حل سری اول پالس

۱) الف)

$$\langle v_i \rangle = \frac{5\times1 + (-1)\times(2)}{3} = 1 \text{ Volt}$$

$$\text{Duty cycle} = \frac{PW}{T} = \frac{1}{3}$$

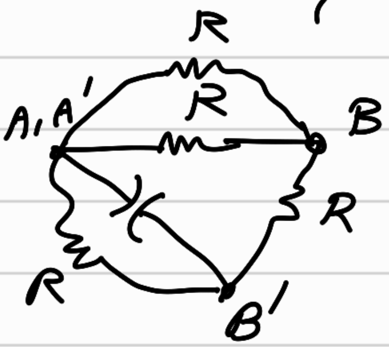
زمان وظیفه

ب)

$$t_r = t_f = \frac{0.35}{f_h} = \frac{0.35}{100MHz} = 0.35\times10^{-8}$$
$$= 3.5\, nSec$$

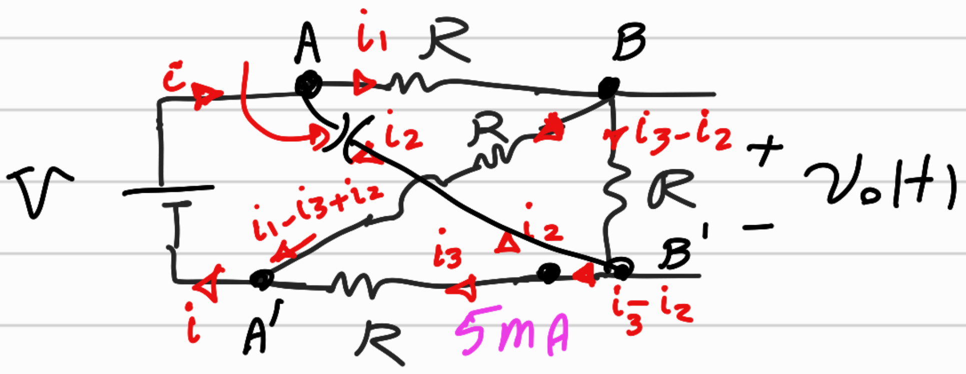
$$\text{٪کجی} = 2\pi \times f_l \times PW = 2\pi \times 100kHz \times 1\mu sec$$
$$= 0.628 \times 100\% = 62.8\%$$

ج) ثابت زمانی مدار



$$\tau = C \times ((R/2 + R) \| R)$$
$$= 2nF \left(3/2 \,\|\, 1k\Omega \right)$$
$$= 2 \times \frac{3/2 \times 1}{3/2 + 1} = \frac{3\times2}{5} \mu sec$$
$$\tau = 1.2\, \mu sec$$

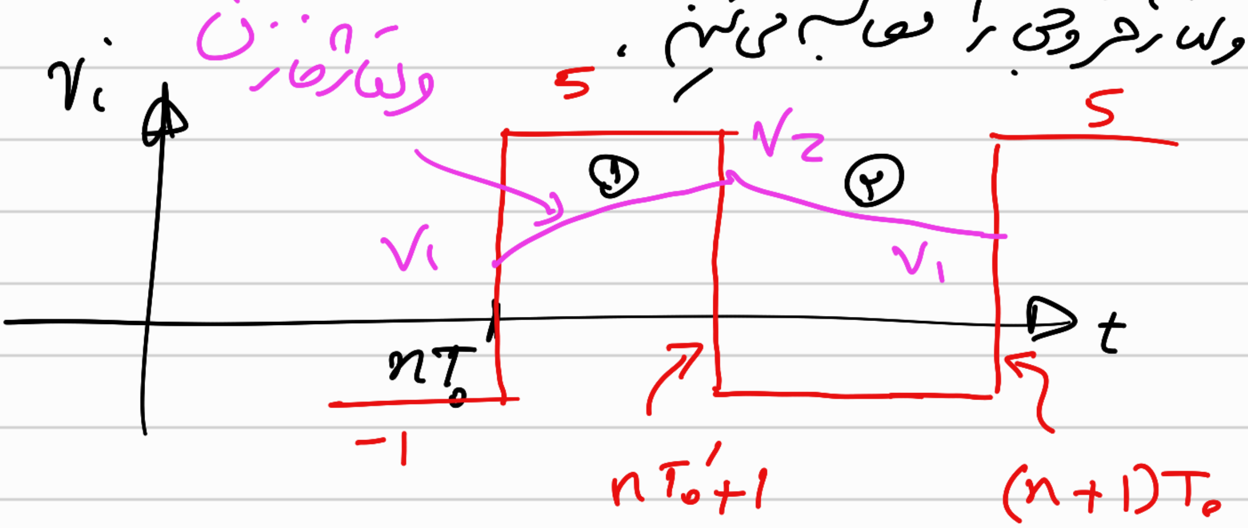
$$V_o(t) = V_o(\infty) + (V_o(0) - V_o(\infty))\, e^{-t/\tau}$$



