ECE 20100 – Spring 2018
Exam #1

February 8, 2018

Section (include on scantron)

Michelusi (9:30) – 0001 Tan (1:30) – 0004 Li (10:30) – 0005

Hosseini (12:30) – 0006 Cui (11:30) – 0007

Kildishev (12:30) – 0008 Liu (8:30) – 0009 Zhu (3:30) – 0010

Instructions

1. DO NOT START UNTIL TOLD TO DO SO.
2. Write your name, section, professor, and student ID# on your **Scantron** sheet. We may check PUIDs.
3. This is a CLOSED BOOKS and CLOSED NOTES exam.
4. The use of a TI-30X IIS calculator is allowed.
5. If extra paper is needed, use the back of test pages.
6. Cheating will not be tolerated. Cheating in this exam will result in, at the minimum, an F grade for the course. In particular, **continuing to write after the exam time is up is regarded as cheating**.
7. If you cannot solve a question, be sure to look at the other ones, and come back to it if time permits.
8. ***All of the problems*** on Exam #1 provide evidence for satisfaction of this ECE 20100 Learning Objective:

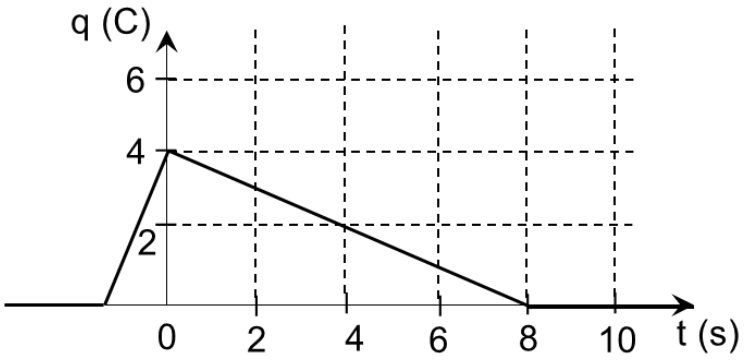
   i) An ability to analyze linear resistive circuits.

   The minimum score needed to satisfy this objective will be posted on Blackboard after the exam has been graded. Remediation options will be posted in Blackboard if you fail to satisfy any of the course outcomes.

By signing the scantron sheet, you affirm you have not received or provided assistance on this exam.

Question 1

Charge flowing through a wire as a function of time is shown in the figure. Find the current flowing through the wire between 2 and 4 seconds (in A).



(1) –5

(2) –2

(3) –1

(4) –0.5

(5) 0.5

(6) 1

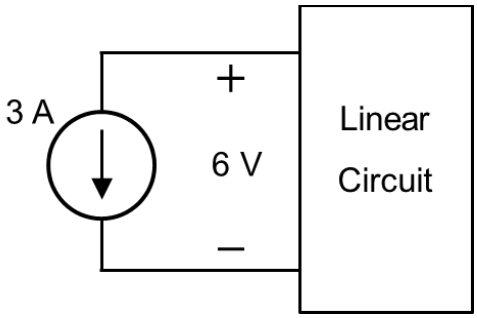
(7) 2

(8) 5

(9) None of the above

Question 2

In the circuit shown below, find the power *delivered* by the current source (in W).



