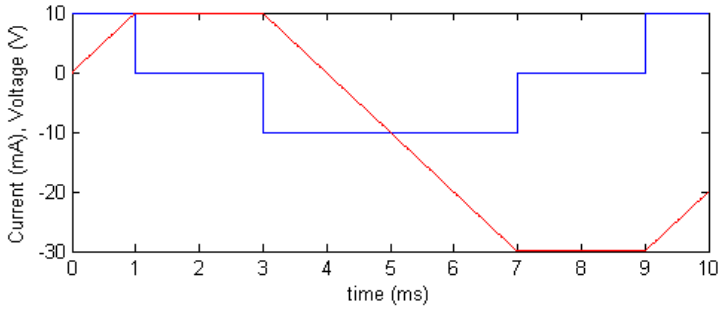
EEE 202: TEST 3 **NAME:____SOLUTIONS___**

3 Problems, equal credit, 75', Closed Book&Notes, 1 sheet of formulae allowed

Problem 1.

The current across a 1μF capacitor is shown in the following figure. The capacitor starts at t = 0 completely discharged. Plot the capacitor voltage. Find the energy stored in the capacitor at t = 10 ms.



We use $\boldsymbol{v(t) = \frac{1}{C}\int i(t)dt}$

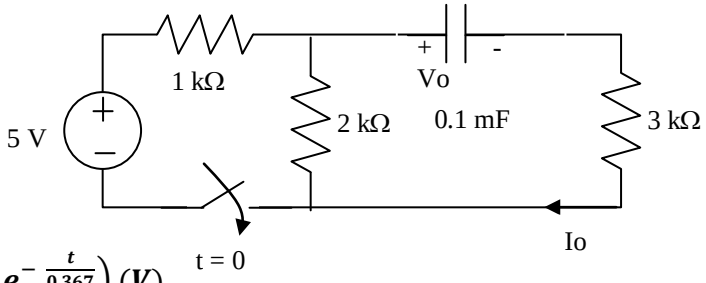
At 1ms, the voltage is

$\boldsymbol{v(t) = \frac{1}{1e-6}1e-3 \times 10e-3 = 10(V)}$

Similarly, the ending voltage is v(10m) = - 20(V)

The capacitor energy at that time is $\boldsymbol{E(10m) = \frac{1}{2}Cv^2(10m) = 0.2mJ}$

Problem 2. In the following circuit, find the voltage V_o for t > 0. (The switch closes at t = 0.)

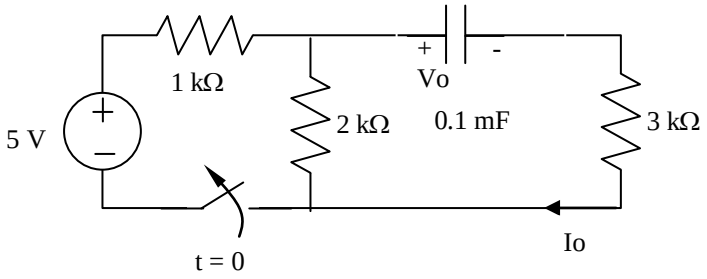


1. IC: $\boldsymbol{V_0(0^-) = V_0(0^+) = 0}$.
2. FV: $\boldsymbol{V_0(\infty) = \frac{2k}{1k+2k}5 = \frac{10}{3}(V)}$.
3. TC: $\boldsymbol{R_{TH} = 3k + 1k||2k = \frac{11}{3}k(\Omega}$

$\boldsymbol{\Rightarrow \tau = R_{TH}C = 0.367(s)}$.

Solution: $\boldsymbol{V_0(t) = FV + (IC - FV)e^{-t/\tau} = \frac{10}{3}\left(1 - e^{-\frac{t}{0.367}}\right)(V)}$

Problem 3. In the following circuit, find the current I_o for t > 0. (The switch opens at t = 0.)



1. IC: $\boldsymbol{V_0(0^-) = V_0(0^+) = \frac{2k}{1k+2k}5 = \frac{10}{3}(V)}$.
1. IC: $\boldsymbol{I_0(0^+) = -\frac{V_0(0^+)}{2k+3k} = -\frac{2}{3}m(A)}$.
2. FV: $\boldsymbol{I_0(\infty) = 0}$.
3. TC: $\boldsymbol{R_{TH} = 3k + 3k = 5k(\Omega}$

$\boldsymbol{\Rightarrow \tau = R_{TH}C = 0.5(s)}$.

Solution: $\boldsymbol{I_0(t) = FV + (IC - FV)e^{-t/\tau} = -\frac{2}{3}e^{-\frac{t}{0.5}}m(A)}$