23W-EC ENGR-10-LEC-1 Hw #1

SANJIT SARDA

TOTAL POINTS

48 / 50

QUESTION 1

1 Problem 1 **5 / 5**

✓ **- 0 pts** *Correct*

QUESTION 2

Problem 2 9 pts

2.1 (a) **1.5 / 3**

✓ **- 1.5 pts** *Wrong Sign*

2.2 (b) **3 / 3**

✓ **- 0 pts** *Correct*

2.3 (c) **3 / 3**

✓ **- 0 pts** *Correct*

QUESTION 3

Problem 3 20 pts

3.1 (a) **3 / 3**

✓ **- 0 pts** *Correct*

3.2 (b) **3 / 3**

✓ **- 0 pts** *Correct*

3.3 (c) **3 / 3**

✓ **- 0 pts** *Correct*

3.4 (d) **3 / 3**

✓ **- 0 pts** *Correct*

3.5 (e) **3 / 3**

✓ **- 0 pts** *Correct*

3.6 (f) **4.5 / 5**

✓ **- 0.5 pts** *Partially Correct Explanation*

QUESTION 4

Problem 4 10 pts

4.1 (a) **5 / 5**

✓ **- 0 pts** *Correct*

4.2 (b) **5 / 5**

✓ **- 0 pts** *Correct (based on answer in part a)*

QUESTION 5

5 Problem 5 **6 / 6**

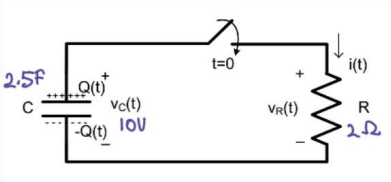
✓ **- 0 pts** *Correct*

ECE 10: HW1

1) $$i(t)=\begin{cases}\frac{1}{2}e^{-5t}, & t\geq 6\\ 0, & t<6\end{cases}.$$

$$Q=\int_{-\infty}^{\infty} i(t)dt=\int_{6}^{\infty}\frac{1}{2}e^{-5t}dt+\int_{-\infty}^{6}0\,dt=-\frac{1}{10}e^{-5t}\Big|_{6}^{\infty}=0-\left(-\frac{1}{10}e^{-30}\right)=\boxed{\frac{e^{-30}}{10}\,C}$$

2)

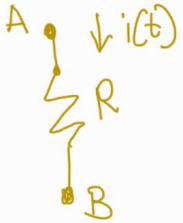


$i(t_0)=2A$

$i(t)=5e^{-t/5}u(t)$ $\longrightarrow$ $\frac{2}{5}=e^{-t_0/5}\therefore \ln\left(\frac{2}{5}\right)=\frac{-t_0}{5}\therefore t_0=-5\ln\left(\frac{2}{5}\right)=5\ln\left(\frac{5}{2}\right)$

a) $V_C(t)=\frac{Q(t)}{C}=\frac{1}{C}\int i\,dt$

$\therefore \frac{dV_C(t)}{dt}@t=t_0=\frac{i(t_0)}{C}=\frac{2}{2.5}=\boxed{\frac{4}{5}\,Vs^{-1}}$



b) $V_R(t_0)=i(t_0)\cdot R=2\cdot 2=\boxed{4V}$ Polarity: $AB=4V$ & $BA=-4V$

c) $Q(t_0)=CV=2.5F\cdot V_R(t_0)=2.5F\cdot 4V=\boxed{10C}$

We also have $Q(t_0)=Q_0-\int i\,dt=25C-15C=10C$ @ $t=t_0$

1 Problem 1 5 / 5

✓ **- 0 pts** *Correct*

ECE 10: HW1

1) $$i(t)=\begin{cases}\frac{1}{2}e^{-5t}, & t\geq 6\\ 0, & t<6\end{cases}.$$

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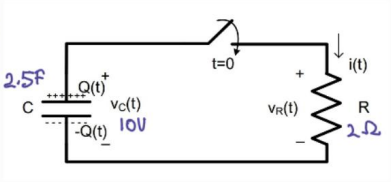