(1) –18

(2) –12

(3) –6

(4) –3

(5) 3

(6) 6

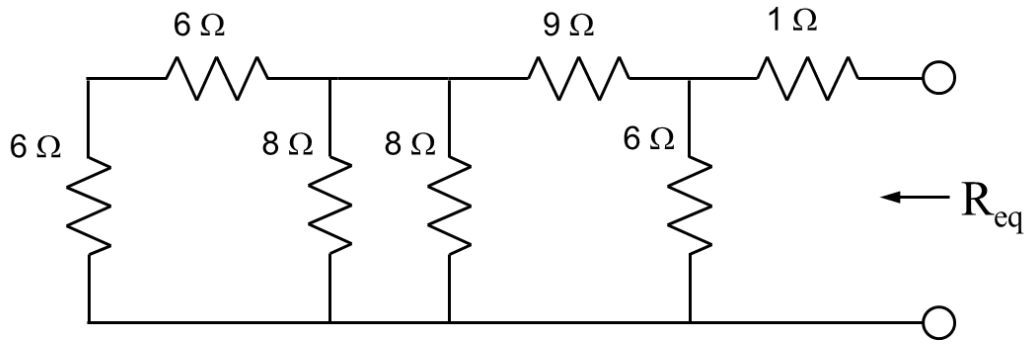
(7) 12

(8) 18

(9) None of the above

Question 3

Find the equivalent resistance for the circuit shown (in Ohm).



(1) 1

(2) 2

(3) 3

(4) 4

(5) 5

(6) 6

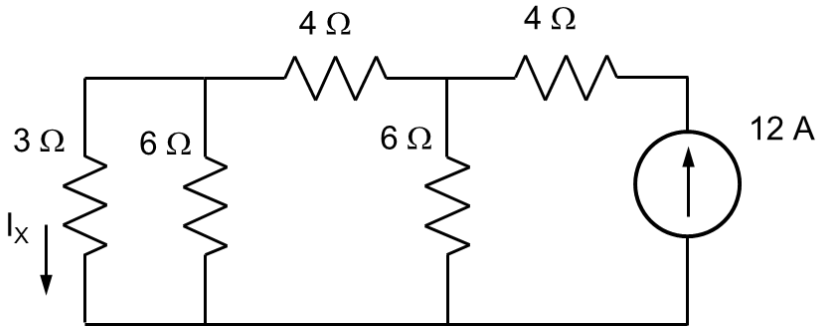
(7) 7

(8) 8

(9) None of the above

Question 4

Find the current I_X (in A) in the circuit shown.



(1) 1

(2) 2

(3) 3

(4) 4

(5) 6

(6) 8

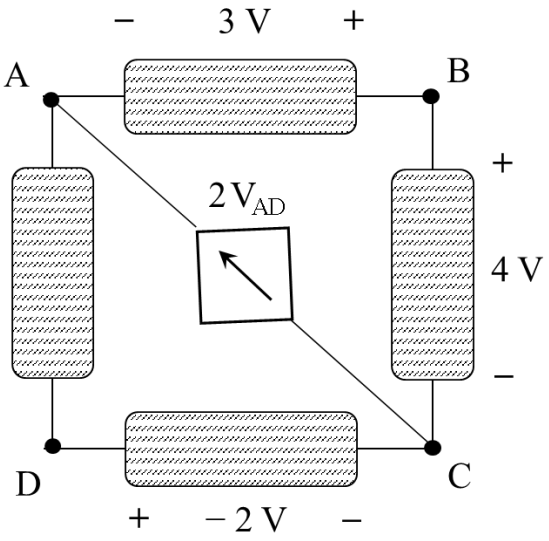
(7) 9

(8) 12

(9) None of the above

Question 5

The shaded boxes below are generalized circuit elements (resistors or sources). Find the power *delivered* by the dependent current source (in W).



