



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION

BACHELOR OF TECHNOLOGY IN ELECTRICAL AND ELECTRONIC ENGINEERING

TEE 4201: ELECTRICAL CIRCUIT THEORY I

END OF SEMESTER EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

DATE: July 2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Answer any **THREE** questions. Each question carries 20 marks.

Do not write on the question paper.

QUESTION 1 [20 marks]

(a) Differentiate between passive and active component and state one example of each type and in each case draw its schematic symbol.

(4 marks)

(b) State

- Thevenin's theorem.
- Maximum power transfer theorem

(6 marks)

(c) Apply Mesh theorem in Fig. Q1 to calculate currents through resistors R_1 , R_2 and R_3

given that $E_1 = 20\text{ V}$, $E_2 = 10\text{ V}$, $R_1 = 2\text{ k}\Omega$, $R_2 = 3\text{ k}\Omega$, $R_3 = 6\text{ k}\Omega$. Indicate the direction of current in each branch.

(10 marks)

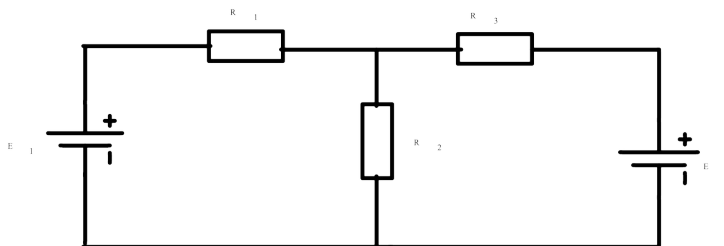


Fig. Q1.

QUESTION 2 [20 marks]

(a) Two alternating voltages v_1 and v_2 are represented by $v_1 = 10 \sin\left(400t + \frac{\pi}{3}\right)$ and

$$v_2 = 20 \sin\left(400t - \frac{\pi}{4}\right). \text{ Determine:}$$

- The rms value of v_1 and v_2 .
- Period of v_1 and v_2 .
- The sum of the two voltages.

(6 marks)

(b) Draw a well labeled phasor diagram of Fig. Q2 where V is sinusoidal voltage.

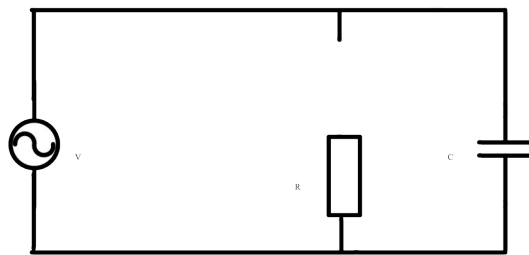


Fig. Q2

(c) For Fig. Q2, given that $R = 5 \Omega$, $L = 0.1 \text{ H}$, $C = 150 \mu\text{F}$ and $V = 200 \text{ V}$, 50 Hz calculate:

- Total current I
- Current through the inductor L
- Phase angle between circuit current I and applied voltage V

(4 marks)

(10 marks)

QUESTION 3 [20 marks]

(a) Describe with appropriate diagrams the principle of generation of 3-Phase a.c voltage

(6 marks)

(b) Describe two possible connections of three phase circuit and draw the phasor for each case.

(4 marks)

(c) A balance star connected load is supplied from a symmetrical three phase 380 V system. The current in each phase is 20 A and lags phase voltage by 30° .

- Calculate the phase and line voltage
- Draw the phasor diagram showing the current and voltage

(10 marks)

QUESTION 4 [20 marks]

An inductor L in series with a resistor R is connected to a d.c voltage V_o via a switch S_1 .

(a) Show that current i_R through the resistor is given by $i_R = I_o \left(1 - e^{-\frac{Rt}{L}}\right)$ where $I_o = \frac{V_o}{R}$ **(10 mark)**

- (b) Using the expressions in (a) show that voltage v_L across the inductor is $v_L = V_o e^{\frac{-Rt}{L}}$ **(4 mark)**
- (c) Given that $V_o = 25 \text{ V}$, $R = 5 \text{ } \Omega$, $L = 1 \text{ H}$, calculate the circuit current, 100 ms after the switch connection. **(6 marks)**

QUESTION 5 [20 marks]

- (a) Using Source transformation method, find the value of current I in Fig. Q5. **(10 marks)**

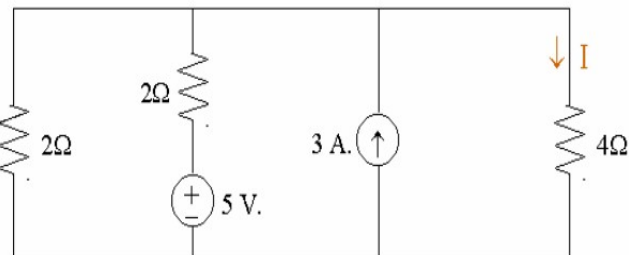


Fig. Q5

- (b) An RLC series circuit with $R = 10 \text{ } \Omega$, $L = 100 \text{ mH}$ and $C = 2 \text{ } \mu\text{F}$ is connected to 50 Volts variable frequency power supply. Determine
- Resonant frequency
 - Current at resonance
 - Q-factor at resonance
 - Cut-off frequencies
 - The circuit band Width

(10 marks)