NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONIC ENGINEERING

ELECTRICAL ENGINEERING CIRCUIT ANALYSIS

EEE 1143

Examination Paper

December 2024

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: N/A

Examiner's Name: Mr B. Dlodlo & Ms S. Nyathi

INSTRUCTIONS

1. Answer ALL questions
2. Use of calculators is permissible
3. Begin each answer to a full question on a fresh page.

MARK ALLOCATION

QUESTION	MARKS
A1.	**6**
A2.	**9**
A3.	**10**
A4.	**9**
A5.	**8**
A6.	**9**
A7.	**9**
B1.	**20**
B2.	**20**
TOTAL	**100**

SECTION A (*Answer all questions*)

QUESTION A1

Define the following terms,

a) Voltage. [2]

b) Current. [2]

c) Resistance. [2]

QUESTION A2

Using Mesh analysis, determine the current through R_2 in the network of figure QA2. [9]

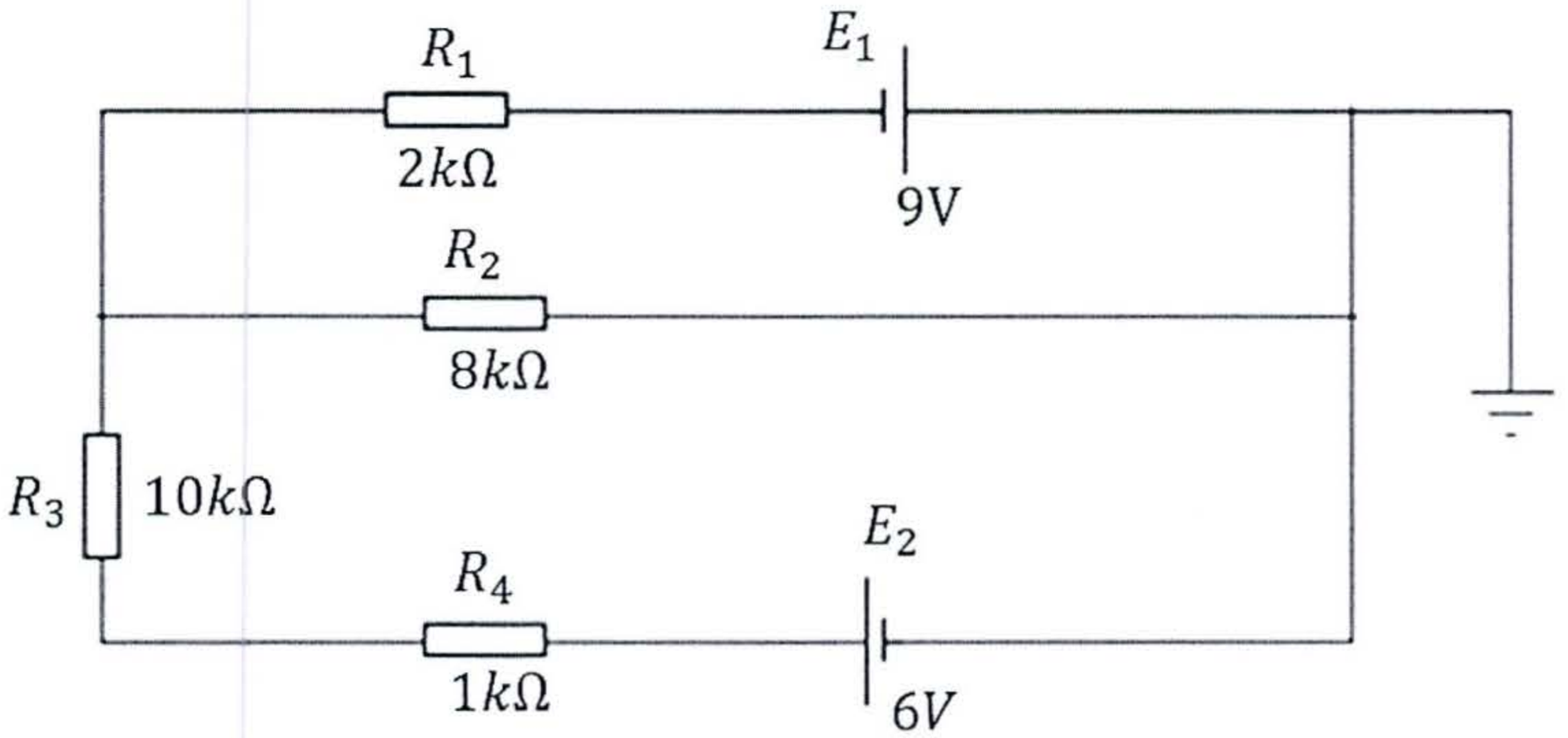


Figure QA2

QUESTION A3

For the network shown in figure QA3,

a) Find the Thevenin's equivalent circuit for the network external to the resistor **R**. [7]

b) State the value of **R** for maximum power transfer. [1]

c) Calculate the value of the power dissipated in **R** at maximum power condition. [2]