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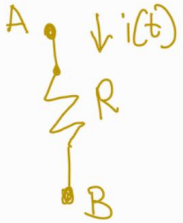

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2.1 (a) **1.5 / 3**

✓ **- 1.5 pts** *Wrong Sign*

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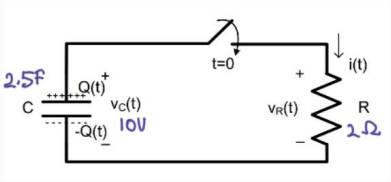

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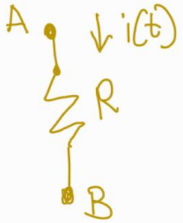

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2.2 (b) **3 / 3**

✓ **- 0 pts** *Correct*

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$$Q=\int_{-\infty}^{\infty} i(t)dt=\int_{6}^{\infty}\frac{1}{2}e^{-5t}dt+\int_{-\infty}^{6}0\,dt=-\frac{1}{10}e^{-5t}\Big|_{6}^{\infty}=0-\left(-\frac{1}{10}e^{-30}\right)=\boxed{\frac{e^{-30}}{10}\,C}$$

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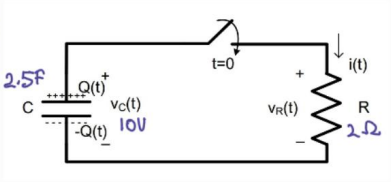

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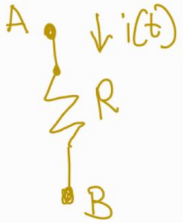

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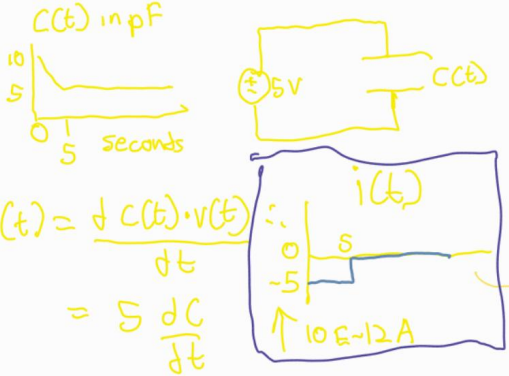
2.3 (c) **3 / 3**

✓ **- 0 pts** *Correct*

3) Paralled Plate Capacitor to a 5V source



a) $i(t) = \frac{d\,C(t)\cdot V(t)}{dt}$

$= 5\frac{dC}{dt}$

b) $E = \frac{1}{2}CV^2 = \frac{1}{2}\cdot 10pF\cdot(5V)^2 =$ 1.25 E-10 joules.

c) $E = \frac{1}{2}CV^2 = \frac{1}{2}\cdot 5pF\cdot(5V)^2 =$ 6.25 E-11 joules.

d) $\Delta E = E_f - E_i = (.625 - 1.25)E-10\text{ joules} =$ -6.25E-11 joules

Since change in Energy is negative Energy is being removed.

e) $\Delta E_B = \int_0^5 VI\,dt = \int_0^5 5(+5E-12)\,dt =$ 1.25 E-10 joules

(positive since work is done on the battery.)

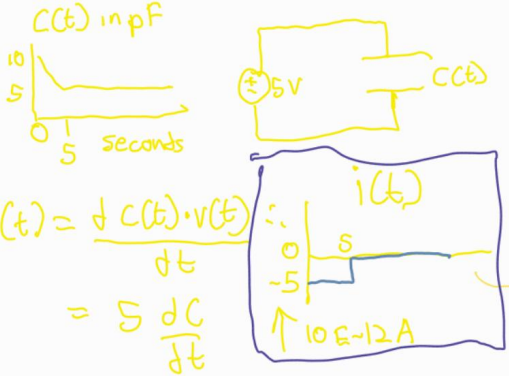
f) $\Delta E_{Battery} = -\frac{1}{2}\Delta E_{cap}$

∴ The battery is getting twice the amount of energy that is released from the capacitor. This doesn't indicate energy is being conserved, since in this case energy seemingly is produced from thin air. However this may be a result of work done on the capacitor to bring the plates further away.

