BINDURA UNIVERSITY OF SCIENCE EDUCATION

PHYSICS AND ENGINEERING DEPARTMENT

PH203: CIRCUIT ANALYSIS

TIME: 3 HOURS

MAR 2024

INSTRUCTIONS

Answer **question one** in Section A and **any three** questions from Section B. Section A carries 40 marks and each question in Section B carries 20 marks.

SECTION A

1 (a) Convert the following from polar to rectangular form: $\boldsymbol{C} = 10 \angle 45°$. [6]

(b) Determine the sum of $\boldsymbol{C_1} = 3 + j\,6$ and $\boldsymbol{C_2} = -6 + j\,3$. [4]

(c) Find the product of $\boldsymbol{C_1}$ and $\boldsymbol{C_2}$ if $\boldsymbol{C_1} = -2 - j\,3$ and $\boldsymbol{C_2} = 4 - j\,6$. [6]

(d) Given that $\boldsymbol{C_1} = 2 \angle -40°$ and $\boldsymbol{C_2} = 7 \angle 120°$, calculate the product of $\boldsymbol{C_1}$ and $\boldsymbol{C_2}$. [6]

(e) Transform the following sinusoid in time domain to phasor domain: $v = -4\sin(30t + 50°)$ V. [5]

(f) Convert the sinusoid corresponding to the following phasor to time domain: $\mathbf{I} = 12 + j\,5$ A. [5]

(g) The instantaneous current of an ac sinusoidal current is given by $I = I_m cos\omega t$. Show that $I_{rms} = \frac{I_m}{\sqrt{2}}$. [8]

SECTION B

2 For the network shown in Fig. 2.1, find the equivalent resistance *Rab* and the current *i* using the Wye-Delta transformation. [20]

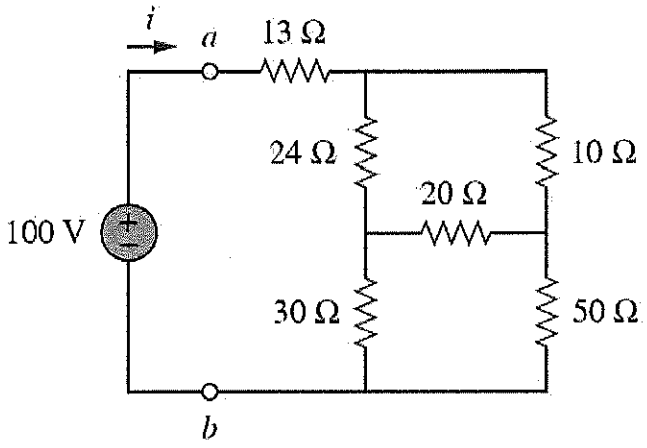


Fig. 2.1

3 (a) Find the current through R_L in the circuit of Fig. 3.1 using Norton's Theorem. [16]

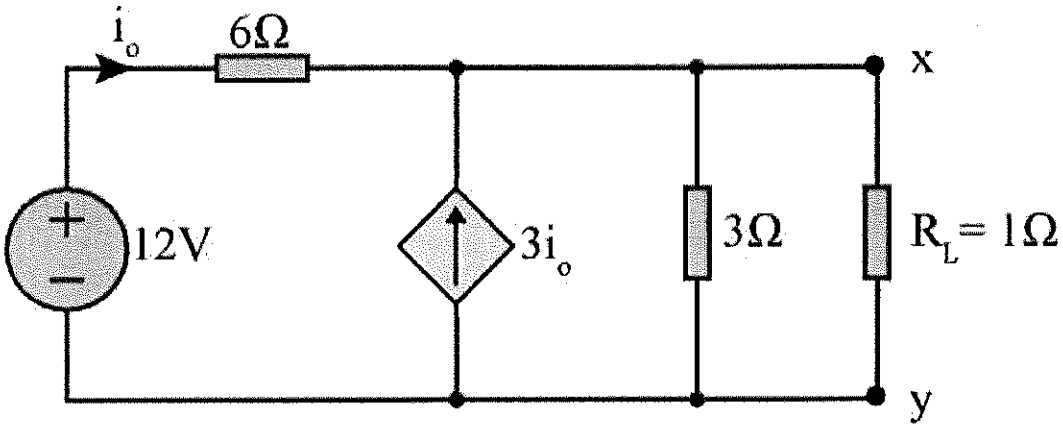


Fig. 3.1

(b) Calculate the amount of heat energy dissipated in the resistor R_L in part (a) over a time interval of 1 hour [4]

4 (a) Solve the circuit in Fig. 4.1 to find the current through 15 Ω using Thevenin's Theorem. [16]