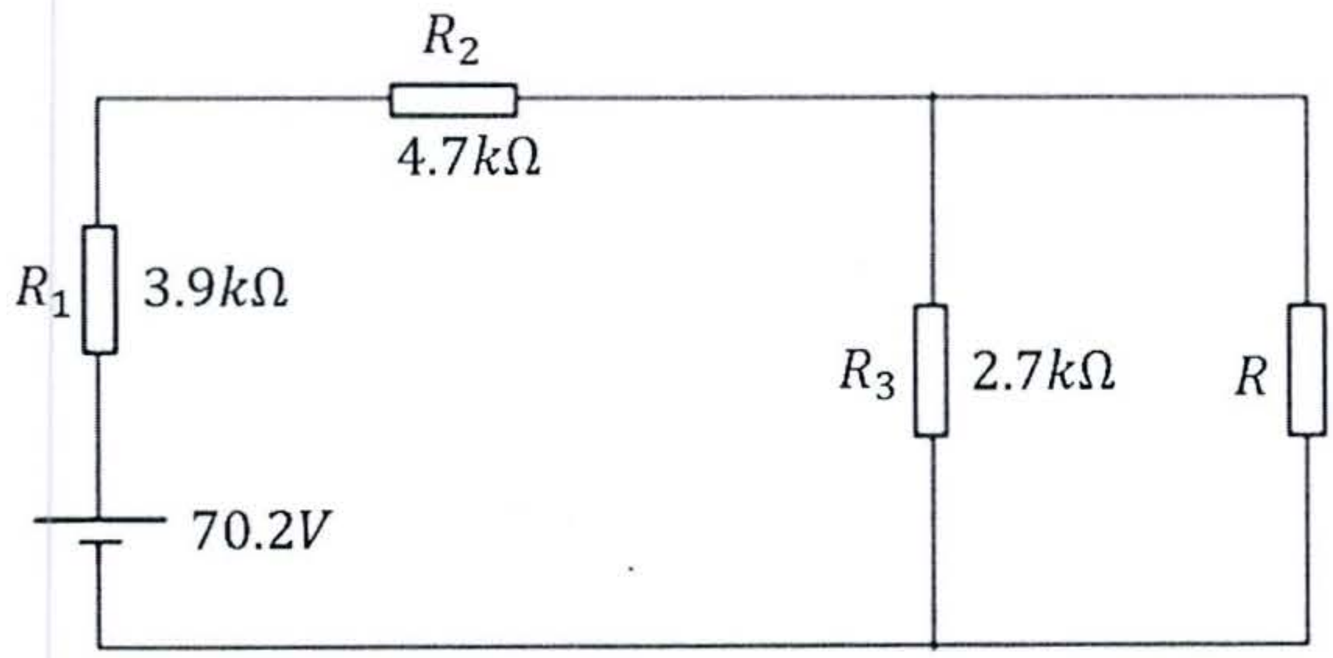
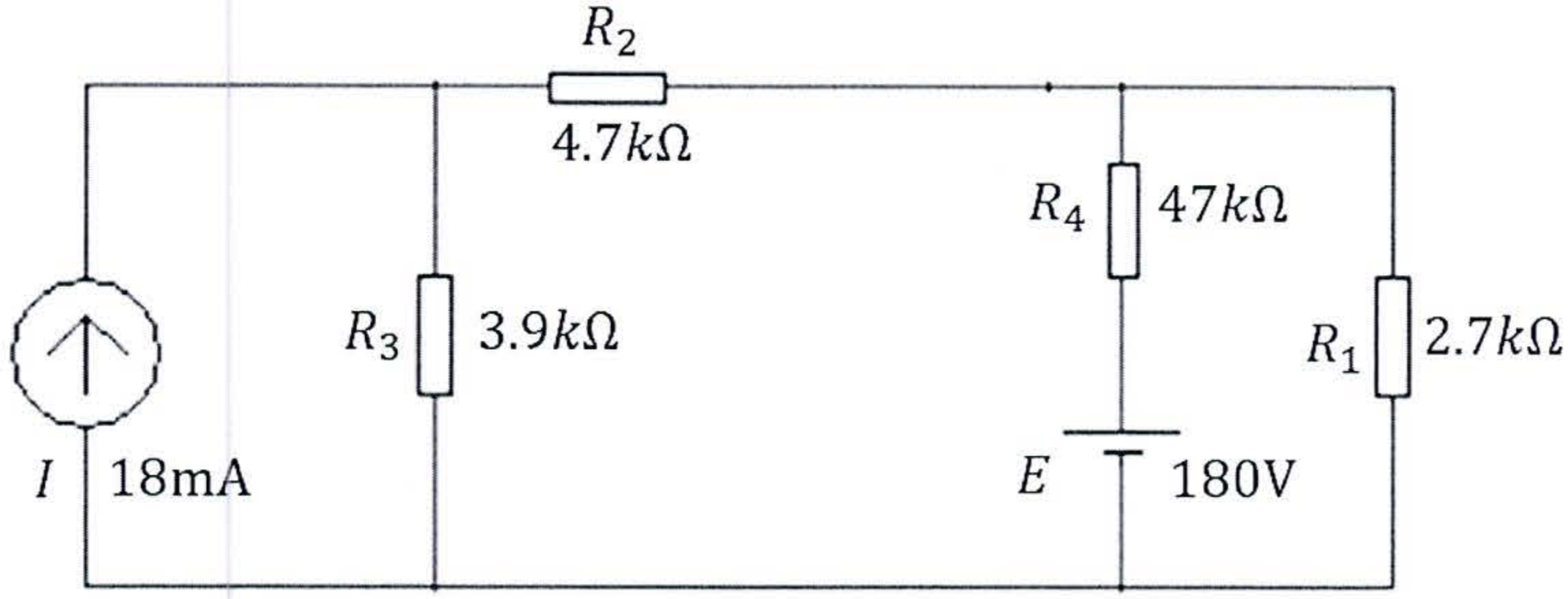


Figure QA3

QUESTION A4

Using the Superposition Theorem in the network of figure QA4, find the current through the resistor R_1. [9]



FigureQA4

QUESTION A5

Consider the circuit shown in figure QA5. The capacitor is initially uncharged. The switch is closed at time, t = 0ms. Determine the time it takes for the capacitor to charge to 19V. [8]

