Name _____ Grade = /100
(1 point)

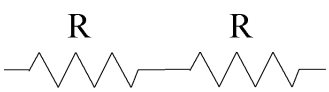
ECE 2040 Midterm Exam
Spring 2019

Each question is worth 3 points.
All of your answers need to be on this sheet.
Only the final answers, as indicated by the question, will be considered correct for each question.
You will only turn in this single sheet. You can take the rest of the exam with you.

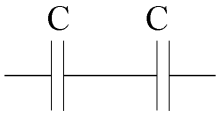
Choose the best possible answer available in all cases.

1. _____	12. _____	23. _____
2. _____	13. _____	24. _____
3. _____	14. _____	25. _____
4. _____	15. _____	26. _____
5. _____	16. _____	27. _____
6. _____	17. _____	28. _____
7. _____	18. _____	29. _____
8. _____	19. _____	30. _____
9. _____	20. _____	31. _____
10. _____	21. _____	32. _____
11. _____	22. _____	33. _____

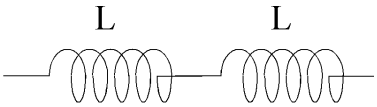
Use the following circuit diagrams for the following questions: (R = 10kΩ, C = 1nF, L = 1mH)



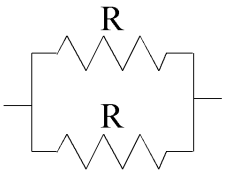
(1)



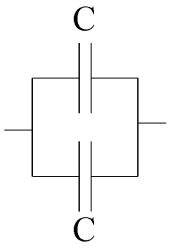
(3)



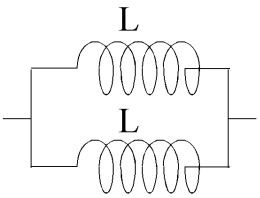
(5)



(2)



(4)



(6)

1. For the elements in (1) above, the equivalent resistance is
a. 2.5kΩ
b. 5kΩ
c. 10kΩ
d. 20kΩ
e. 40kΩ

2. For the elements in (2) above, the equivalent resistance is
a. 2.5kΩ
b. 5kΩ
c. 10kΩ
d. 20kΩ
e. 40kΩ

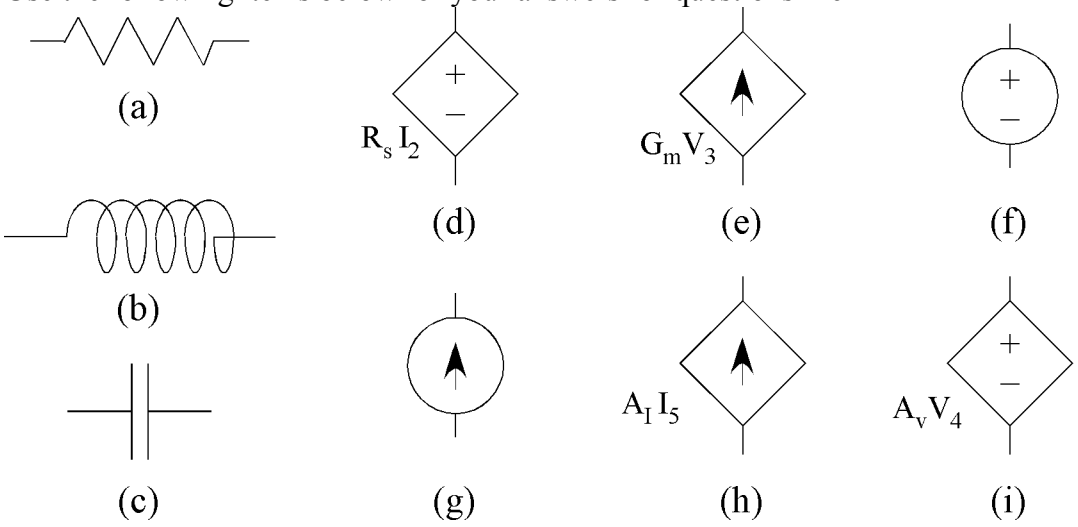
3. For the elements in (3) above, the equivalent capacitance is
a. 0.25nF
b. 0.5nF
c. 1nF
d. 2nF
e. 4nF

4. For the elements in (4) above, the equivalent capacitance is
a. 0.25nF
b. 0.5nF
c. 1nF
d. 2nF
e. 4nF

5. For the elements in (5) above, the equivalent capacitance is
a. 0.25mH
b. 0.5mH
c. 1mH
d. 2mH
e. 4mH

6. For the elements in (6) above, the equivalent capacitance is
a. 0.25mH
b. 0.5mH
c. 1mH
d. 2mH
e. 4mH

Use the following items below for your answers for questions 1-6



$V = RI$ (j)

$I = C\frac{dV}{dt}$ (k)

$V_{out} = V_{in}\frac{R_2}{R_1 + R_2}$ (l)

$V = L\frac{dI}{dt}$ (m)

7. Voltage controlled current source element

8. Capacitor equation

9. Current controlled voltage source element

10. Inductor Element

11. Current source element

12. Inductor equation

Answer the following questions assuming a = True, and b = False.