ولتاژ دو سر خازن یعنی $V_{AB'}$ را در حالت دائمی نوسان بدست می آوریم.

چون می دانیم ولتاژ خازن فرم پیوسته دارد ابتدا آنرا بدست می آوریم

از روی آن ولتاژ خروجی را محاسبه می کنیم.

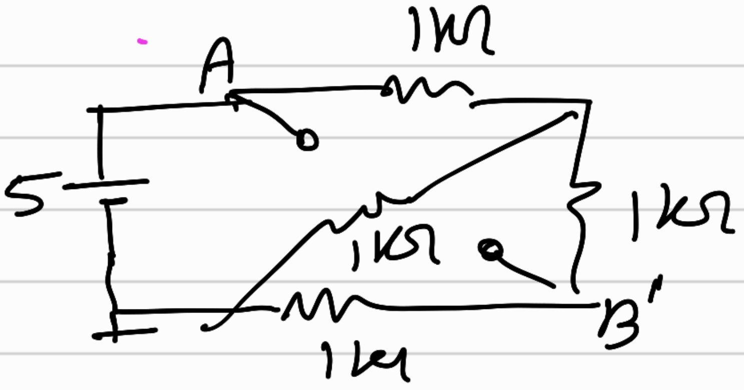


$T_0 = 3\mu sec$

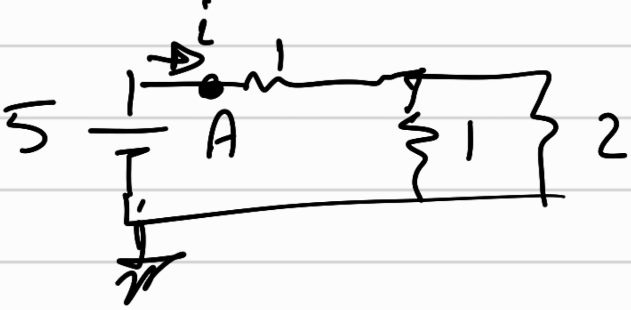
دوره تناوب

① بخش منحنی ولتاژ خازن

$$v_c(t) = V_c(\infty) + \left(V_c(nT_0^+) - V_c(\infty)\right)e^{-\frac{(t-nT_0}{\tau}}$$