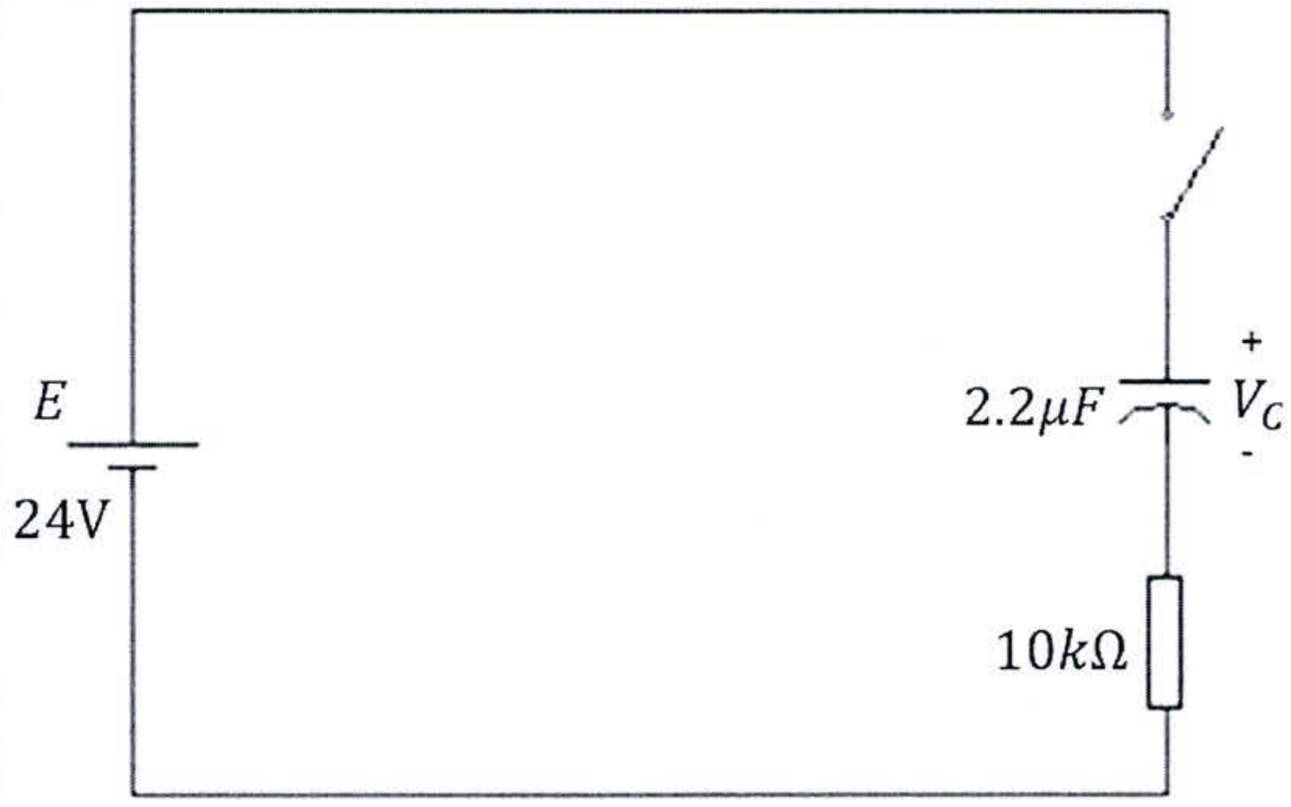


Figure QA5

QUESTION A6

In the magnetic circuit of figure QA6, the total core length is 0.2m, the air gap length is 8×10^{-4}m, and the cross-sectional area is 2×10^{-4}m^2. The coil has 500 turns. Magnetic fringing may be ignored. The relative permeability of cast steel may be taken to be 680. Permeability of free space is given as $4\pi \times 10^{-7}$H/m.

a) Draw the magnetic equivalent circuit. [2]

b) Determine the current required to establish a flux density of 0.8T in the air gap. [5]

c) Calculate the magnetic field strength in the core. [2]