(1) –2

(2) –4

(3) –6

(4) 2

(5) 4

(6) 6

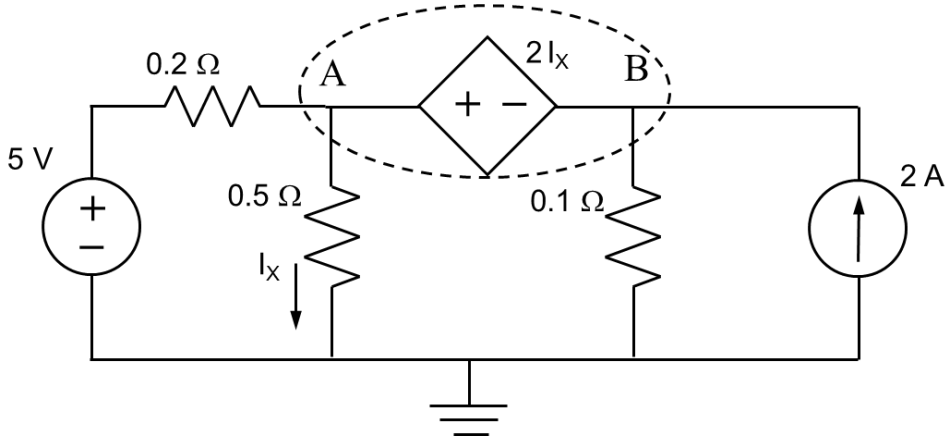
(7) 8

(8) 0

(9) None of the above

Question 6

In the circuit shown, a supernode is drawn around nodes A and B (dashed line). Find the correct nodal equation for the supernode.



(1) $0.1\ V_A + 10\ V_B = 23$

(2) $0.2\ V_A + 0.1\ V_B = 27$

(3) $3\ V_A + 10\ V_B = 27$

(4) $3\ V_A + 0.1\ V_B = 23$

(5) $5\ V_A + 10\ V_B = 23$

(6) $0.5\ V_A + 0.1\ V_B = 27$

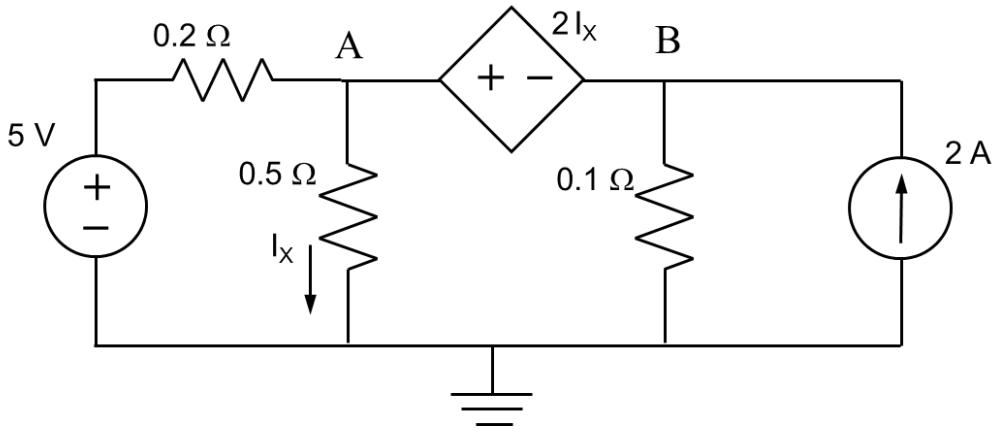
(7) $7\ V_A + 10\ V_B = 27$

(8) $7\ V_A + 0.1\ V_B = 23$

(9) None of the above

Question 7

Find the equation that best represents the relationship between node voltages V_A and V_B (in V).



(1) $V_A + V_B = 0$

(2) $2\,V_A + V_B = 0$

(3) $3\,V_A + V_B = 0$

(4) $4\,V_A + V_B = 0$

(5) $5\,V_A + V_B = 0$

(6) $V_A + V_B = V_A$

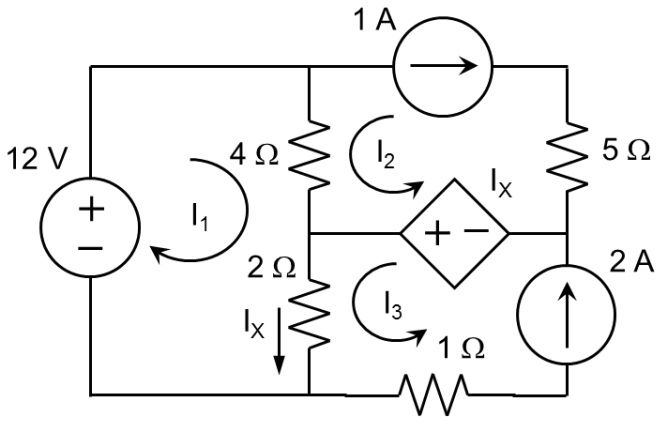
(7) $2\,V_A - V_B = 0$

(8) $5\,V_A - V_B = 0$

(9) None of the above

Question 8

In the circuit shown below, find the loop current I_1 (in A).



