Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #4
March 20, 2013

Keep this quiz closed and face up until you are told to begin.

1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**
4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

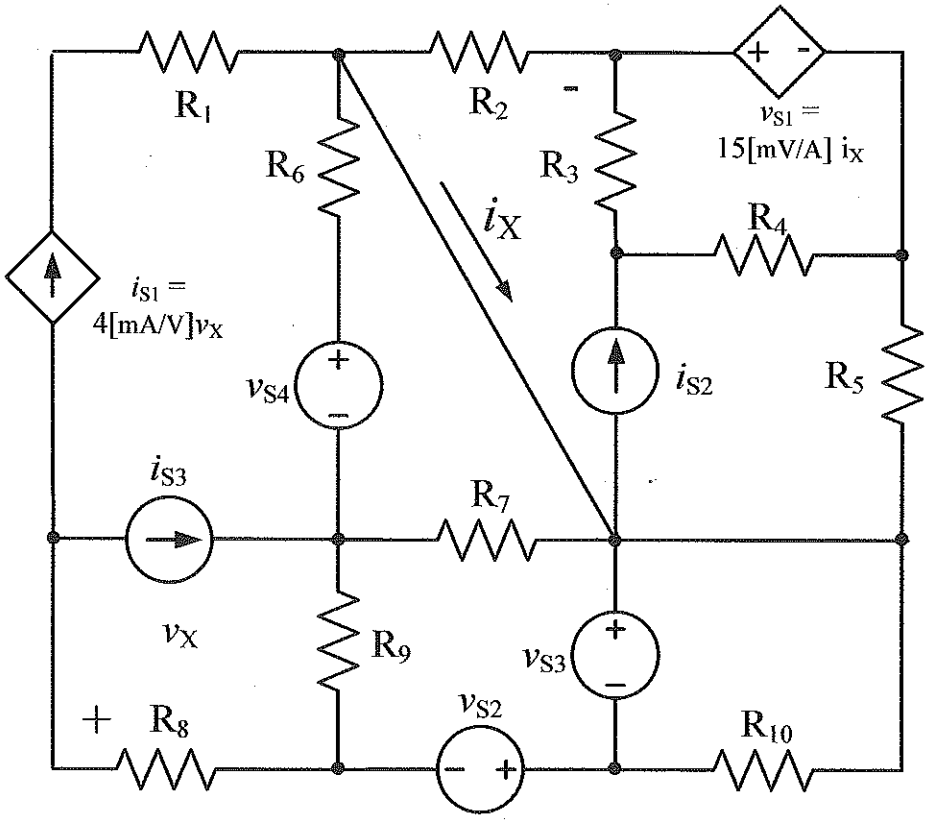
_____/20

Room for extra work

Using either the Node Voltage Method or the Mesh Current Method, write a set of equations that could be used to solve the circuit. Do not attempt to simplify the circuit. Do not attempt to solve the equations.

To receive full credit you must carefully and clearly label all circuit variables.

You will not receive extra credit for using both methods.



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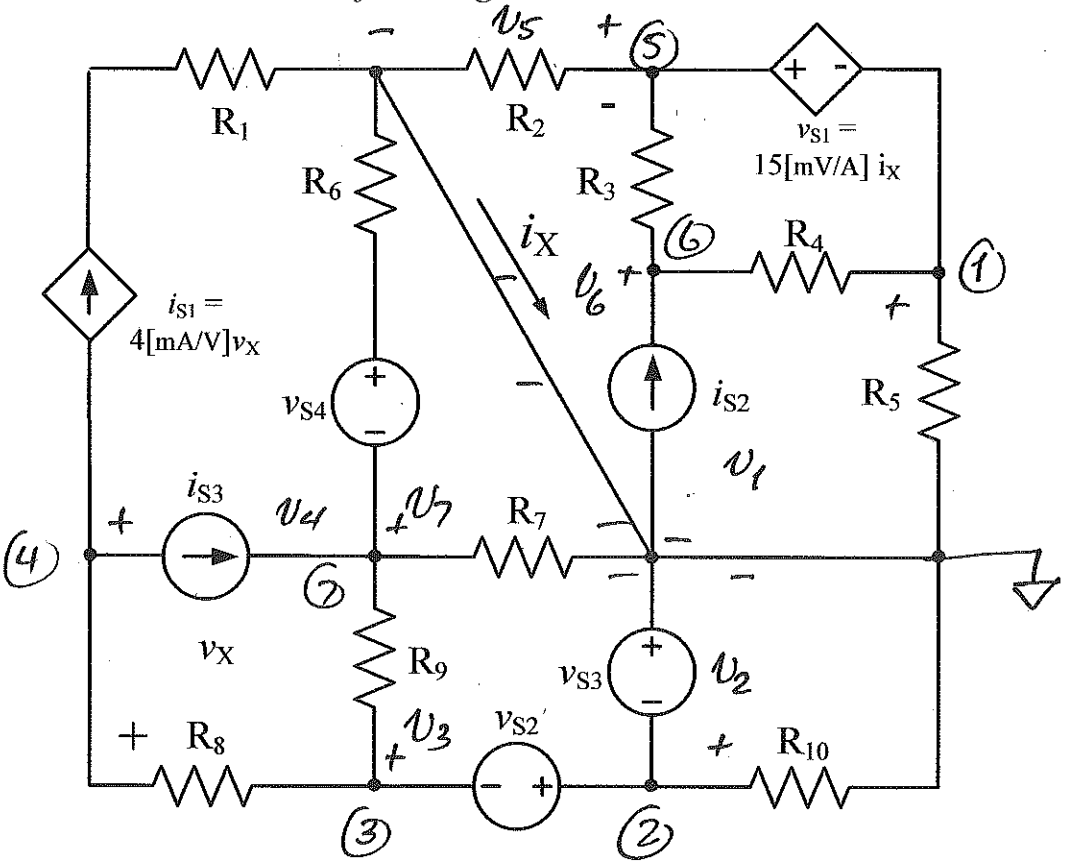