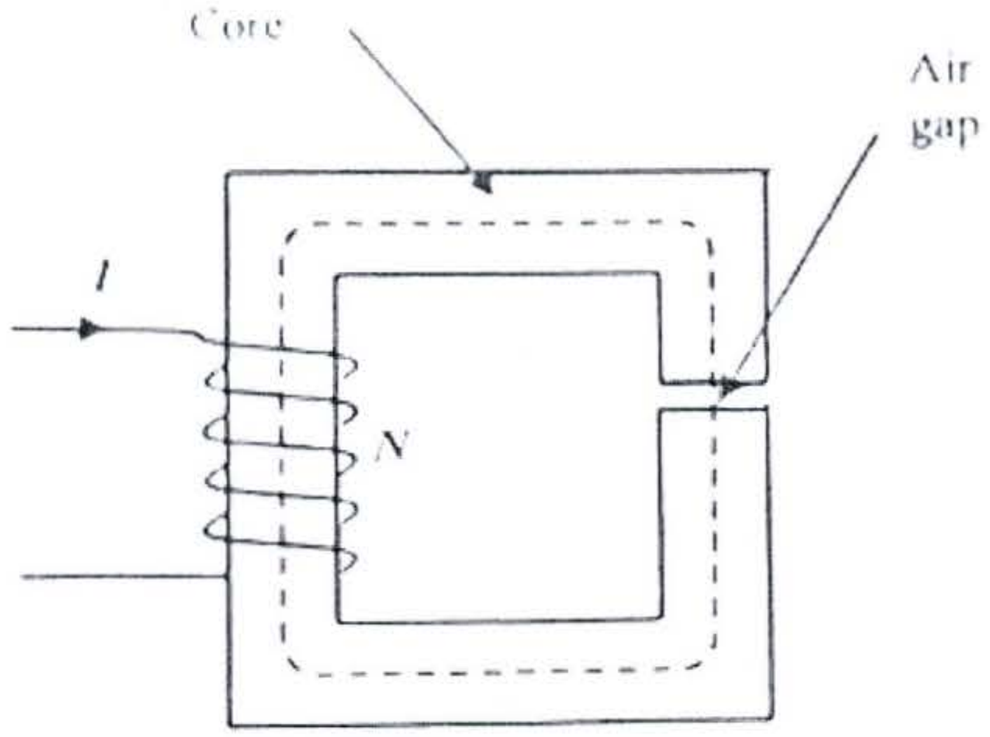


Figure QA6

QUESTION A7

For the network of figure QA7,

a) Calculate the total apparent power and overall power factor. [4]

b) Calculate the total current drawn from the source. [2]

c) Sketch the waveforms for supply voltage and source current on the same axes. [3]

