23S-EC ENGR-3-LEC-1 FINAL EXAM NEW

SANJIT SARDA

TOTAL POINTS

95 / 100

QUESTION 1

Q1 15 pts

1.1 A **10 / 10**

✓ **- 0 pts** *Correct*

- 5 pts Wrong with partial correct steps

- 10 pts Wrong

1.2 B **5 / 5**

✓ **- 0 pts** *Correct*

- 5 pts Wrong

QUESTION 2

2 Q2 **15 / 15**

✓ **- 0 pts** *Correct Answer (B)*

- 5 pts Missing/Incorrect explanation for $$R_{1}$$

- 5 pts Missing/Incorrect explanation for $$R_{3}$$

- 5 pts Minor conceptual mistake

- 10 pts Major conceptual mistake

- 15 pts Not attempted/Missing

QUESTION 3

3 Q3 **25 / 25**

✓ **- 0 pts** *Correct*

- 2 pts Calculation error

- 15 pts Minor error

- 20 pts Major error

- 25 pts Wrong

QUESTION 4

4 Q4 **25 / 25**

✓ **- 0 pts** *Correct*

- 20 pts Wrong with partial correct calculation

- 15 pts Wrong with partial correct formula

- 2 pts Calculation error

- 25 pts Wrong

QUESTION 5

5 Q5 **5 / 10**

- 0 pts Correct

✓ **- 5 pts** *Wrong with partial reasonable justification*

- 10 pts Wrong

QUESTION 6

6 Q6 **10 / 10**

✓ **- 0 pts** *Correct*

- 10 pts Wrong

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DO NOT OPEN UNTIL INSTRUCTED TO DO SO.

- We will grade your test using Gradescope.
- Be sure to check the front and back of each sheet!
- Confine your work to the problem's page and back side.
- Put your name in the blank on every page front side.
- Show your setup.
- Circle your answers.
- ADD NOTES to help the graders determine your intentions.

(BACK OF COVER SHEET)

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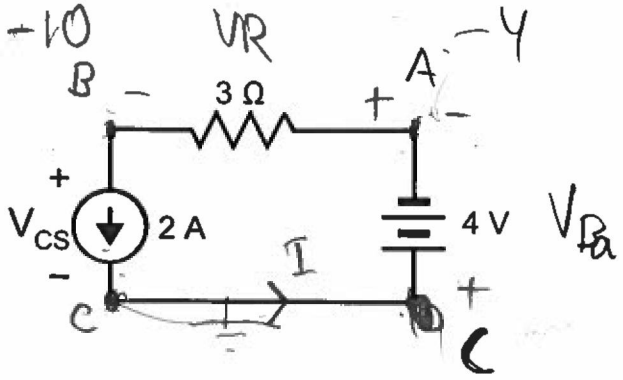
1 (front) (15 points)



a. What is V_{CS}, if V_{CS} is defined as + at the top?

$I = 2A$

$V_R = IR = 6V$

$V_{Ba} = 4V$

$\therefore A = V_R + B$

$A = C - 4$

$\therefore 6 + B = C - 4$ $\quad \therefore B = C - 10$

$\therefore B - C = -10$

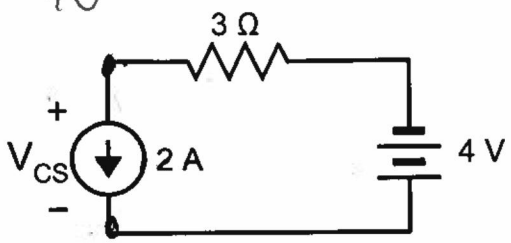
$\therefore V_{CS} = B - C = -10V$

$V_{CS} = -10\,V$

1 (back)

-10

(Circuit from front repeated)



b. Is the current source providing or absorbing power? (circle one)

PROVIDING ABSORBING

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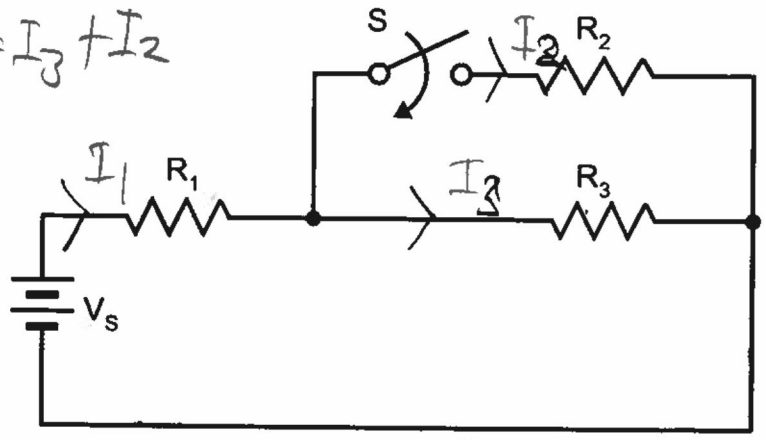
2 (front) (15 points)

$I_1 = I_3 + I_2$



NOTE: if you really understand series and parallel circuits, you will get the answer through intuition and logic; no analysis needed.