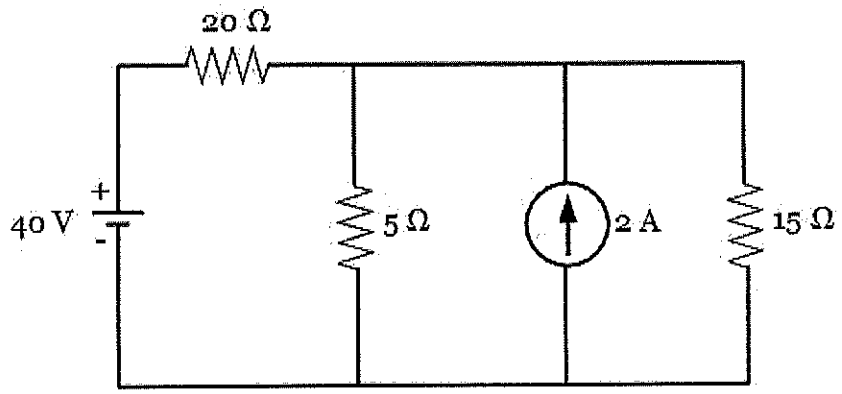


Fig. 4.1

(b) Calculate the potential difference across and the power dissipated in the 15 Ω resistor in part (a). [4]

5 Two current sources are connected to a resistor, capacitor and an inductor as shown in Fig. 5.1.

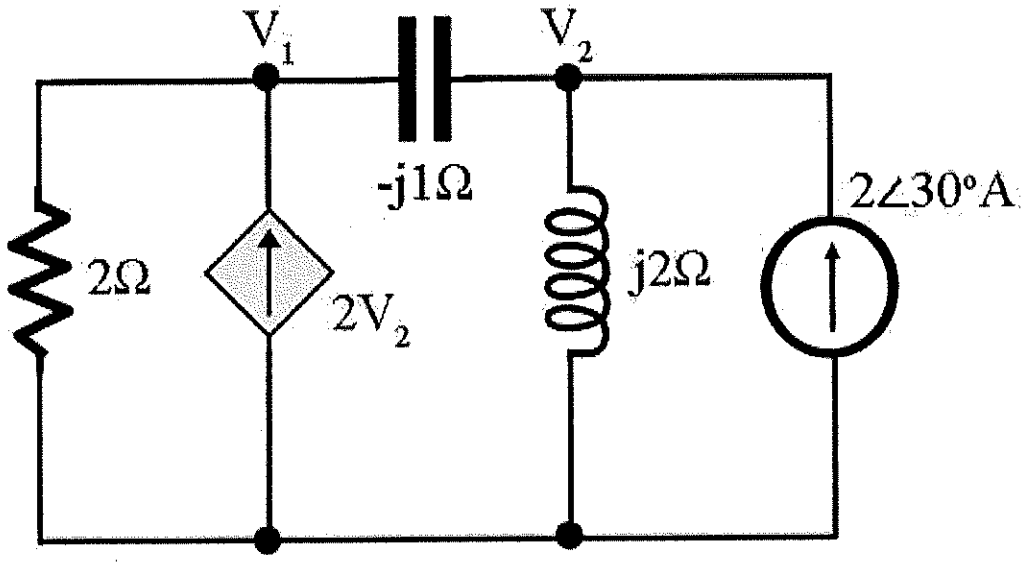
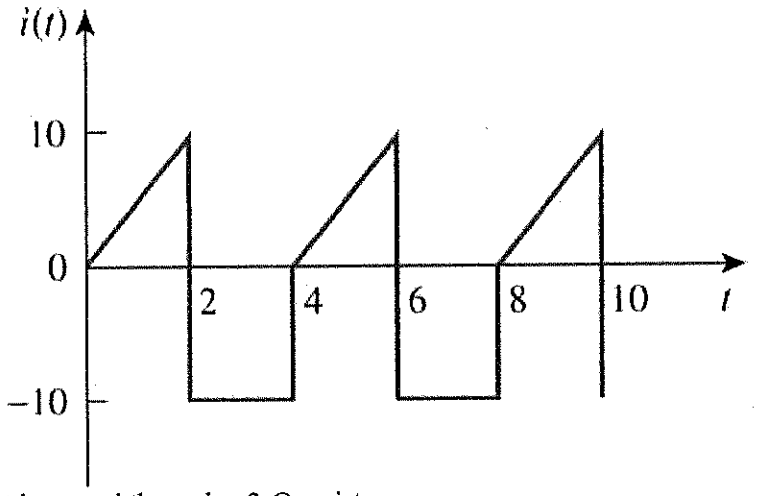


Fig. 5.1

Calculate the node voltage V_1 and V_2 expressing your answers in phasor form. [20]

6 A current waveform is described by the function: $i(t) = \begin{cases} 5t, & 0 < t < 2 \\ -10, & 2 < t < 4 \end{cases}$ as shown in Fig. 6.1.



The current is passed through a 2-Ω resistor.

(a) Find the rms value of the current. [18]

(b) Calculate the average power absorbed by the resistor. [2]