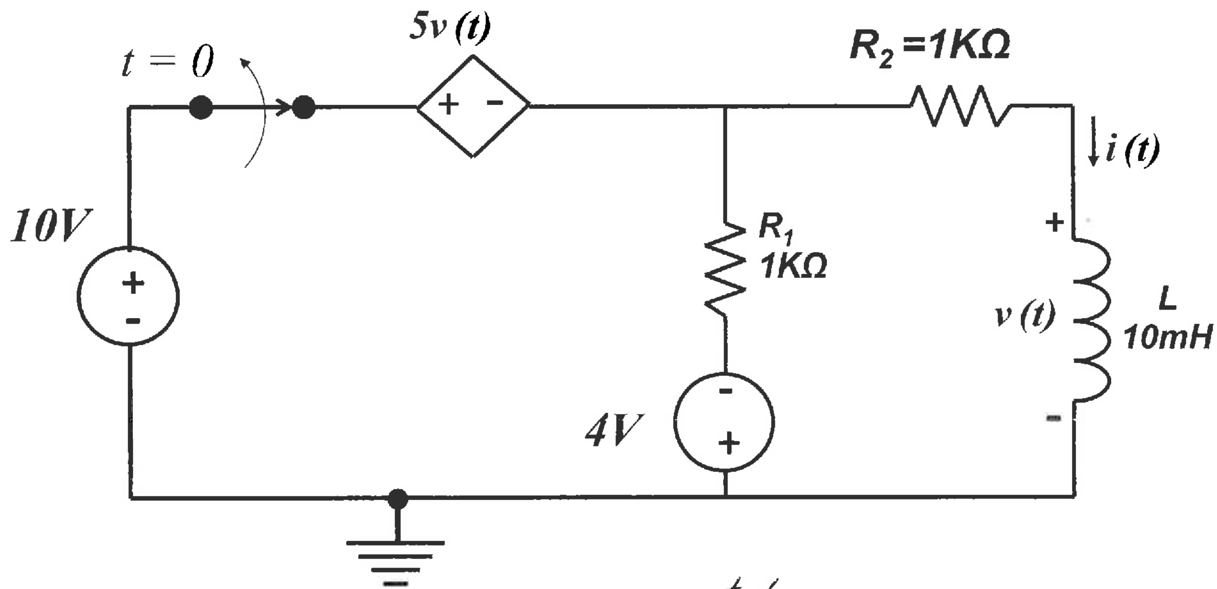
Name : **ID #**

Problem # 1 (10 Points)

The switch in the circuit is opened at time $t = 0$ after long being closed. Find $i_L(t)$ at $t = 2\mu sec$ and $t = 9\mu sec$.



$i_L(t>0) = I_F + (I_{L^i} - I_F)e^{-t/\tau}$

For switch is closed for long time, $v(t)=0$, $5v(t)=0$

$\therefore$ 10V apears across $R_2 = 1K\Omega$

$I_{L^i}(t=0) = \frac{10V}{1K\Omega} = 10mA$

After switch is opened, circuit will find new steady-state condition, with: $i(t) = -\frac{4V}{2K\Omega} = -2mA$

$\therefore \quad i_L(t) = -2\overset{mA}{} + (10+2)\overset{mA}{}e^{-t/\tau}$, $\tau = \frac{L}{R} = \frac{10mH}{2K\Omega} = 5\mu sec$

$i_L(t) = -2+12e^{-t/5\mu sec}$ mA for $t>0$

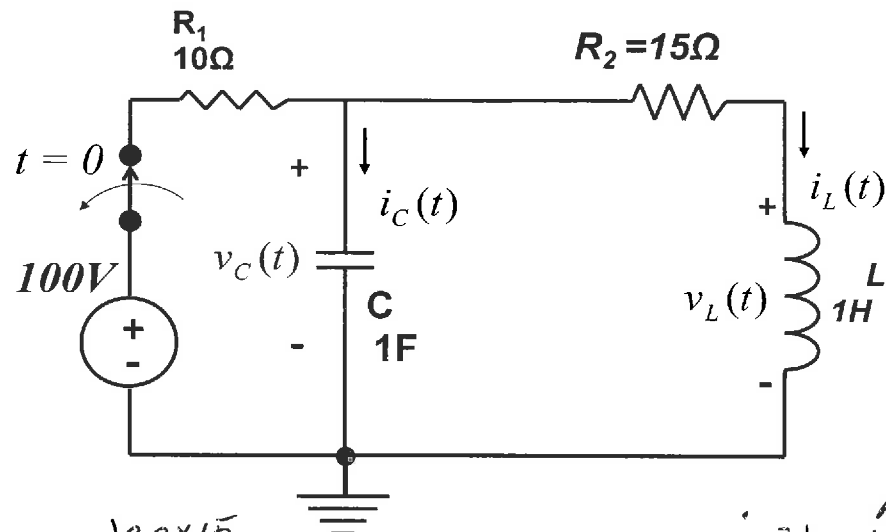
at $t = 2\mu sec$, $i_L(t=2\mu sec) = -2+12e^{-\frac{2}{5}} = 6.04$ mA

at $t = 9\mu sec$, $i_L(t=9\mu sec) = -2+12e^{-9/5} = -0.016$ mA

Problem # 2 (10 Points)

In this circuit, switch has been closed for a long time and then is opened at t = 0, find

$i_C(t=0^+)$, $v_C(t=0^+)$, $v_C(t=\infty)$, $v_C'(t=0^+)$, $i_L(t=0^+)$, $i_L(t=\infty)$, $i_L'(t=0^+)$.



At $t=0^-$ $\quad v_c(0^-) = \frac{100\times15}{10+15} = 4A \times 15^{\Omega} = 60V, \quad i_L(0^-) = 4^A$

For $t=0^+$ $\quad v_c(0^+) = 60V, \quad i_L(0^+) = 4A, \quad v_c(\infty)=0, \quad i_L(\infty)=0$

$$i_c(0^+) = -i_L(0^+) = -4A$$

$$i_c(0^+) = C\left.\frac{dv_c}{dt}\right|_{t=0^+}, \quad \left.\frac{dv_c}{dt}\right|_{t=0^+} = \frac{i_c(0^+)}{C} = \frac{-4A}{1F} = -4\ ^{V}/_{sec}$$

Also $\quad v_L(0^+) - v_c(0^+) + i_L(0^+)R_2 = 0$

$$v_L(0^+) - 60^V + 4^A \cdot 15 = 0, \quad v_L(0^+) = 0$$

$$v_L(0^+) = L\left.\frac{di_L}{dt}\right|_{t=0^+} = 0, \quad \left.\frac{di_L}{dt}\right|_{t=0^+} = 0$$