BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

JAN 2025

DEPARTMENT: ENGINEERING AND PHYSICS

PROGRAMME BSc HONOURS DEGREE IN COMPUTER SCIENCE / BSc EDUCATION HONOURS DEGREE IN COMPUTER SCIENCE

COURSE CODE PH206 (1): ELECTRONICS 1

DURATION: 3 HOURS TOTAL MARKS: 100

INSTRUCTIONS TO CANDIDATES

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: $F = 4 + j3$. [4]

(b) Determine the sum of $F_1 = 6 + j2$ and $F_2 = 5 + j6$. [4]

(c) Find the product of F_1 and F_2 if $F_1 = 6 + j4$ and $F_2 = 3 + j9$. [4]

(d) Given that $F_1 = 3\angle 80°$ and $F_2 = 12\angle 20°$, calculate the product of F_1 and F_2. [4]

(e) Transform the following sinusoid in time domain to phasor domain: V = 10cos(70t - 20°) V. [5]

(f) Convert the sinusoid corresponding to the following phasor to time domain: $\mathbf{I} = -14\angle 60°$ A. [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) Using the Wye-Delta transformation, find the equivalent resistance between J and K in Fig. 2.1. [18]

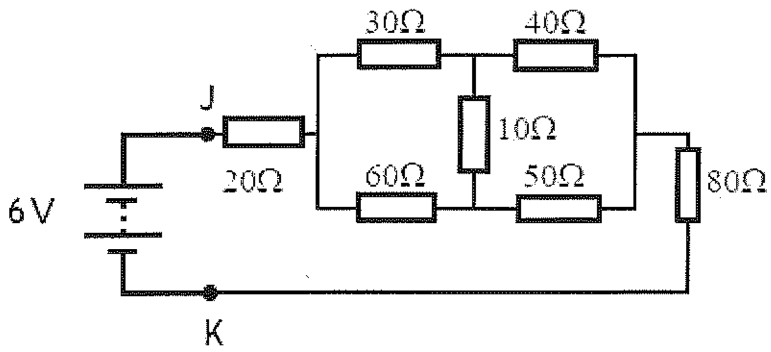

Fig. 2.1

(b) Use your answer in (a) to determine the value of the current supplied by the power source. [2]

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

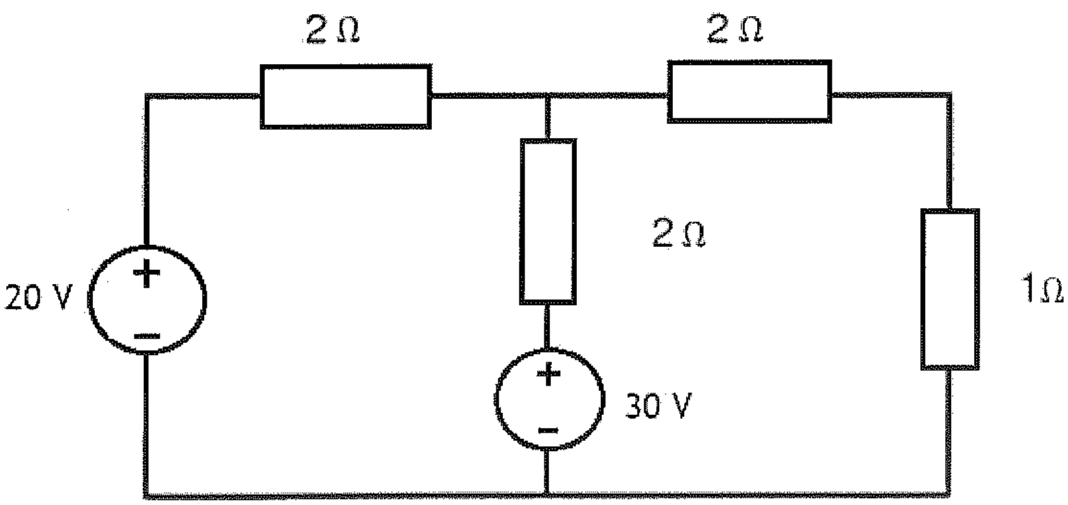

Fig. 3.1

(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 Use Thevenin's Theorem to 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 in the network of Fig. 4.1. [20]

