EECS 215-002 Quiz 6 Fall 2017

Name : **ID #**

Problem # 1(5 Points)

Current in a 100mF capacitor is given as follows.

$$i = \begin{cases} -200t\ mA & 0 \le t \le 5\sec \\ 0\,A & for\ \ t > 5\ \sec \end{cases}$$

If capacitor is already charged to 100V, find the amount of voltage across the capacitor after 10sec.

$$i_c = C\frac{dv_c}{dt}$$

$$v_c = \frac{1}{C}\int i_c\,dt + V_c(0)$$

$$v_c = \frac{1}{C}\int_0^{5sec} (-200\times10^{-3} t\,A)\,dt + 100^V \qquad For\ 0 \le t \le 5^{sec}$$

$$v_c = \frac{10^3}{100F}(-0.2)\frac{t^2}{2}\Big|_0^{5sec} + 100\,V$$

$$v_c = -25^V + 100\,V = 75^V$$

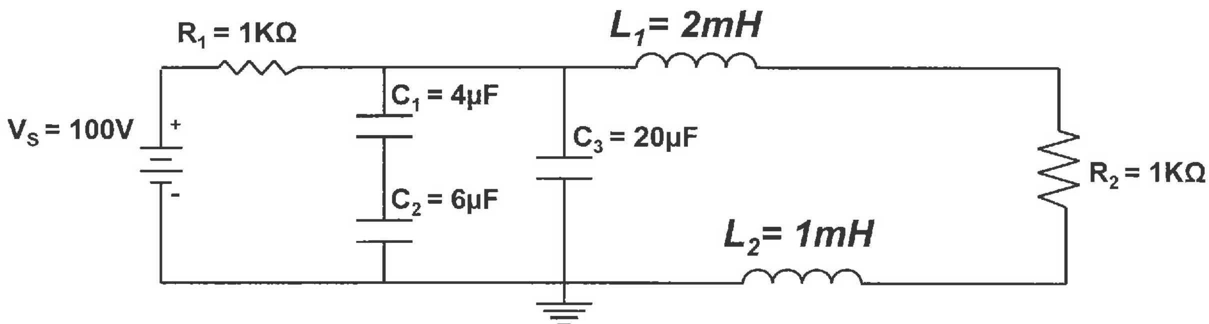
For $t > 5$ sec

$$v_c = \frac{1}{C}\int_{5sec}^{\infty} 0\,dt + V_c(5\,sec) = V_c(5\,sec)$$

$$v_c(t > 5\,sec) = 75\ V$$

Problem # 2(15 Points)

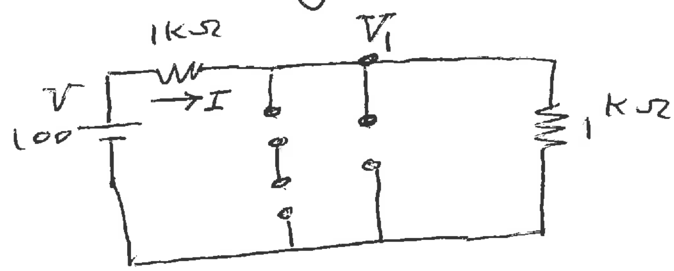
Assuming the following circuit is in steady state condition; calculate the amount of energy stored in each capacitor and inductor.



Enter the results here:

W_{C1} = 1,8m: W_{C2} = 1,2 mJ W_{C3} = 25 mJ W_{L1} = 2,5 μJ W_{L2} = 1,25 μJ

The circuit is reduced to the following circuit in stead state



$$V_1 = \frac{100\,V \cdot 1\,K\Omega}{1+1\,K\Omega} = 50\,V$$

$$I = \frac{100\,V}{2\,K\Omega} = 50\,mA$$

$$V_{C3} = 50\,V, \quad V_{C1} = \frac{C_2}{C_1+C_2} \cdot V = \frac{6\,\mu F}{10\,\mu F} \times 50 = 30\,V$$

$$V_{C2} = \frac{C_1}{C_1+C_2} \cdot V = \frac{4}{10} \times 50 = 20\,V$$

$$W_{L_1} = \frac{1}{2} L I_1^2 = \frac{1}{2} \times 2\times10^{-3} (50\times10^{-3})^2 = 2500\,nW = 2.5\,\mu J$$

$$W_{L_2} = \frac{1}{2} \times 10^{-3}\,H\,(50\times10^{-3})^2 = 1.25\,\mu J$$

$$W_{C1} = \frac{1}{2} C_1 V_1^2 = \frac{1}{2} \times 4\times10^{-6} (30^V)^2 = 1.8\,mJ$$

$$W_{C2} = \frac{1}{2} C_2 V_2^2 = \frac{1}{2} \times 6\times10^{-6} (20^V)^2 = 1.2\,mJ$$

$$W_{C3} = \frac{1}{2} C_3 V^2 = \frac{1}{2} \times 20\times10^{-6} (50)^2 = 25\,mJ$$