(1) 1

(2) 2

(3) 3

(4) 4

(5) 5

(6) 6

(7) 7

(8) 8

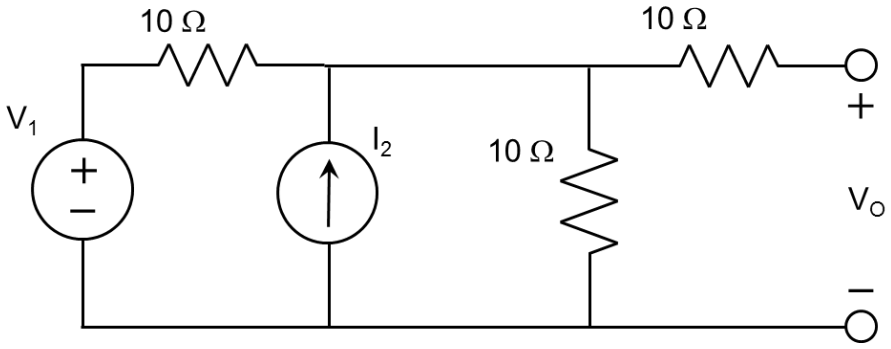
(9) None of the above

Question 9

Initial values for the voltage (V_1) and current (I_2) sources in the circuit shown produce an output potential, V_O, equal to 16 V. V_O is a linear function of V_1 and I_2 according to the equation,

$$V_O = \mathrm{A}\, V_1 + \mathrm{B}\, I_2$$

If doubling I_2 changes V_O to 20 V when V_1 remains constant, find V_1 (in V).



(1) 6

(2) 8

(3) 12

(4) 16

(5) 18

(6) 20

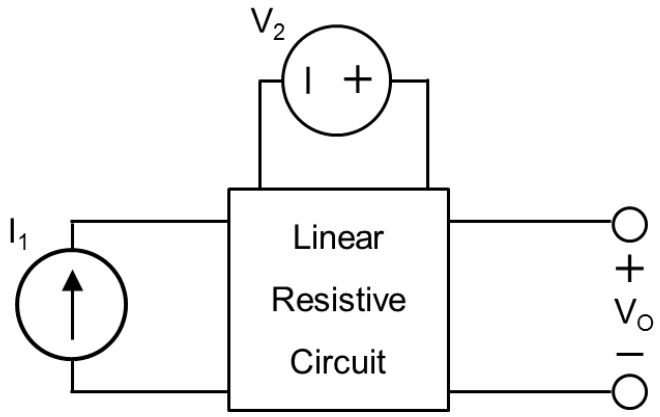
(7) 21

(8) 24

(9) None of the above

Question 10

The linear resistive circuit below contains only resistors and dependent sources. Measurements of V_O for different input excitations are tabulated below. Find V_O when I_1 = 0.2 A and V_2 = – 2 V (in V).