13. When one draws a wire in a circuit diagram, one must take into account a non-zero resistance along the line.

14. When performing nodal analysis on a resistive circuit without dependant sources, the diagonal terms are the sum of conductances at the node.

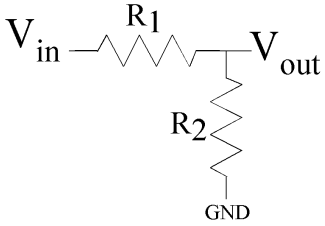
15. Kirchoff's current law states that all of the currents into a node must be equal to zero because there is no charge accumulation at the node.

16. When performing nodal analysis on a resistive circuit without dependant sources, the off-diagonal terms are sum of resistances between the nodes

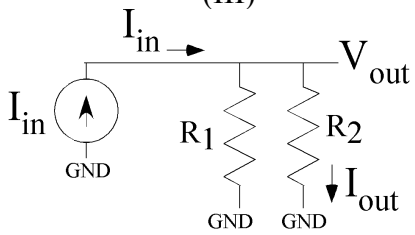
17. Kirchoff's voltage law states the sum of voltages around the loop is equivalent the sum of the voltages sources in the loop.

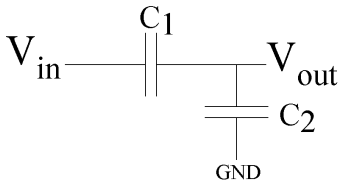
The following questions use these four circuits below. Choose the most correct answers.

(I)

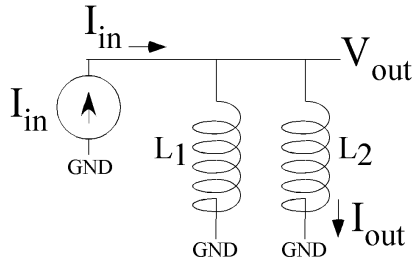


(III)





(II)



(IV)