NODE VOLTAGE

Supernode ①,⑤: $\frac{v_1 - v_6}{R_4} + \frac{v_1}{R_5} + \frac{v_5 - v_6}{R_3} + \frac{v_5}{R_2} = 0$

$v_5 - v_1 = 0.015\, i_x$

② $v_2 = -v_{S3}$

③ $v_3 = -v_{S2} - v_{S3}$

Room for extra work

④ $0.004 v_x + i_{s3} + \frac{v_4 - v_3}{R_8} = 0$

⑥ $-i_{s2} + \frac{v_6 - v_1}{R_4} + \frac{v_6 - v_5}{R_3} = 0$

⑦ $\frac{v_7}{R_7} + \frac{v_7 + v_{s4}}{R_6} - i_{s3} + \frac{v_7 - v_3}{R_9} = 0$

i_x: $i_x - \frac{v_5}{R_2} - 0.004 v_x - \frac{v_7 + v_{s4}}{R_6} = 0$

v_x: $v_x + v_5 - v_4 = 0$

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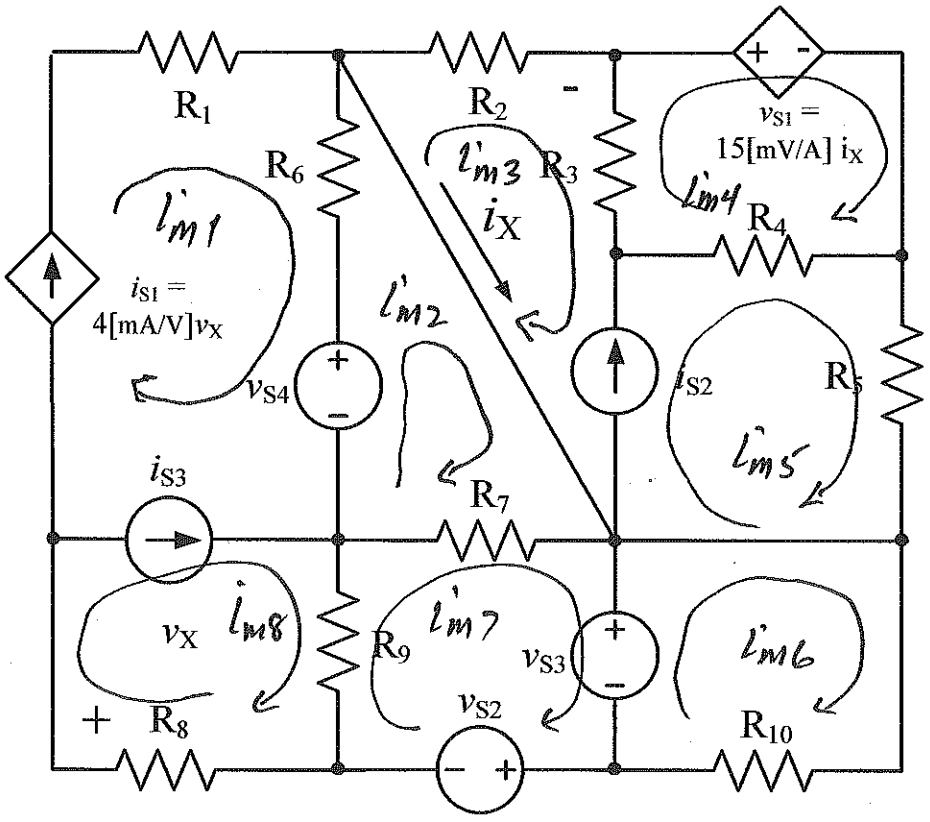

MESH CURRENT

supermesh ①, ⑧:

$$i_{m1} = 0.004 v_x \qquad i_{m8} - i_{m1} = i_{s3}$$

(Note that these two equations define i_{m1} and i_{m8}. There is no need to do a KVL and in fact we can't, because the voltage across i_{s1} is not known.)

② $-v_{s4} + R_6(i_{m2} - i_{m1}) + R_7(i_{m2} - i_{m7}) = 0$

Room for extra work

Supermesh ③, ⑤ :

$$R_2 i'_{m3} + R_3 (i'_{m3} - i'_{m4}) + R_4 (i'_{m5} - i'_{m4}) + R_5 i'_{m5} = 0$$

$$i'_{m5} - i'_{m3} = i'_{s2}$$

④ $$0.015\, i'_x + R_4 (i'_{m4} - i'_{m5}) + R_3 (i'_{m4} - i'_{m3}) = 0$$

⑥ $$-v_{s3} + R_{10} i'_{m6} = 0$$

⑦ $$R_9 (i'_{m7} - i'_{m8}) + R_7 (i'_{m7} - i'_{m2}) + v_{s3} + v_{s2} = 0$$

i'_x: $$i'_{m2} - i'_{m3} = i'_x$$

v_x: $$v_x + v_{s1} + R_5 i'_{m5} + R_{10} i'_{m6} + v_{s2} + R_8 i'_{m8} = 0$$

$$v_{s1} = 0.015\, i'_x$$