Family Name .....

Given Name .....

Student No. .....

Signature .....

**THE UNIVERSITY OF NEW SOUTH WALES**

**School of Electrical Engineering & Telecommunications**

**MID-SEMESTER EXAMINATION**

**Semester 2, 2018**

**ELEC1111**
**Electrical and Telecommunications Engineering**

| | |
|---|---|
| **TIME ALLOWED:** | **75 min** |
| **TOTAL MARKS:** | **100** |
| **TOTAL NUMBER OF QUESTIONS:** | **5** |

**THIS EXAM CONTRIBUTES 25% TO THE TOTAL COURSE ASSESSMENT**

Reading Time: 5 minutes.

This paper contains 4 pages.

Candidates must **ATTEMPT ALL** questions.

Answer each question in a **separate answer booklet**.

Marks for each question are indicated beside the question.

This paper **MAY NOT** be retained by the candidate.

Print your name, student ID and question number on the front page of each answer book.

Authorised examination materials:

Candidates should use their own UNSW-approved electronic calculators.

This is a closed book examination.

Assumptions made in answering the questions should be stated explicitly.

All answers must be written in ink. Except where they are expressly required, pencils **may only be used** for drawing, sketching or graphical work.

## QUESTION 1 [15 marks]

For the circuit shown in Figure 1,

**a. (6 marks)** Calculate the equivalent resistance $R_{\text{eq}}$ as seen from terminals $a$-$b$.

**b. (3 marks)** Find voltage $v$ using the result of part (a).

**c. (6 marks)** Use voltage division to find voltage $v_1$ from voltage $v$.

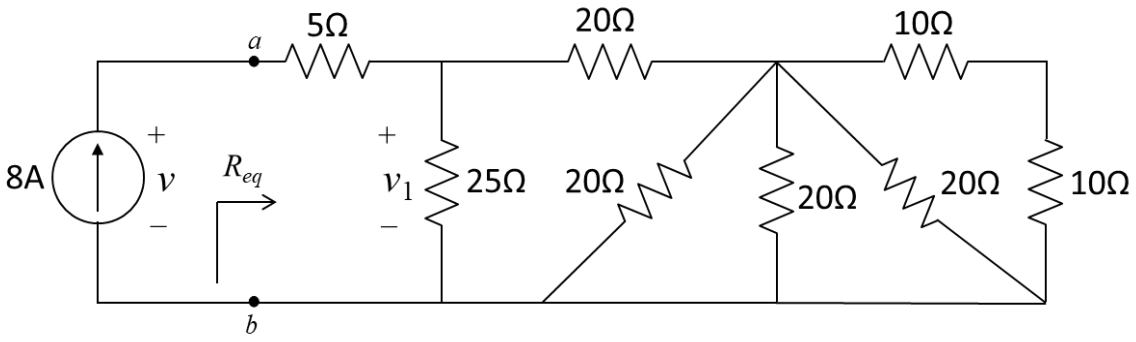


*Figure 1*

## QUESTION 2 [20 marks]

Use nodal analysis to calculate the power supplied/absorbed by the dependent voltage source in the circuit shown in Figure 2.

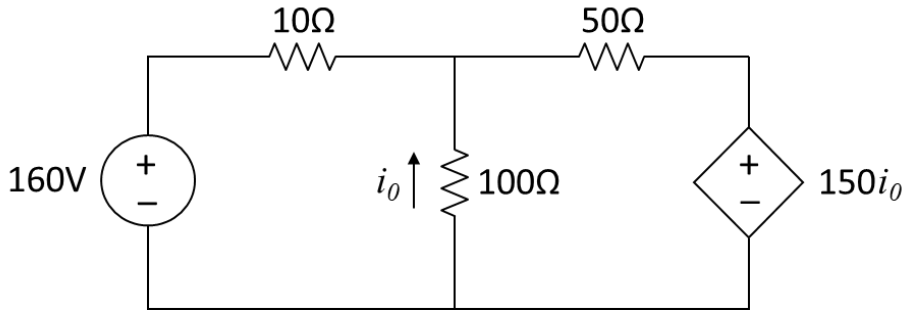


*Figure 2*

## QUESTION 3 [15 marks]

Use a series of source transformations to find $i_0$ in the circuit shown in Figure 3.

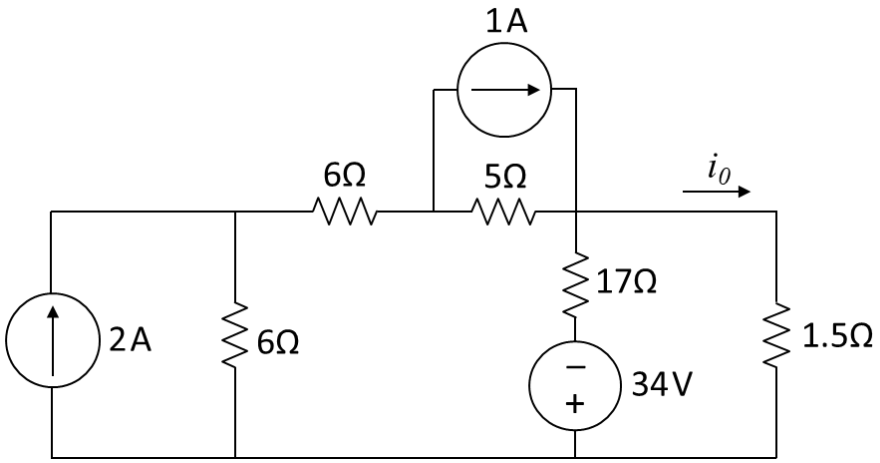


*Figure 3*

## QUESTION 4 [20 marks]

The system shown in Figure 4 is being used to power a load.