3.1 (a) **3 / 3**

✓ **- 0 pts** *Correct*

3) Paralled Plate Capacitor to a 5V source



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3.2 (b) **3 / 3**

✓ **- 0 pts** *Correct*

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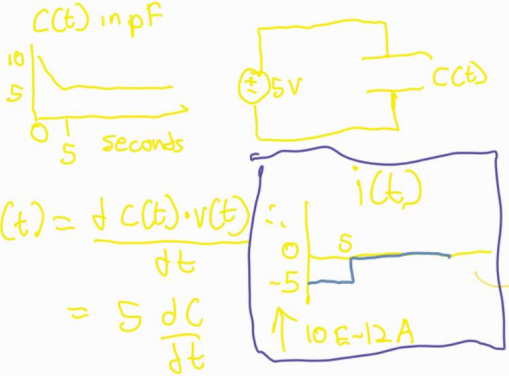

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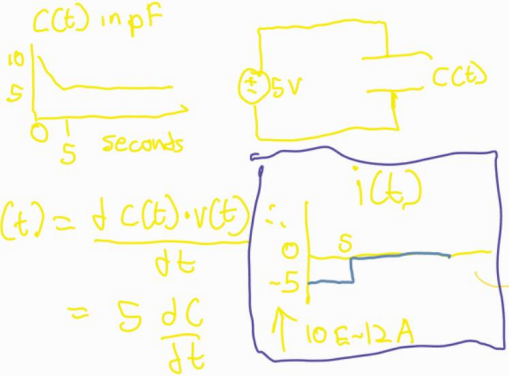
3.3 (c) **3 / 3**

✓ **- 0 pts** *Correct*

3) Paralled Plate Capacitor to a 5V source



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3.4 (d) **3 / 3**

✓ **- 0 pts** *Correct*

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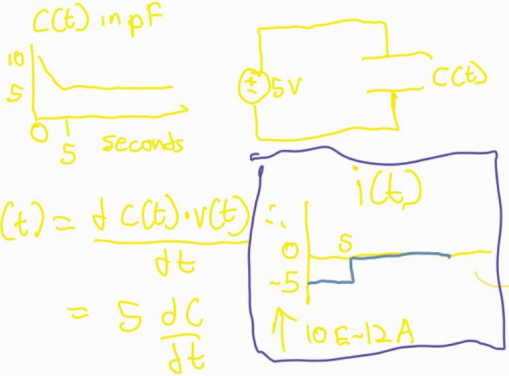

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3.5 (e) **3 / 3**

✓ **- 0 pts** *Correct*

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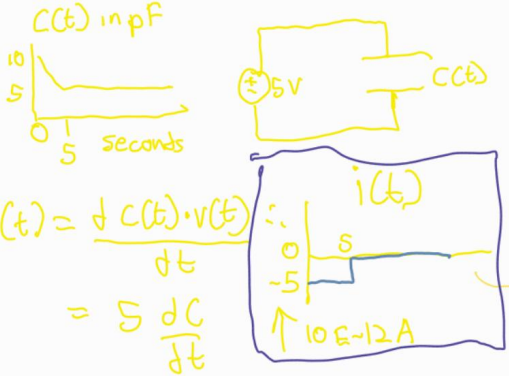

