Class: EE 100  
Date: Wednesday, June 29th, 2005  
Office Hour Notes:

\( C = 3 \mu F \)  
\( V(t) = 10 \text{V} \)

**Sketch:**
- Voltage, power, and stored energy vs. time.
- Graph showing voltage and time.

**Equations:**
\[
V(t) = \begin{cases} 
100 & t < 1 \\
0 & 1 \leq t < 2 \\
-100 & t \geq 2 
\end{cases}
\]

\[
V(t) = \frac{1}{C} \int_0^t i(t) dt + V_0 = \begin{cases} 
100 & 0 \leq t < 1 \\
100 - \frac{100}{3} t & 1 \leq t < 2 \\
0 & 2 \leq t 
\end{cases}
\]

\[10 + \frac{100}{3} = V(t = 1 \text{ms})\]
Regime 1:
\[ v(0) = 100 \text{ m/s} \]
\[ (\tan 10) = \frac{v(0) + 10}{1 - 0} = \frac{100}{3} \]
\[ \therefore v(t) = \frac{100}{3} t + 10 \text{ m/s} \]

\[ \rho(0) = u(0), \quad \rho(t) = \frac{1000 \text{ m/m}}{t + 1000 \text{ m/m}} \]

\[ R(t) = \frac{10 t + 1 \omega}{3} \]

\[ \rightarrow \text{ Carry from now!} \]
b4.2)

\[ t \leq 0 \]

Note: Check online exams on http://bkn.eecs.berkeley.edu for good practice problems.

Example: Fall 2000 midterm 1, problem 3.
Problem #3

Initial Conditions
In each of the problems below, find the value of the current or voltage just after the switch moves (t = 0+). (What is requested is just a numerical value, not an equation or function of time.

a.

\[ i_R = \text{?} \]

\[ V_0 = 1 \text{V} \]

\[ V_0 = 1 \text{V} = V(t=0^+) \]

\[ V_0 = 1 \text{V} \]

\[ 0.1 \text{pF} \]

\[ 20 \text{K} \]

\[ i_R = \text{__ microAmps} \]

b.

\[ 1 \text{V} \]

\[ 1 \text{M} \]

\[ t = 0 \]

\[ 2 \text{0.01K} \]

\[ 100 \]

\[ i_{a0} = 50 \text{mA} \]
(c) (Slight variation),

\[ V(t=0) = 1 \text{ V} \]

\[ V_C(0^+) = 1 \text{ V} \]

\[ V_B(0^+) = 1 \text{ V} \]

\[ V_{C}(t^+) = 1 \text{ V} \]

\[ \text{(Voltage divider)} \]
\[ 2 - (0)(1m) - V_s - V_C = 0 \]

\[ \Rightarrow \begin{cases} V_s = 2 - 1 = 1 \text{ V} \end{cases} \]

\[ V_x(t^+) = \frac{200 \text{ k}}{300 \text{ k}} \cdot 2 = 2 \text{ V} \]
At \( t = 0^+ \),

\[ V_{IC} = V_C = 0 \]

because \( i \neq 0 \)

**KCL:**

\[ 3 - V_R - V_{2C} = 0 \Rightarrow V_{2C} = 3 - V_R \]

\[ = 3 - i \left( \frac{100}{2k} \right) \]

\[ = 3 - \left( \frac{3-2}{2k} \right) \cdot 1mA \]

\[ = 3 - 0.5 = 2.5 \text{ V} \]

\[ V_{IC}(0^+) = 2.5 \text{ V} \]
(Q1.) What happens

'The switch is closed for t < 0. When the switch is closed, the capacitor voltage cannot change instantaneously. Therefore, the voltage across the capacitor remains zero for t < 0.'

(Q2.66) Find Thevenin & Norton equivalent.

'Ideally bad! $V_C$ cannot change instantaneously!!!'
\[ \text{KCL @ } V_1: \quad i_1 = i_2 + i_3 \quad \Rightarrow \quad \frac{25 - V_1}{10} = \frac{V_1}{25} + \frac{V_1 - V_{oc}}{5} \]
Set up KCL at $V_{AC}$ and then solve!

More example problems: refer to old exams & review problems from 33100 website (e.g., Click on "EE100 Spring 2005 website" on EE100 homepage & click on Exam 1).

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**Example:**

\[ V_{AB} = ? \]

\[ V_A = \frac{9\,\text{V}}{20 + 20\,\Omega} \cdot 6\,\text{V} \quad \text{(voltage divided)} \]

\[ V_A = 2\,\text{V} \]

\[ V_B = \frac{2\,\text{V}}{20\,\Omega} \cdot 6\,\text{V} = 4\,\text{V} \]

\[ V_{AB} = V_A - V_B = -2\,\text{V} \]
\[ V_{ac} = -(\text{mA})(10 \, \text{K}) \]

\[ V_{ac} = -10 \, \text{V} \]

\[ \rho = (2 \, \text{V}) \left( 6 \, \text{mA} \right) = \boxed{12 \, \text{mV}} = \rho \]
Note: Before attacking the loop analysis, draw the following loop analysis diagram.

Example: Find $V_x$. Now, $V_x = V_m - (-10V)$

$$= (-99 + 1V) + 10$$

$$= -88 + 10 = 98V$$

$V_x = -88V$
Hint: for \( t < \infty \)

Steady state!