I_1	V_2	V_O
0.1 A	0	8 V
0	4 V	2 V

(1) 6

(2) 8

(3) 12

(4) 14

(5) 15

(6) 16

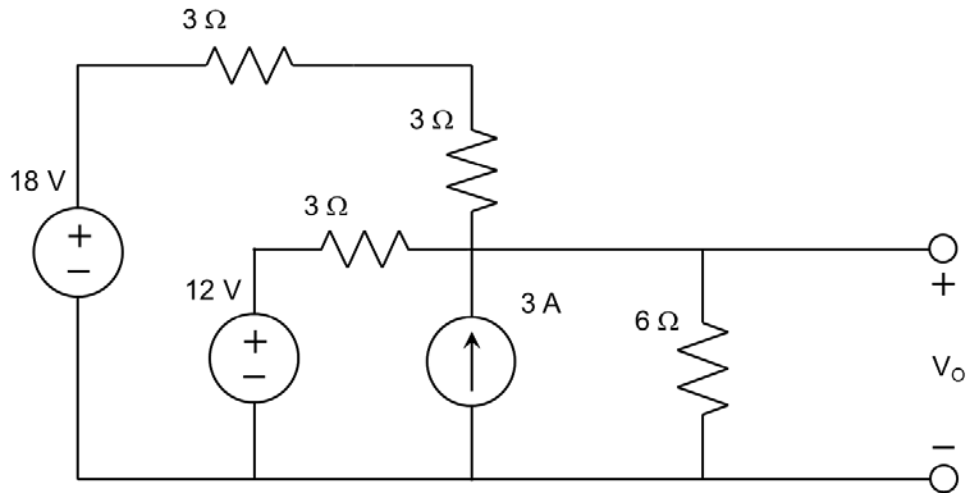
(7) 17

(8) 18

(9) None of the above

Question 11

In the circuit below, find V_O (in V). [Hint: source transformations may be useful]



(1) 6

(2) 8

(3) 9

(4) 10

(5) 12

(6) 15

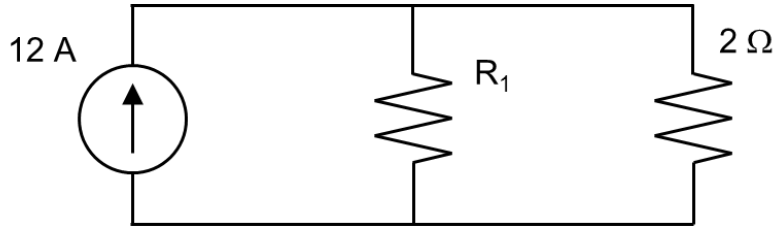
(7) 16

(8) 18

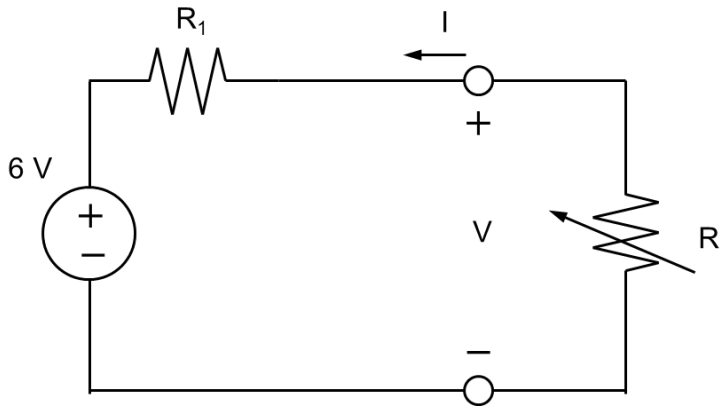
(9) None of the above

Question 12

A resistor of unknown value, R_1, is connected to a 2 Ω resistor and a 12 A independent current source as shown below. In this configuration, the 2 Ω resistor absorbs 128 W.



The same resistor is subsequently connected to a variable resistor (R) and voltage source as shown below. Find the correct current-voltage (I-V) relationship for this configuration.



(1) I = 2 V + 1.5

(2) I = 0.33 V + 6

(3) I = 0.25 V + 1.5

(4) I = 3 V + 1.5

(5) I = 2 V – 6

(6) I = 0.33 V – 6

(7) I = 0.25 V – 1.5

(8) I = 3 V – 6

(9) None of the above