
- i) its ends are open-circuited. (4 marks)
  - ii) its ends are connected to a load of 10  $\Omega$  resistance. (2 marks)

**QUESTION 3**

- a) Define the transformer turn ratio. (2 marks)
- b) The amount of mutual inductance depends upon several factors. Identify FOUR (4) factors that affect mutual inductance. (4 marks)
- c) State THREE (3) characteristics of a non-ideal transformer. (3 marks)
- d) A step-down transformer has a turn ratio,  $n$  of 20:1, a primary voltage,  $V_p$  of 4 kV and a load of 10 kW. By neglecting losses, determine the value of the secondary current,  $I_s$ . (5 marks)
- e) Refer to the transformer circuit as shown in Figure 4:

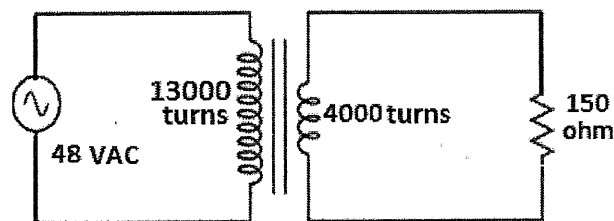


Figure 4

- i) Determine the primary voltage,  $V_p$ . (1 mark)
- ii) Determine the secondary voltage,  $V_s$ . (2 marks)
- iii) Determine the secondary current,  $I_s$ . (2 marks)
- iv) Determine the primary current,  $I_p$ . (2 marks)
- f) Based on the Figure 5:

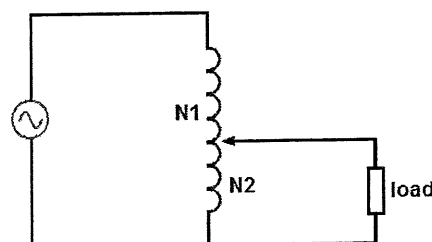


Figure 5

- i) Name the type of this transformer. (1 mark)
- ii) Identify THREE (3) advantages of this transformer. (3 marks)

**QUESTION 4**

- a) List FOUR (4) advantages of a three-phase system. (4 marks)
- b) With a diagram, show the circuit diagram for three phase system in a Y-Y connection. (9 marks)
- c) A three-phase load is supplied with a line voltage of 415 V and a frequency of 50 Hz. Each phase consists of a  $15 \Omega$  resistor connected in series with an inductor of 0.05 H in DELTA - connection.
- i) Calculate the phase current,  $I_p$ . (5 marks)
- ii) Calculate the line current,  $I_L$ . (3 marks)

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