**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF SCIENCE AND ENGINEERING**

**DEPARTMENT: ENGINEERING AND PHYSICS**

**PROGRAMME BSc HONOURS DEGREE IN NETWORK ENGINEERING**

**COURSE CODE PH203 (1): CIRCUIT ANALYSIS**

**DURATION: 3 HOURS TOTAL MARKS: 100**

**INSTRUCTIONS TO CANDIDATES** NOV 2024

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 rectangular to polar form: $\boldsymbol{C} = 3 + j\,4$. [4]

(b) Determine the sum of $\boldsymbol{C}_1 = 2 + j\,4$ and $\boldsymbol{C}_2 = 3 + j\,1$. [4]

(c) Find the product of $\boldsymbol{C}_1$ and $\boldsymbol{C}_2$ if $\boldsymbol{C}_1 = 2 + j\,3$ and $\boldsymbol{C}_2 = 5 + j\,10$. [4]

(d) Given that $\boldsymbol{C}_1 = 5\,\angle 20°$ and $\boldsymbol{C}_2 = 10\,\angle 30°$, calculate the product of $\boldsymbol{C}_1$ and $\boldsymbol{C}_2$. [4]

(e) Transform the following sinusoid in time domain to phasor domain: i = 6cos(50t - 40°) A. [5]

(f) Convert the sinusoid corresponding to the following phasor to time domain: V = $-10\,\angle 30°$ V. [5]

(g) The instantaneous current of an ac sinusoidal current is given by $= I_m cos\omega t$ . Show that $I_{rms} = \frac{I_m}{\sqrt{2}}$ . [6]

(h) Distinguish between ideal and practical sources in electric circuit theory. [2]

(i) Use resistor colour codes to determine the resistances of resistors with the following band colours:

(1) green, brown, blue, silver. [2]

(2) yellow, violet, silver. [2]

(3) grey, red, gold. [2]

## SECTION B

2 (a) Find the equivalent resistance between A and B in Fig. 2.1 using the Wye-Delta transformation. [18]

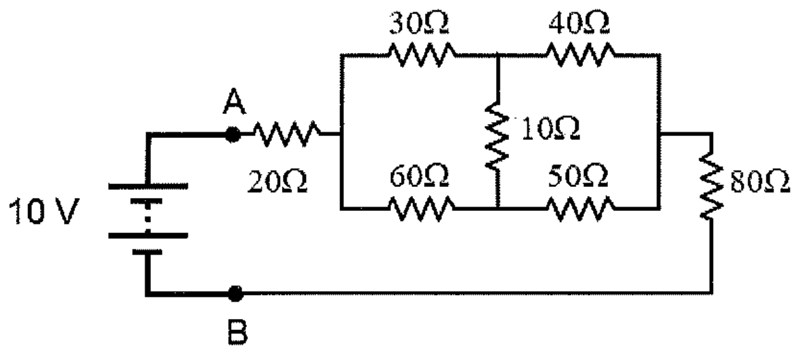


**Fig. 2.1**

(b) Hence determine the value of the current supplied by the power source. [2]

3 (a) Determine the current through the 1 Ω resistor in the circuit in Fig. 3.1 using Superposition Theorem. [16]

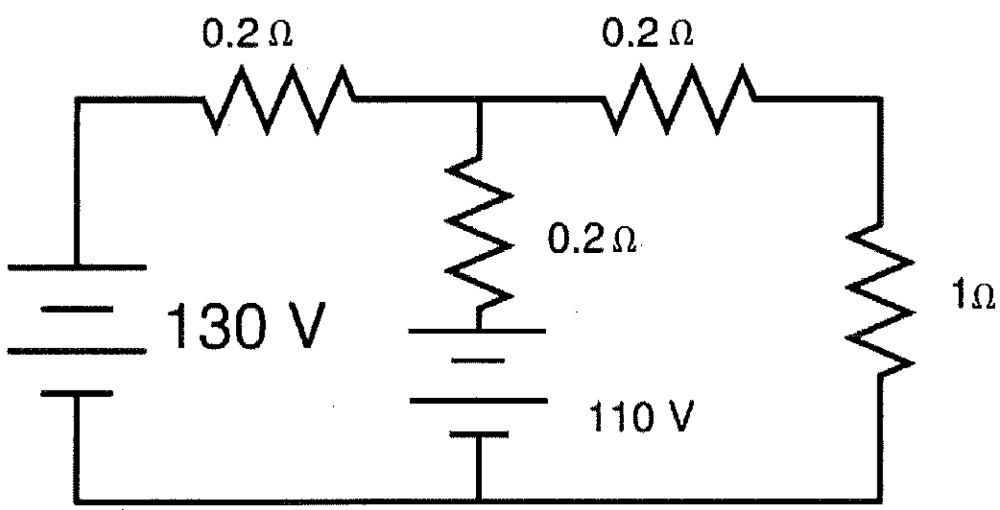


**Fig. 3.1**

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

4 In the network of Fig. 4.1, find the Thevenin voltage ($V_{TH}$), Thevenin resistance ($R_{TH}$) and the load current $I_L$ flowing through and load voltage ($V_L$) across the load resistor $R_L$ = 5 kΩ using Thevenin's Theorem. [20]