18. V_{out} vs. V_{in} for circuit (I) is

a. $V_{out} = V_{in}\frac{R_1}{R_2}$

b. $V_{out} = V_{in}\frac{R_2}{R_1 + R_2}$

c. $V_{out} = V_{in}\frac{R_1}{R_1 + R_2}$

d. $V_{out} = V_{in}\frac{R_1}{R_1 + R_2} + V_{offset}$

e. $V_{out} = V_{in}\frac{R_2}{R_1 + R_2} + V_{offset}$

19. V_{out} vs. V_{in} for circuit (II) is

a. $V_{out} = V_{in}\frac{C_1}{C_2}$

b. $V_{out} = V_{in}\frac{C_2}{C_1 + C_2}$

c. $V_{out} = V_{in}\frac{C_1}{C_1 + C_2}$

d. $V_{out} = V_{in}\frac{C_1}{C_1 + C_2} + V_{offset}$

e. $V_{out} = V_{in}\frac{C_2}{C_1 + C_2} + V_{offset}$

20. I_{out} vs. I_{in} for circuit (III) is

a. $I_{out} = I_{in}\frac{R_1}{R_2}$

b. $I_{out} = I_{in}\frac{R_1}{R_1 + R_2}$

c. $I_{out} = I_{in}\frac{R_2}{R_1 + R_2}$

d. $I_{out} = I_{in}\frac{R_2}{R_1 + R_2} + I_{offset}$

e. $I_{out} = I_{in}\frac{R_1}{R_1 + R_2} + I_{offset}$

21. I_{out} vs. I_{in} for circuit (IV) is

a. $I_{out} = I_{in}\frac{L_1}{L_2}$

b. $I_{out} = I_{in}\frac{L_1}{L_1 + L_2}$

c. $I_{out} = I_{in}\frac{L_2}{L_1 + L_2}$

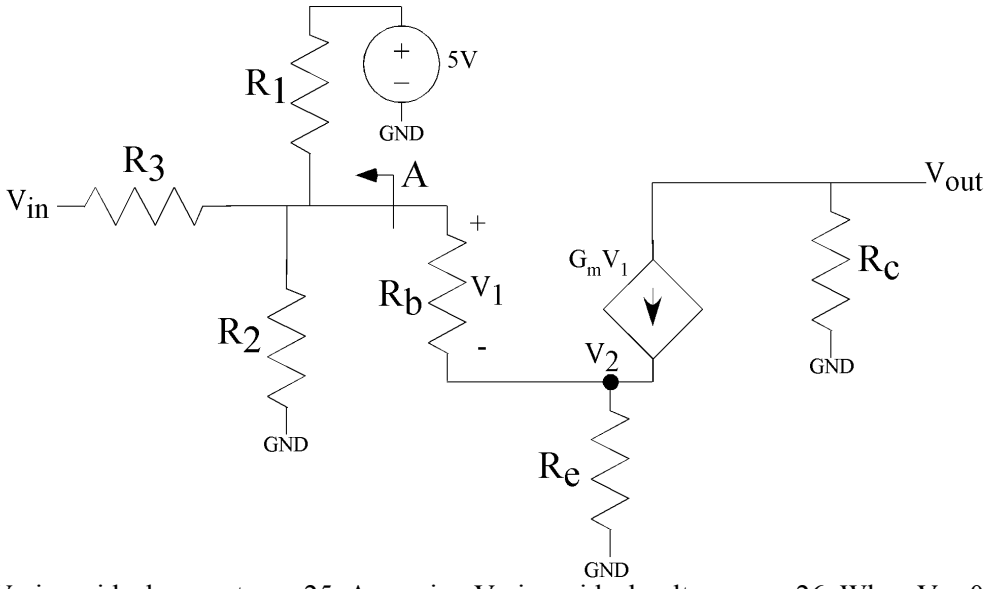
d. $I_{out} = I_{in}\frac{L_2}{L_1 + L_2} + I_{offset}$

e. $I_{out} = I_{in}\frac{L_1}{L_1 + L_2} + I_{offset}$

22. For circuit (II), V_{out} can not be 1V when V_{in} = 0V (a =True, b =False).

23. For circuit (IV), I_{out} could be 1mA when I_{in} = 0V (a =True, b =False).

The following questions relate to the circuit below. $R_1 = R_2 = 10k\Omega$, $1/G_m = 500\Omega$, $R_3 = 50k\Omega$, $R_b \rightarrow$ infinity, $R_e = 10k\Omega$, $R_c = 100k\Omega$.



24. Assuming V_{in} is an ideal current source, what is the equivalent Thevenin resistance for the one-port looking into point A?
a. 1kΩ
b. 5kΩ
c. 10kΩ
d. 20kΩ
e. 100kΩ

25. Assuming V_{in} is an ideal voltage source, and if the 5V voltage source is turned off, what is the equivalent Thevenin voltage source for the one-port looking into point A?
a. $V_{in}/20$
b. $V_{in}/10$
c. $V_{in}/2$
d. V_{in}
e. $2V_{in}$

26. When $V_{in}=0$, what is the equivalent Thevenin voltage source for the one-port looking into point A?
a. 0V
b. 1V
c. 2.5V
d. 4V
e. 5V

27. When $V_{in} = 0$, what is V_1?
a. 10mV
b. 25mV
c. 100mV
d. 250mV
e. 1V

28. When $V_{in} = 0$, what is V_2?
a. 10mV
b. 25mV
c. 100mV
d. 250mV
e. 1V

29. When $V_{in} = 0$, what is the equivalent Thevenin resistance for the one-port looking in at V_{out}?
a. 5kΩ
b. 10kΩ
c. 20kΩ
d. 100kΩ
e. 200kΩ

30. If the 5V source is off, what is V_1 (magnitude) as a function of V_{in}?
a. $V_{in}/250$
b. $V_{in}/100$
c. $V_{in}/50$
d. $V_{in}/20$
e. $V_{in}/10$

31. If the 5V source is off, what is V_2 (magnitude) as a function of V_{in}?
a. $V_{in}/250$
b. $V_{in}/100$
c. $V_{in}/50$
d. $V_{in}/20$
e. $V_{in}/10$

32. If the 5V source is off, what is magnitude of V_{out} as a function of V_{in}?
a. $V_{in}/2$
b. V_{in}
c. $2\ V_{in}$
d. $4\ V_{in}$
e. $8\ V_{in}$

33. If the 5V source is off, V_{out} changes in an opposite sign as V_{in}. If V_{in} increases 1V, V_{out} decreases. (a=True/b=False).

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1. d	12. m	23. a
2. b	13. b	24. b
3. b	14. a	25. b
4. d	15. a	26. c
5. d	16. b	27. a
6. b	17. b	28. d
7. e	18. b	29. d
8. k	19. d	30. a
9. d	20. b	31. e
10. b	21. e	32. b
11. g	22. a	33. a