در این حالت



$i = \frac{5}{1+2/3} = \frac{15}{5} = 3$ mA

$V_A = 5$ ولت

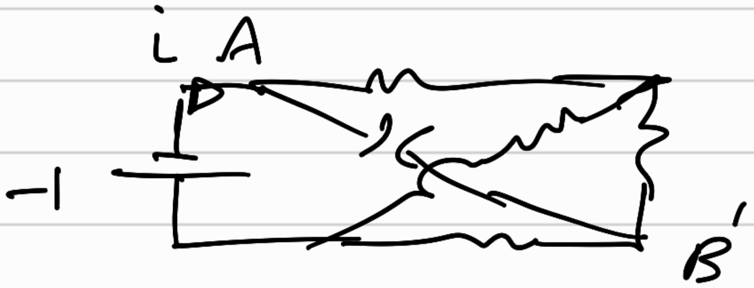
$V_{B'} = 1$ ولت

$\Rightarrow V_C(\infty) = 4$ ولت

$$V_C(t) = 4 + (V_1 - 4)e^{-(t-nT_0)/\tau}$$

$$V_C(nT_0+1) = V_2 = 4 + (V_1 - 4)e^{-1/\tau} \quad ①$$

سرد ②



$i(\infty) = \frac{-1}{1+2/3} = -3/5$ mA

شابه حالت قبل

$V_A = -1$

$V_{B'} = -1/5$

$\Rightarrow V_C(\infty) = -1 + 1/5 = -4/5$ ولت

$$V_C(t) = -4/5 + (V_2 + 4/5)e^{-(t-nT_0)/\tau}$$

$$V_C((n+1)T_0) = V_1 = -4/5 + (V_2 + 4/5)e^{-2/\tau} \quad ②$$

①, ② $V_1 = -4/3 + (4 + (V_1 - 4)e^{-1/\tau} + 4/5)e^{-2/\tau}$

$$V_1 = \frac{-4/5 + 4e^{-2/\tau} - 4e^{-3/\tau} + 4\ e^{-2/\tau}}{1 - e^{-3/\tau}}$$

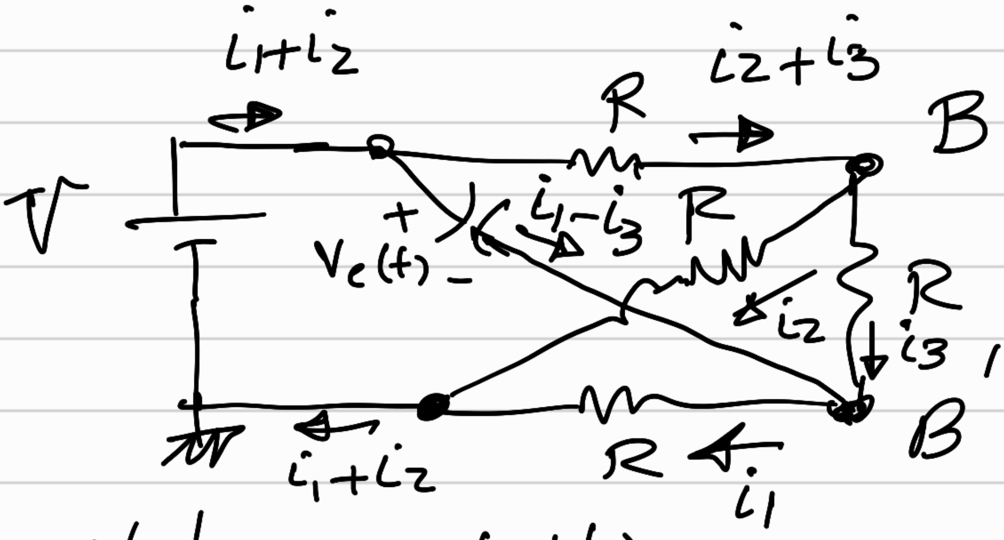
$$V_1 = -0.2416 \Rightarrow V_2 = 4 + (-0.2416 - 4)e^{-\frac{1}{1.2}}$$

$\tau = 1,2$ ① $V_2 = 2.1566$ ولت

① $v_c(t) = 4 + (V_1 - 4)e^{-(t-nT_0)/\tau}$ $nT_0 \le t \le nT_0 + 1$

② $v_c(t) = -4/5 + (V_2 + 4/5)e^{-(t-nT_0)/1.2}$

$nT_0 + 1 \le t \le (n+1)T_0$



$V_B' = V - V_c(t)$

$i_1 = V_B'/R = V_B'/1 = V_B'$

$i_2 = V_B/R = V_B$

$i_3 = \frac{V_B - V_B'}{R} = V_B - V_B' = V_o(t)$

$\Rightarrow i_2 - i_1 = V_o(t)$

$$i_1 = V - V_c(t) \longrightarrow i_2 = V - V_c(t) - V_o(t)$$

$$V_c(t) = R(i_2 + i_3) + R i_3$$

$$V_c(t) = R i_2 + 2R i_3$$

$$V_c(t) = V_o(t) + V - V_c(t) + 2V_o(t)$$

$$V_o(t) = \frac{2V_c(t) - V}{3}$$

①

②

$$\begin{cases} V_o(t) = \dfrac{2V_c(t) - 5}{3} & nT_0 \le t < nT_0 + 1 \\ V_o(t) = \dfrac{2V_c(t) + 1}{3} & nT_0 + 1 \le t \le (n+1)T_0 \end{cases}$$