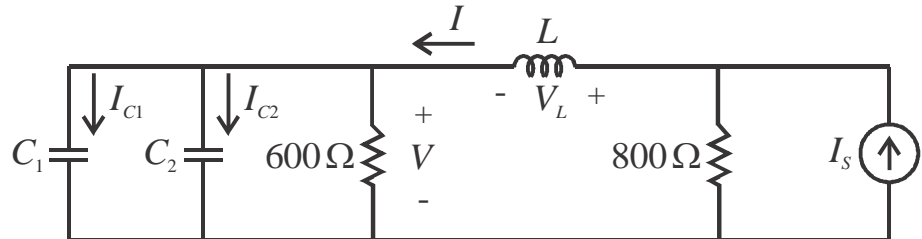


EE 220/220L Circuits I (Spring 2011) Examination 3

Name _____

Instructions: Show all work for full credit. Write answers in indicated places. Attach equation sheet.

- 1) For the DC circuit shown, determine the labeled currents and voltages. Also, find the charge and energy stored by each of the capacitors as well as energy stored by the inductor. Given: $L = 0.4 \text{ H}$, $C_1 = 30 \mu\text{F}$, $C_2 = 50 \mu\text{F}$, and $I_S = 70 \text{ mA}$.

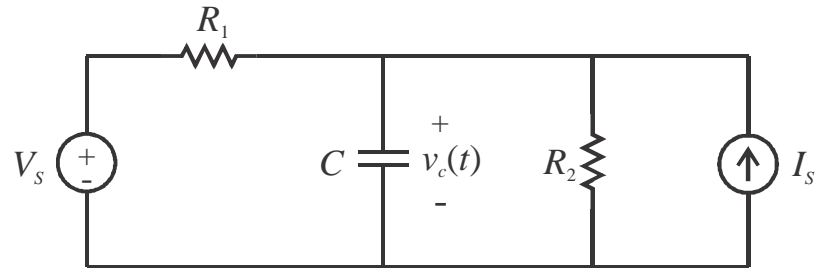


$V = \underline{24V}$ $V_L = \underline{0}$ $w_L = \underline{0.32 \text{ mJ}}$

$I = \underline{40 \text{ mA}}$ $I_{C1} = \underline{0}$ $I_{C2} = \underline{0}$

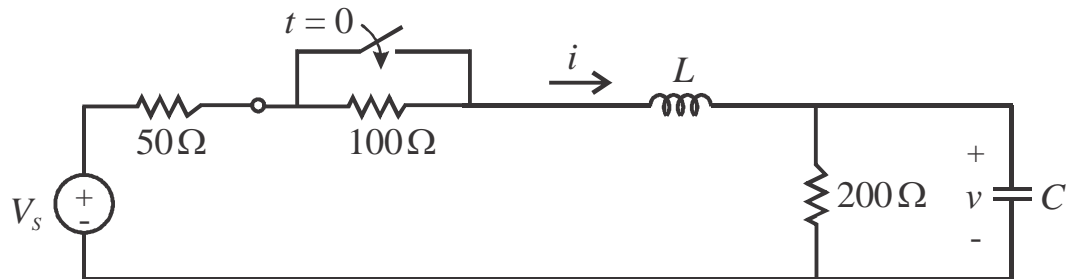
$w_{C1} = \underline{8.64 \text{ mJ}}$ $w_{C2} = \underline{14.4 \text{ mJ}}$ $Q_{C1} = \frac{\underline{0.72 \text{ mC}}}{\underline{720 \mu\text{C}}}$ $Q_{C2} = \frac{\underline{1.2 \text{ mC}}}{\underline{1200 \mu\text{C}}}$

- 2) Find the voltage across the capacitor for **all** time when $R_1 = 2 \text{ k}\Omega$, $R_2 = 1.5 \text{ k}\Omega$, $C = 15 \text{ }\mu\text{F}$, $V_S = 80 \text{ V}$, and $I_S = 0.1 u(t) \text{ A}$.



$$v_c(t) = \begin{cases} 34.2857 \text{ V} & t < 0 \\ 120 - 85.7143 e^{-77.77t} \text{ V} & t \geq 0 \end{cases}$$

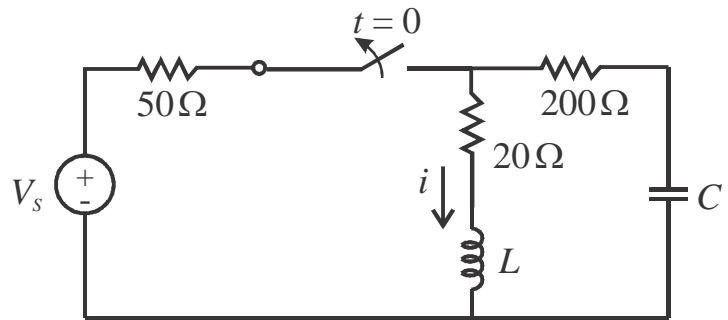
- 3) For the circuit shown, the switch has been open for a very long time before closing at $t = 0$. Find $i(0^+)$, $v(0^+)$, $i(\infty)$, $v(\infty)$, $\left. \frac{di}{dt} \right|_{t=0^+}$, and $\left. \frac{dv}{dt} \right|_{t=0^+}$. Given: $L = 0.2 \text{ H}$, $C = 20 \text{ }\mu\text{F}$, and $V_S = 30 \text{ V}$.



$$i(0^+) = \underline{85.7143 \text{ mA}} \quad v(0^+) = \underline{17.143 \text{ V}} \quad i(\infty) = \underline{120 \text{ mA}} \quad v(\infty) = \underline{24 \text{ V}}$$

$$\left. \frac{di}{dt} \right|_{t=0^+} = \underline{42.857 \text{ A/s}} \quad \left. \frac{dv}{dt} \right|_{t=0^+} = \underline{0}$$

- 4) For the circuit shown, $L = 0.2 \text{ H}$, $C = 50 \text{ } \mu\text{F}$, and $V_S = 21 \text{ V}$. Is the circuit overdamped, critically-damped, or underdamped? Why? Give roots of characteristic equation. Then, given $i(0) = 0.3 \text{ A}$ and $\left. \frac{di}{dt} \right|_{t=0^+} = 0$, determine $i(t)$ for $t > 0$.



overdamped, critically-damped, or underdamped? (circle correct answer) $s_1 = \underline{-100 \text{ n/s}}$

Why? $s_1 + s_2$ are both real and $s_1 \neq s_2$ $s_2 = \underline{-1000 \text{ n/s}}$

$i(t) = \underline{0.33 e^{-100t} - 0.033 e^{-1000t} \text{ (A)} \quad t \geq 0}$