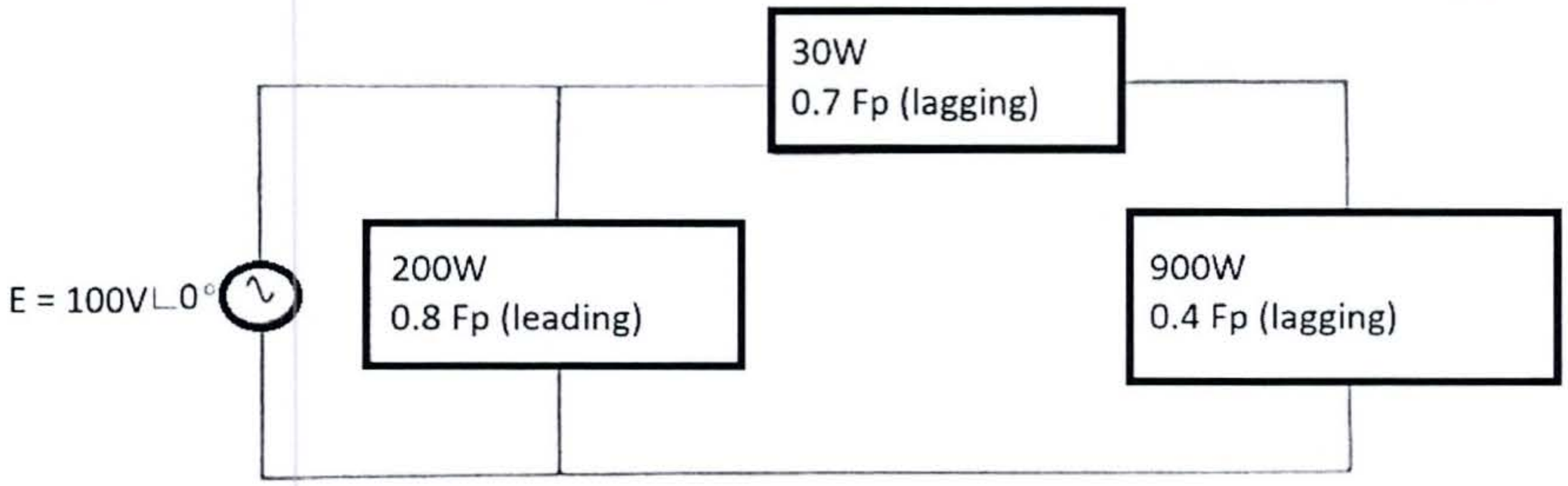


Figure QA7

SECTION B (Answer all questions)

QUESTION B1

For the network shown in figure QB1,

a) Obtain the total resistance as seen by the source. [14]

b) Calculate the conductance as seen by the source. [2]

c) Calculate the current drawn from the source. [2]

d) Determine the voltage drop across $\mathbf{R_{int}}$. [2]

