EE23BTECH11047 - Deepakreddy P

44 The switch S_1 was closed and S_2 was open for a long time. At t=0,switch S_1 is opened and S_2 is closed,simultaneously. The value of $i_c(0^+)$, in amperes, is (GATE EC 44)

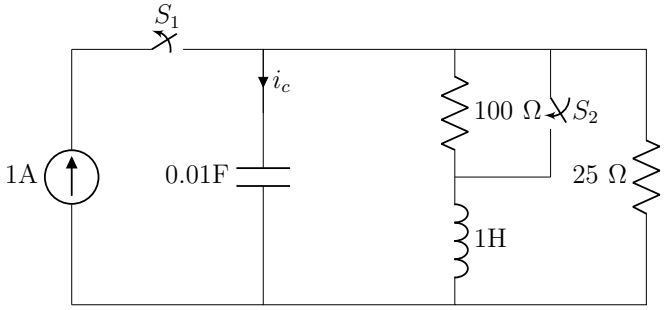

Fig. 1. Circuit 1

Solution:

1) Switch S_1 was closed and S_2 was open

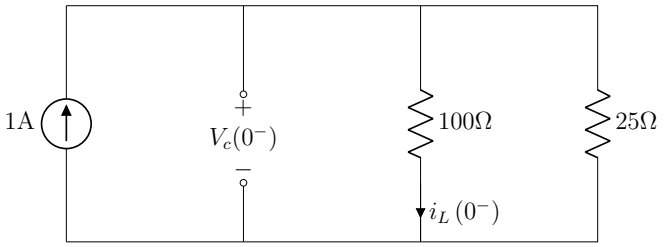

Fig. 2. Circuit 2

$$R_{eff} = 20\Omega \tag{1}$$

$$i_L\left(0^-\right) = \frac{25}{125}A = 0.2A \tag{2}$$

$$i_L\left(0^-\right) = i_L\left(0^+\right) \tag{3}$$

$$\tag{4}$$

Apply KVL

$$-V_c\left(0^-\right) + 20\left(1\right) = 0 \tag{5}$$

$$V_c\left(0^-\right) = 20V \tag{6}$$

2) Switch S_1 is open and S_2 was closed

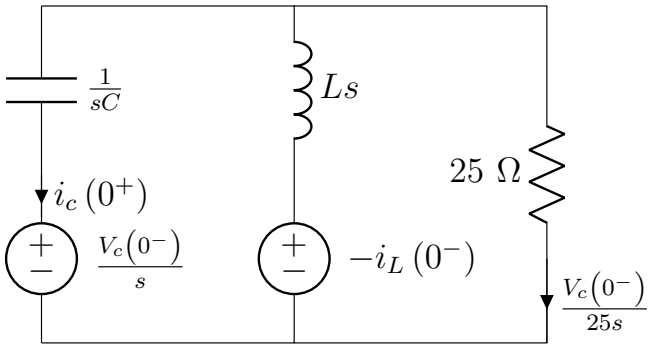

Fig. 3. Circuit 3

At $t = 0^+$ The capacitor is charged. Thus, it acts as a voltage source.The inductor acts as the current source.

$$i_c\left(0^+\right) = -\left(i_L\left(0^-\right) + \frac{V_c\left(0^-\right)}{25s}\right) \tag{7}$$

$$i_c\left(0^+\right) = -\left(0.2 + \frac{0.8}{s}\right) \tag{8}$$

Taking Inverse Laplace Transform

$$i_c\left(0^+\right) = -0.2\delta\left(t\right) - 0.8u\left(t\right) \tag{9}$$

$$= -1A \tag{10}$$

Parameter	Description	Remarks
$V_c\left(0^-\right)$	Voltage across capacitor in case 1	20V
$i_L\left(0^-\right)$	current across inductor in case 1	$\frac{0.2}{s}$
$i_L\left(0^+\right)$	current across inductor in case 2	$\frac{0.2}{s}$
C	Capacitance	0.01F
L	Inductance	1H

TABLE I
PARAMETERS

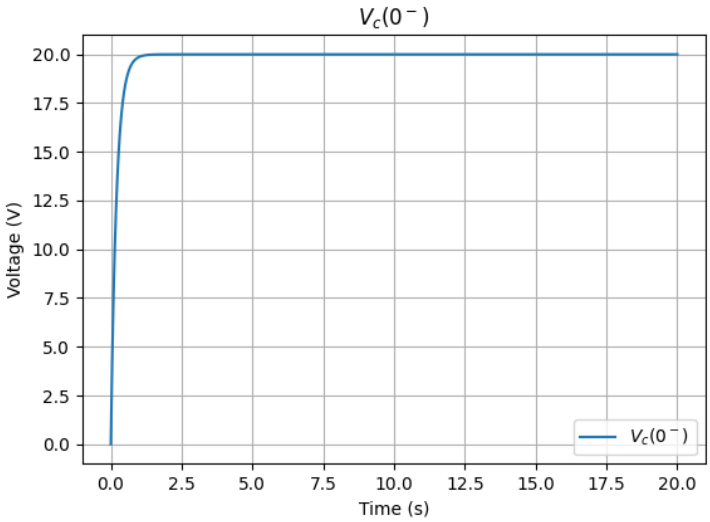

Fig. 4. Plot of $V_c(0^-)$ vs time