Assume all resistors are not zero and not infinite. What happens to the currents through R_1 and R_3 when switch S is closed?

a. R_1 current stays the same, R_3 current decreases
b. R_1 current increases, R_3 current decreases
c. Both R_1 current and R_3 current increase
d. Both R_1 current and R_3 current decrease
e. Both R_1 current and R_3 current stay the same

$R_1 \uparrow$

If S_1, then $R_{eq} <$ Before

$\therefore I_\phi >$ before, since $V = I\uparrow R\downarrow$

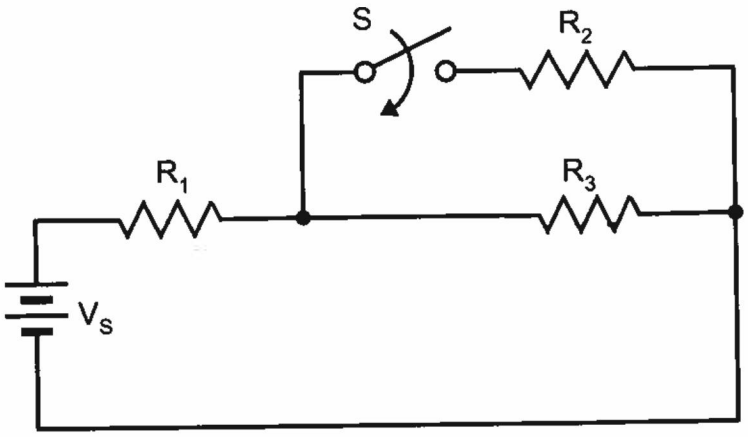
I is increasing when R decreasing

$\therefore R_1$ curr $\uparrow$

Since Current has more space, place $R_3 \downarrow$

2 (back)

(Circuit from front repeated)



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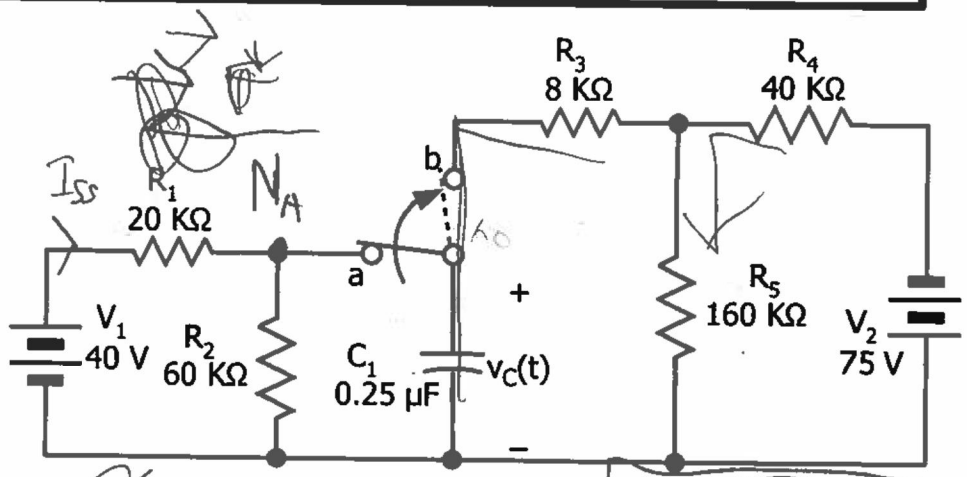
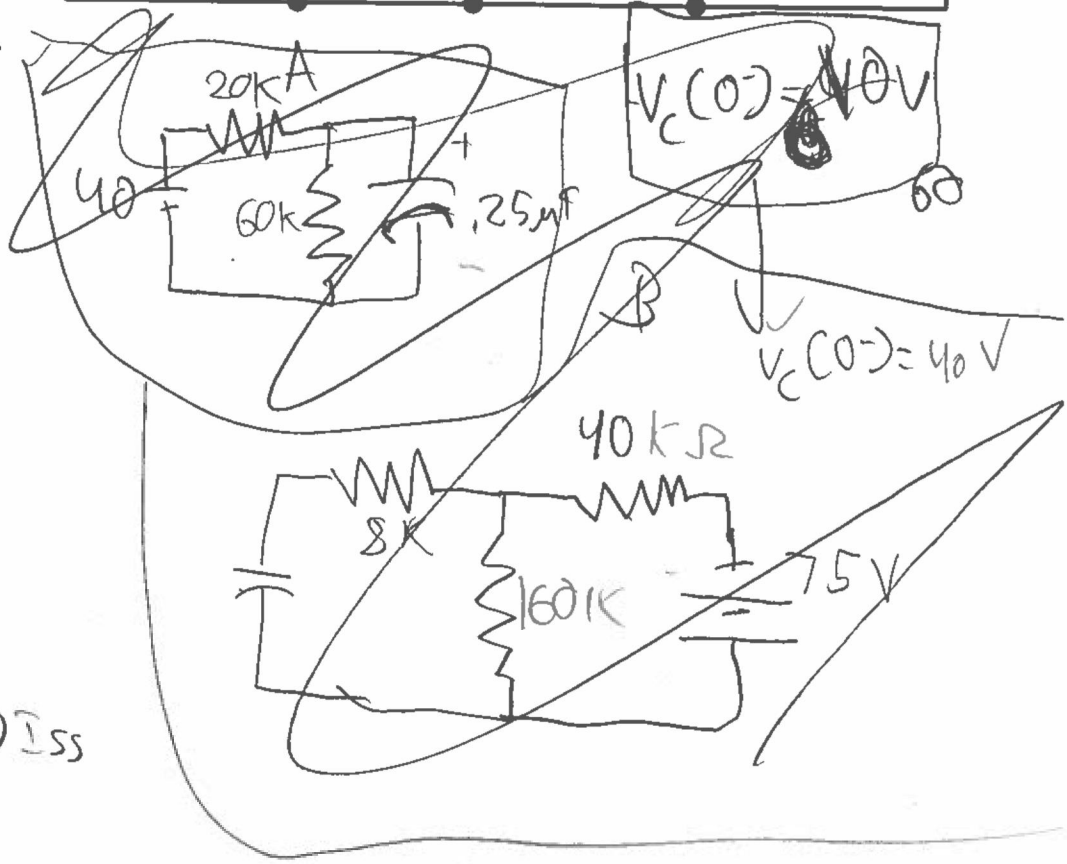
3 (front) (25 points)