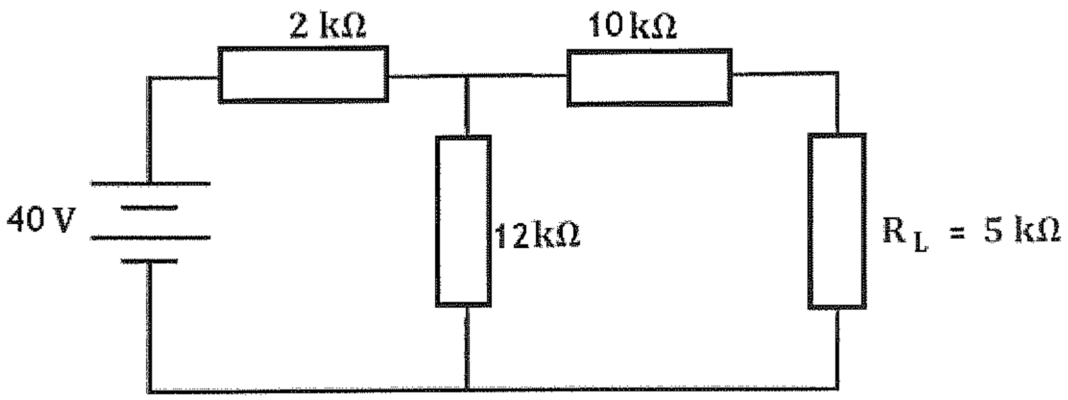

Fig. 4.1

5 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 = 15 Ω using Norton's Theorem in the network of Fig. 5.1. [20]

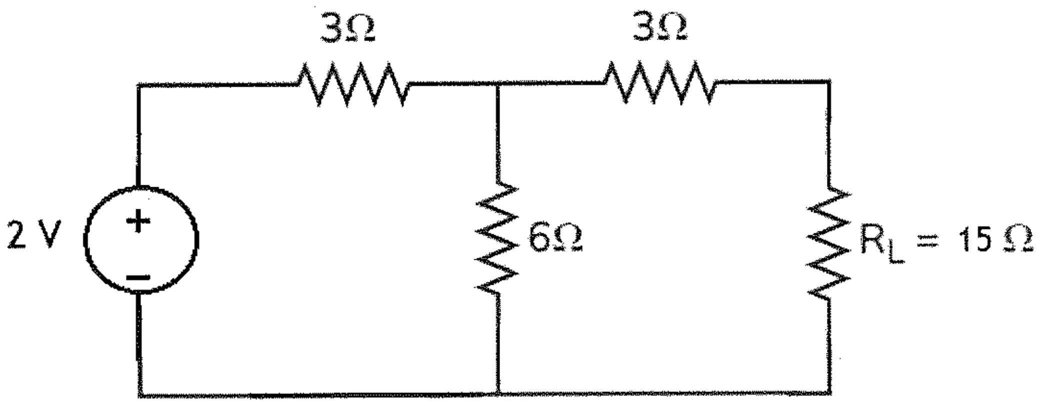

Fig. 5.1

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.

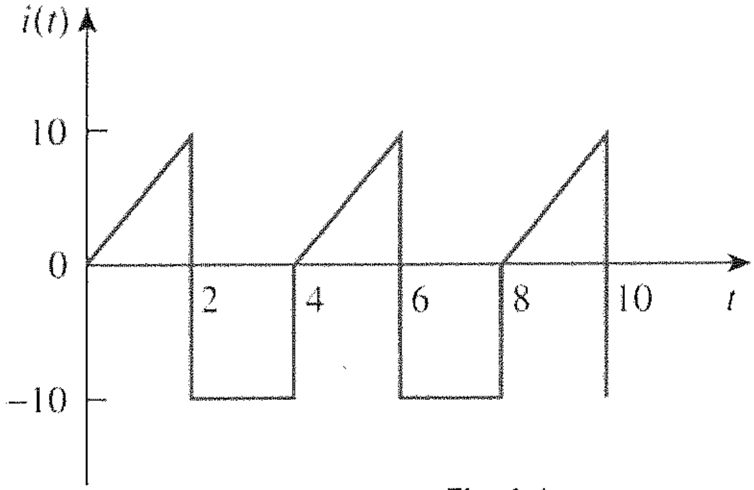

Fig. 6.1

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]