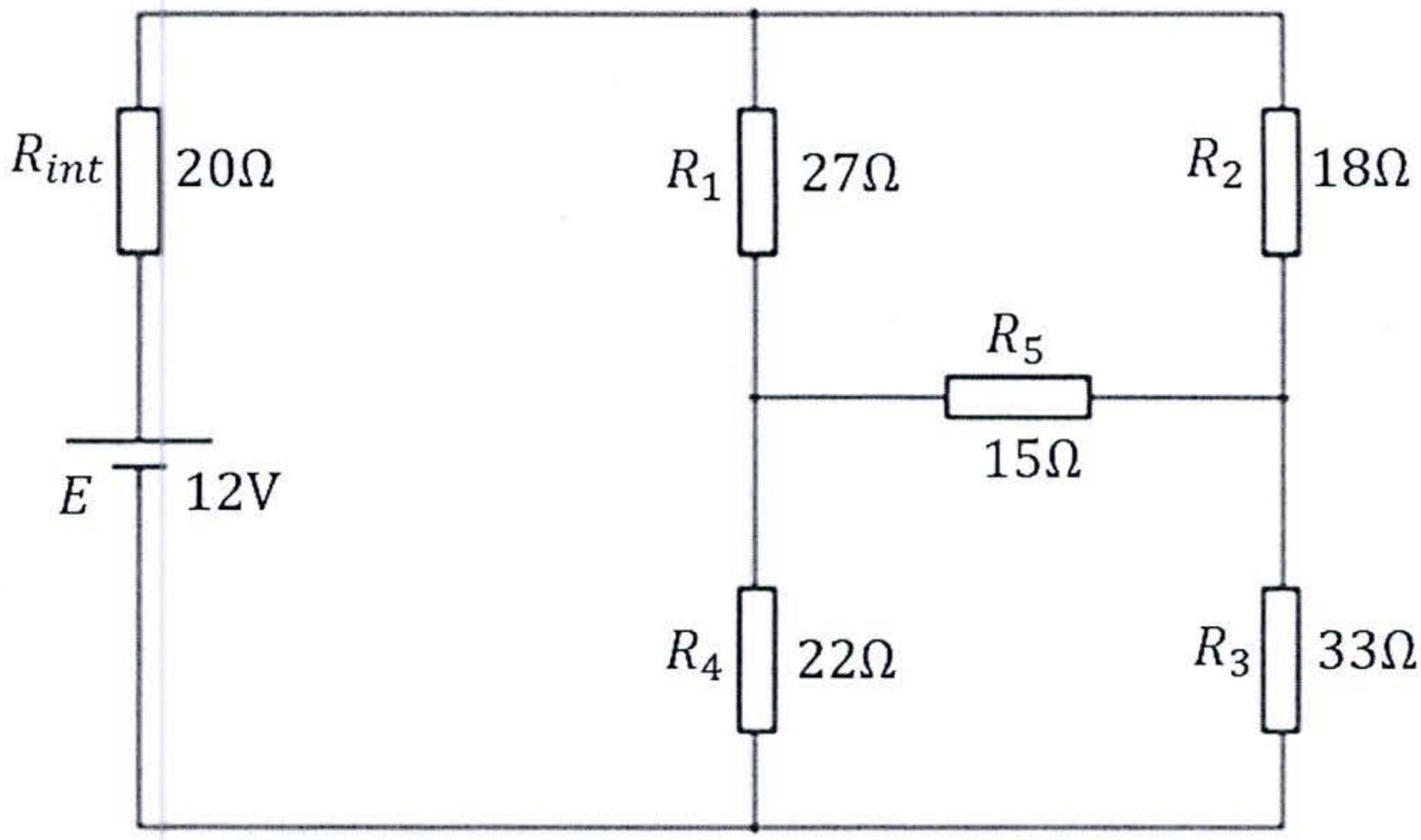


Figure QB1

QUESTION B2

For the network shown in figure QB2, determine I_S, I_5 and V_8. [20]

