Family Name .....

Given Name .....

Student No. .....

Signature .....

THE UNIVERSITY OF NEW SOUTH WALES

School of Electrical Engineering & Telecommunications

MID-SESSION EXAMINATION

S2 2016

ELEC1111
Electrical and Telecommunications Engineering

TIME ALLOWED:	**50 minutes**
TOTAL MARKS:	**40**
TOTAL NUMBER OF QUESTIONS:	**4**

THIS EXAM CONTRIBUTES 20%TO THE TOTAL COURSE ASSESSMENT

This paper contains 3 pages.

Candidates must **ATTEMPT ALL** questions.

Answer all questions in the answer booklet provided.

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 [10 marks]

a) For the resistor network in Figure 1a below
   i. [*4 marks*] Write down an expression for the equivalent resistance R_{ab} as seen from the terminals a and b in terms of individual resistor R_1, R_2, R_3, R_4, R_5, R_6 and R_7.
   ii. [*2 marks*] Calculate R_{ab} when $R_1= R_2= R_3= R_4=60\Omega$ and $R_5=R_6= R_7=20\Omega$.

b) A practical battery having voltage V_s and internal resistor R_s is connected to the terminals a-b of the resistor network in part (a-ii) as shown in Figure 1b.
   i. [*2 marks*] Find the current I_s suppling by the battery
   ii. [*2 marks*] Calculate the total power dissipated by the resistor network and R_s and the power supplied by the voltage source V_s. Show that power is conserved in this circuit.

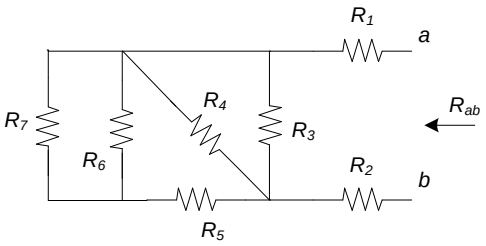

Figure 1a

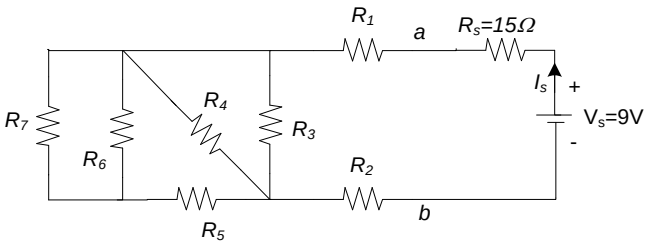

Figure 1b

QUESTION 2 [10 marks]

For the circuit below in Figure 2
   i. [*6 marks*] Apply nodal analysis to write down the node voltage equations at nodes V_a and V_b.
   ii. [*2 marks*] Solve the voltage equations in part (i) to find the voltages V_a and V_b.
   iii. [*2 marks*] Find the currents i_1, i_2 and i_3 based on your results in part (ii)

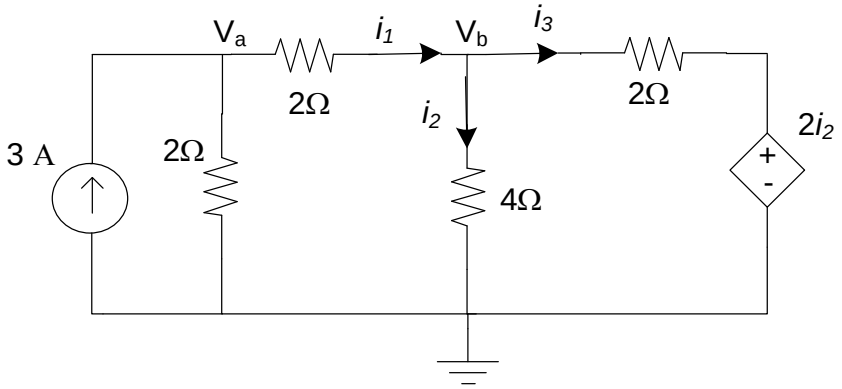

Figure 2

QUESTION 3 [10 marks]

For the circuit below in Figure 3, find the current *i* in the 4Ω resistor using:

(a) [*6 marks*] The superposition principle.

(b) [*4 marks*] The Thevenin equivalent of the circuit to the left of terminal pair a-b.

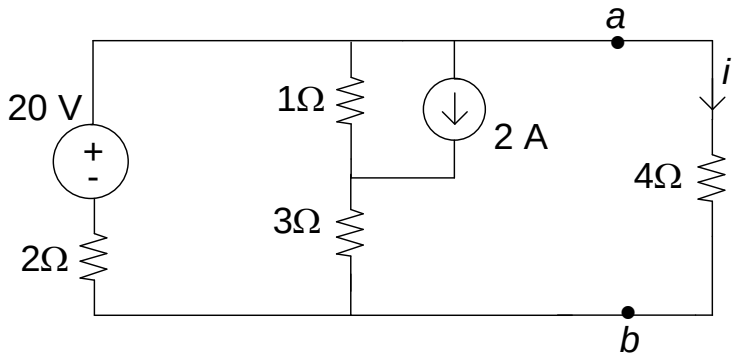

Figure 3

QUESTION 4 [10 marks]

For the circuit below in Figure 4, the switch has been in the same position for a long time before changing position as shown at time $t = 0$.

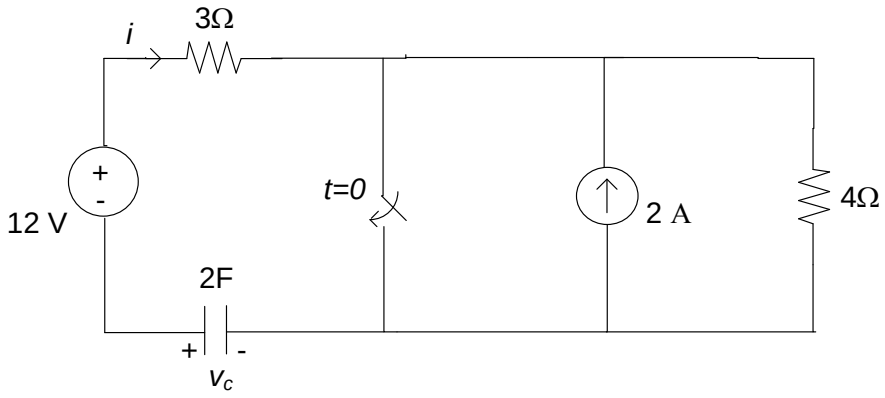

Figure 4

(a) [*3 marks*] Find the voltage v_c and the current *i* when t<0

(b) [*3 marks*] Find v_c and *i* when t>0 and in steady state condition, i.e. $v_c(+\infty)$ and $i(+\infty)$

(c) [*4 marks*] Write down expressions for voltage $v_c(t)$ and current $i(t)$ when t>0

END OF PAPER