University of Toronto
Faculty of Applied Science and Engineering
Department of Electrical and Computer Engineering

ECE110S – Electrical Fundamentals
Midterm Test 2 – March 17, 2011, 6:10 – 7:40 p.m.

ANSWER ALL QUESTIONS ON THESE SHEETS, USING THE BACK SIDE IF NECESSARY.
1. Non-programmable calculators are allowed.
2. For full marks, you must show methods, state UNITS and compute numerical answers when requested.
3. WRITE IN PEN. OTHERWISE, NO REMARKING REQUEST WILL BE ACCEPTED.
4. There is one extra blank page at the end for rough work.
5. One 8 1/2" x 11" aid sheet allowed

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Last Name: _____

First Name: _____

Student Number: _____

Tutorial Section
(YOU LOSE ONE MARK FOR NOT MARKING YOUR TUTORIAL SESSION CORRECTLY)**:**

☐ 01	WB342	Mon. 3-5 p.m.
☐ 02	GB304	Mon. 3-5 p.m.
☐ 03	WB342	Tue. 4-6 p.m.
☐ 04	GB304	Tue. 4-6 p.m.
☐ 05	GB404	Wed. 4-6 p.m.
☐ 06	WB219	Wed. 4-6 p.m.
☐ 07	SF2202	Wed. 2-4 p.m.
☐ 08	WB219	Wed. 2-4 p.m.
☐ 09	GB120	Fri. 4-6 p.m.
☐ 10	WB130	Fri. 4-6 p.m.
☐ 11	SF2202	Fri. 2-4 p.m.
☐ 12	WB130	Fri. 2-4 p.m.

Question	Mark
1	
2	
3	
TOTAL	

1. **[10 marks]** The figure shows a solenoid S with n=200 turns/m and a core radius of 2 mm. The solenoid S houses a coil C in its center as shown. Coil C has a total number of turns N=200 and a core radius of 0.7 mm.

(a) If the time varying current flowing in S is $i(t)=7t$ Amperes, where t is in seconds, what is the magnetic field inside the solenoid. **(3 marks)**
(b) What is the direction of the induced current inside the coil C, due to the flux from the solenoid S. (redraw C in your answer sheet and show the current direction). **(2 marks)**
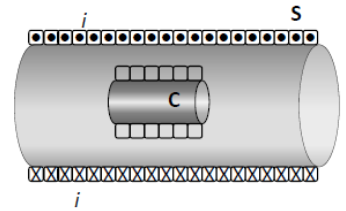(c) Calculate the magnitude of the induced emf in the coil C. **(5 marks)**

ANSWER:

(c) **$1.759t \times 10^{-3}$ T**
(d)

(e) **5.4164×10^{-7} Volts**

2. **[10 marks]** For the circuit below:

(a)   Find V_x when the circuit switch is open. **(5 marks)**

(b)   When the circuit switch is closed, find the power supplied or consumed by each of the sources and clearly indentify whether 'supplied' or 'consumed'. **(5 marks)**
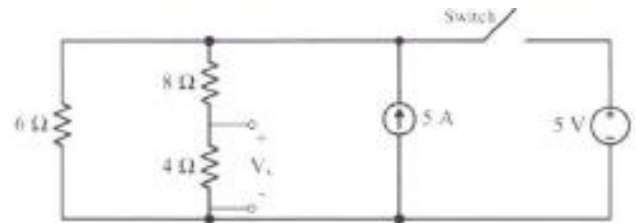

Figure for Question 2

> (a) 6.6667 V
> (b) Power of current source = 25 W supplied
>   Power of voltage source = 18.75 W consumed

3. [10 marks]

(3.a) **[5 marks]** For the circuit shown below, develop the equations for the two nodal potentials, V_1 and V_2. Show the set of equations in the form of

$$a_{11} V_1 + a_{12} V_2 = b_1$$
$$a_{21} V_1 + a_{22} V_2 = b_2$$
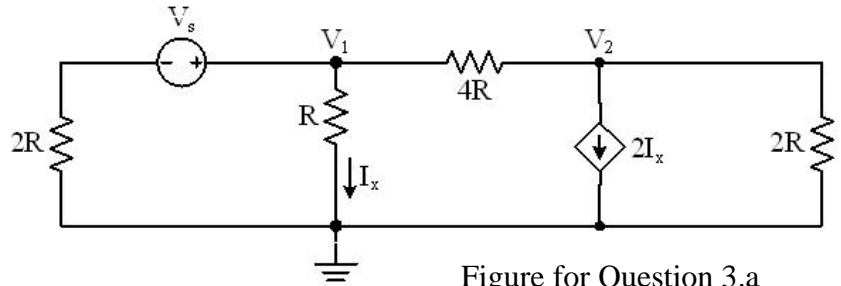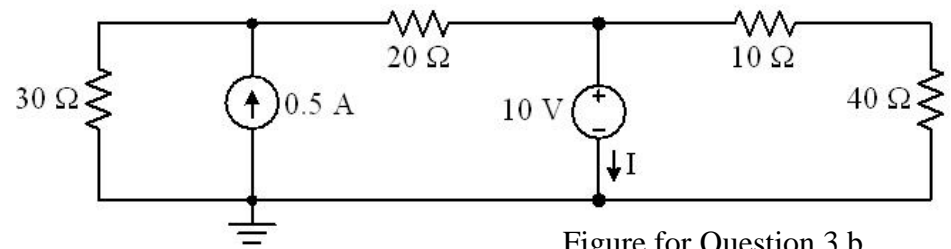
where all coefficients are integers.

Figure for Question 3.a

$$7V_1 - V_2 = 2V_s$$
$$7V_1 + 3V_2 = 0$$

(3.b) **[5 marks]** Use **superposition** to find the current **I** in the circuit given below. (If other techniques were used instead, partial marks will be given.)

Figure for Question 3.b

$-0.1\ A$