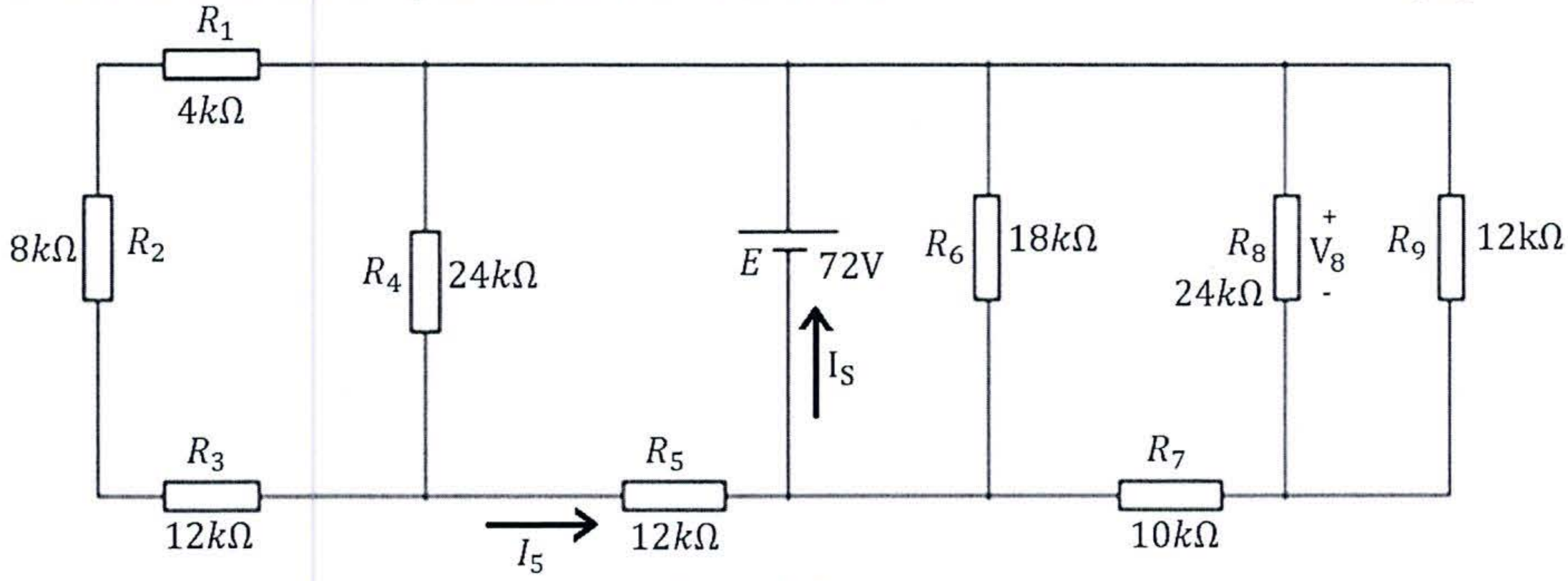


Figure QB2

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