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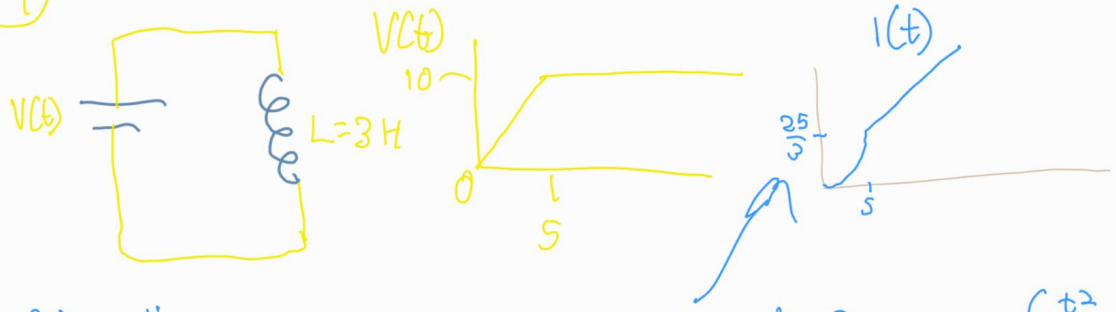
3.6 (f) **4.5 / 5**

✓ **- 0.5 pts** *Partially Correct Explanation*

Q)



a) $v(t) = L\frac{di}{dt}$ $\therefore \frac{1}{L}v(t)dt = di \therefore i(t) = \frac{1}{3}\int v(t)dt = \begin{cases} \frac{t^2}{3}, & 0<t<5 \\ \frac{10t-25}{3}, & 5\leq t \end{cases}$

b) $E = \frac{1}{2}LI^2 = \begin{cases} \frac{t^4}{6}, & 0<t<5 \\ \frac{100t^2-500t+625}{6} & 5\leq t \end{cases}$

4.1 (a) **5 / 5**

✓ **- 0 pts** *Correct*

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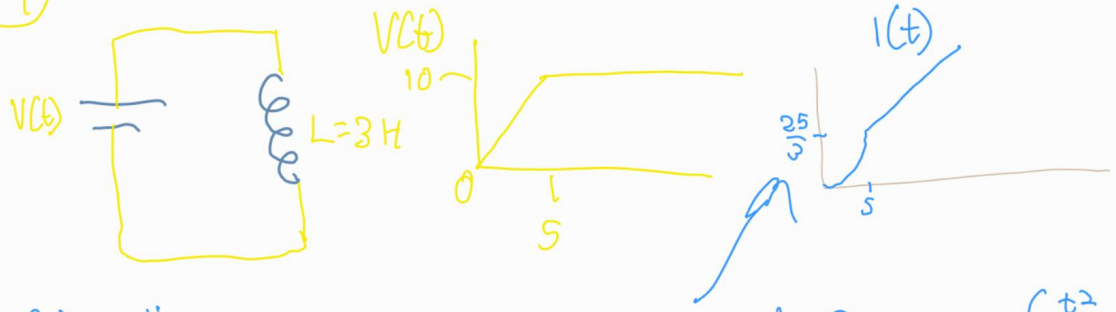

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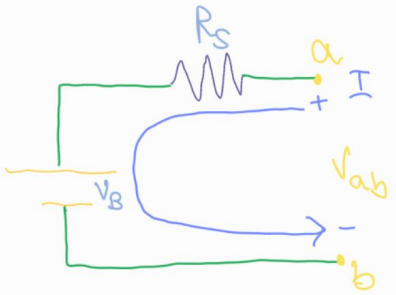
4.2 (b) **5 / 5**

✓ **- 0 pts** *Correct (based on answer in part a)*

5)



$V = IR$

$V_{R_S} = -I \cdot R_S$

$V_B = V_{ab} + V_{R_S}$

Since current is going against V_{ab}

$\therefore V_{ab} = V_B + IR_S$

$Q = CV$

$I = C\frac{dV}{dt}$

$Q = \int I\,dt$

$= C\frac{dV}{dt}$

$I = C\frac{dV}{dt} +$

$\int I\,dt = C\int dV$

5 Problem 5 6 / 6

✓ **- 0 pts** *Correct*