The switch has been in position a for a long time. At t=0, the switch moves instantaneously to position b. The capacitor now discharges through the right half of the circuit according to the equation $v_C(t)=-60+Ke^{-100t}$. Find K.

HINT: the final capacitor voltage in position a is the initial capacitor voltage in position b. IOW, $v_C(0^-) = v_C(\text{long time})$.





$\frac{1}{2}\times 80000 = 5\text{mA}$

$I_{SS} = \frac{40}{20k+60k} = \frac{1}{2k}\text{ A}$

$\therefore V_{N_A} = V_1 + (-20k)I_{SS}$

$= 30\text{V}$

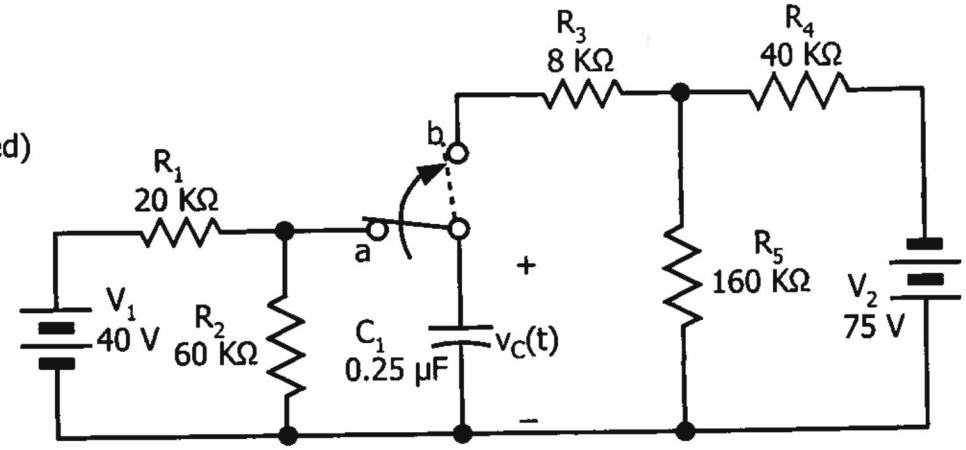
$\therefore V_C(0^-) = 30 = -60 + Ke^{-100t}$

$\therefore V_C(0) = 30 = -60 + Ke^{-100(0)}$

$\therefore 90 = Ke^0 \quad \therefore K = 90$

3 (back)

(Circuit from front repeated)