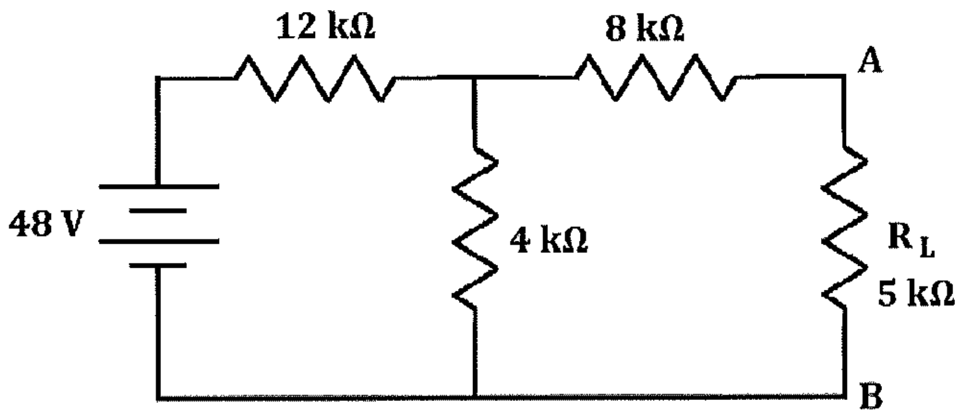


Fig. 4.1

5 In the network of Fig. 5.1, find the Norton current ($I_N$), Norton resistance ($R_N$) and the load current $I_L$ flowing through and load voltage ($V_L$) across the load resistor $R_L$ = 1.5 Ω using Norton's Theorem. [20]

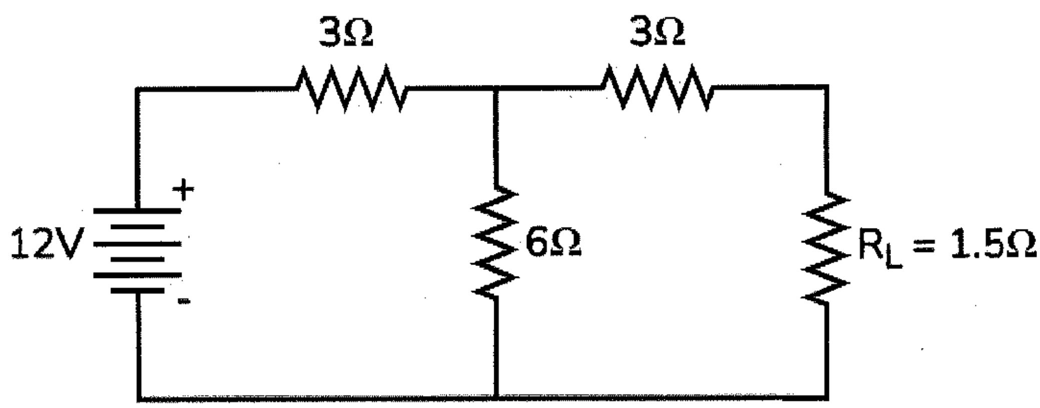


Fig. 5.1

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.

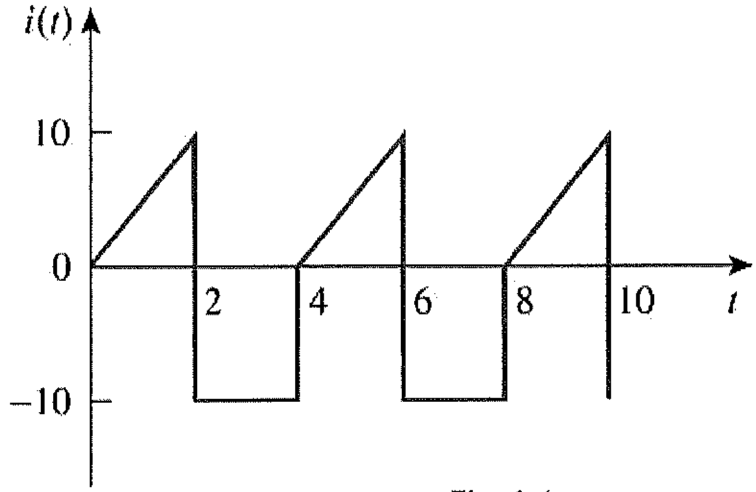


**Fig. 6.1**

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]