**a.** **(15 marks)** Find the Thevenin equivalent of the system.

**b.** **(5 marks)** Find the power in the load using the Thevenin equivalent model from part (a).

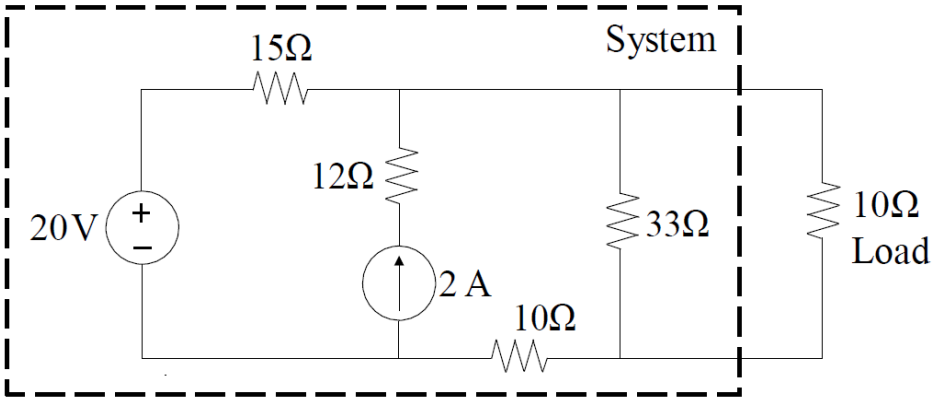


*Figure 4*

## QUESTION 5 [30 marks]

**a.** **(15 marks)** The circuit shown in Figure 5 is used to test a "touch-switch" (Sw B), which detects the touch of a finger by the capacitance of the human body. The body can be modelled as a 100 pF capacitor relative to ground, and the resistance of the arm can be modelled as a 1.5 kΩ resistor.

**i.** **(5 marks)** A person is charged to 2000 V as it walks across a carpet towards the touch-switch (Sw B). It stops in front of the touch-switch at time t = 0 s (Sw A opens). What energy is stored in the body?

**ii.** **(10 marks)** At time t = 0 s, the person touches the touch-switch (Sw B closes). Calculate and plot the current through the 100 kΩ resistor for the first 50 μs. Ensure your plot is to scale and has at least three labelled values.

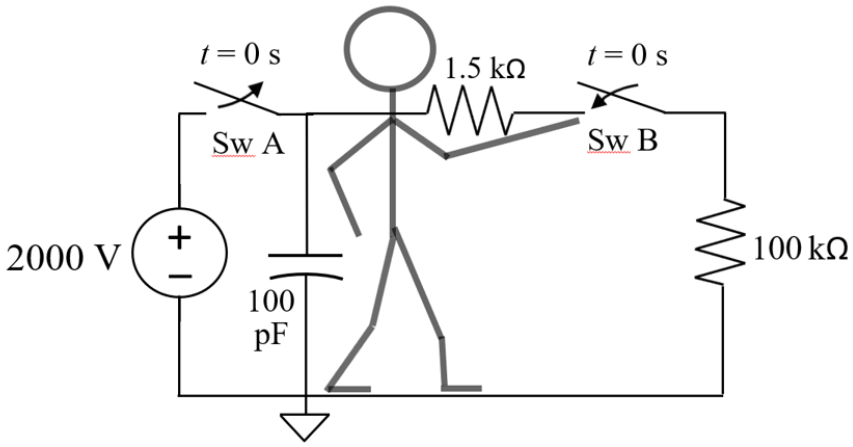


*Figure 5*

**b.** **(15 marks)** In the circuit shown in Figure 6, the switch has been closed for a long time before it is opened at $t = 0$.

**i.** **(4 marks)** Find the initial voltage $v_c(0^-)$ across the capacitor.

**ii.** **(4 marks)** Find the final voltage $v_c(\infty)$ across the capacitor.

**iii.** **(4 marks)** Derive an expression for the voltage of the capacitor $v_c(t)$ for all time (i.e., for both $t < 0$ and $t \geq 0$).

**iv.** **(3 marks)** Sketch the voltage $v_c(t)$ obtained in part (iii) as a function of time.

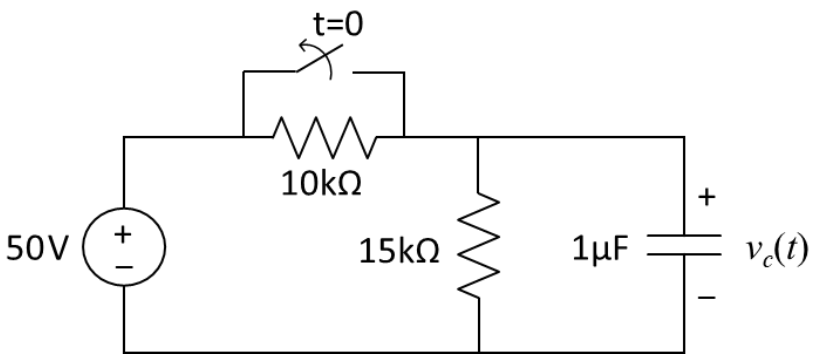


*Figure 6*

**END OF PAPER**