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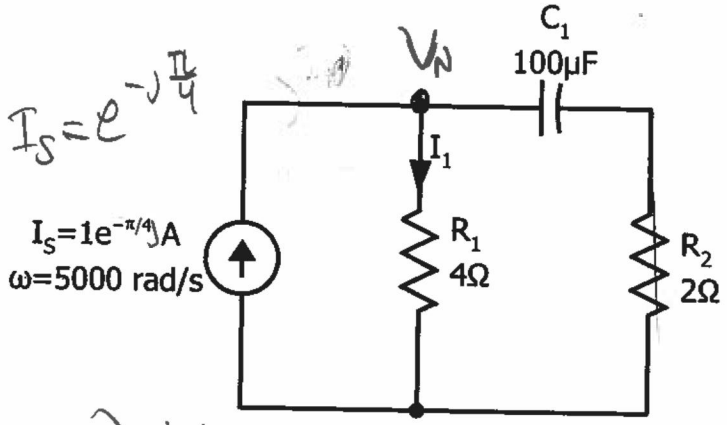
4 (front) (25 points)

Find the current I_1.



$Z_{eq} = \left(2+\frac{1}{j\omega C}\right) \| 4 = 1.788e^{-0.46j}$

$\therefore V_N = IZ = \left(e^{-j\frac{\pi}{4}}\right)\left(1.788e^{-0.46j}\right)$

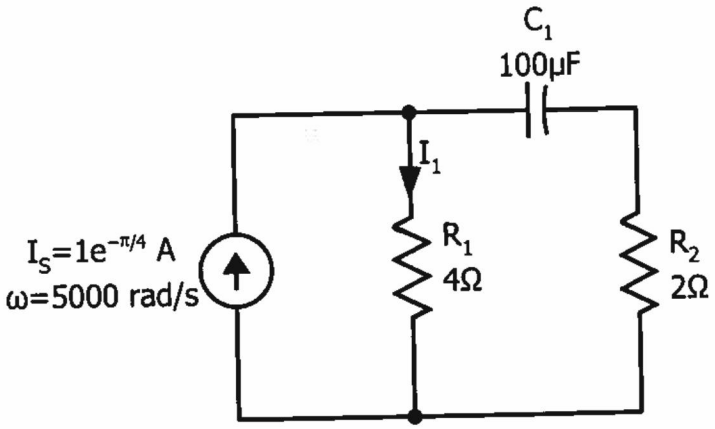
$I_1 = \frac{V_N}{R_1} = \frac{V_N}{4}$

$\therefore I_1 = \frac{\left(e^{-j\frac{\pi}{4}}\right)\left(1.788e^{-0.46j}\right)}{4}$

$= 0.1429 - 0.4235j$

4 (back)

(Circuit from front repeated)



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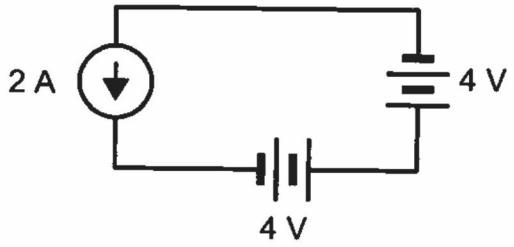
5 (front) (10 points)

In the world of EE3, is this a legal circuit?

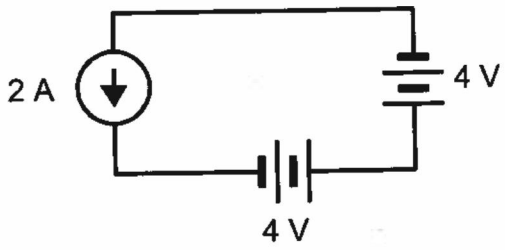
Yes (No)



Basically shorted current source

5 (back)

(Circuit from front repeated)



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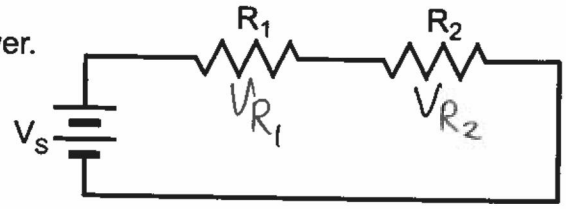
6 (front) (10 points)

In this circuit, $R_1 < R_2$. Which resistor dissipates the least power?

a. Neither; they dissipate the same power.
b. R_1
c. R_2



$P = VI = I^2R$

$\therefore P_1 = V_{R_1} \cdot I = I^2 \cdot R_1$

$P_2 = I^2 \cdot R_2$

$\therefore R_1 < R_2 \rightarrow P_1 < P_2$

6 (back)

(Circuit from front repeated)