پاسخ

رضا ادینه پور

۹۸۱۴۳۰۳

تمرین سری تکنیک پالس

4-1

- PRF = ?
- PW = ?
- Duty cycle = ?
- M/S Ratio = ?
- vertical scale = 0.1 v per division
- horizontal scale = 1 ms/division

$$PRF = \frac{1}{T} = \frac{1}{5\,(div) \times 1\,(\frac{ms}{div})} = \frac{1}{5^{ms}} = 0.2 \times 10^{3} = \boxed{200 \text{ PPS}}$$

$$PW = 2\,(div) \times 1\,(\frac{ms}{div}) = 2 \text{ ms}$$

$$D.C = \frac{PW}{T} \times 100\% = \frac{2^{ms}}{5^{ms}} \times 100 = 40\%$$

$$M/S = \frac{PW}{SW} = \frac{2^{ms}}{3\,(div) \times 1\,(\frac{ms}{div})} = \boxed{\frac{2}{3} = 0.6}$$

5-1

الف) زمان صعود: مدت زمانی است که سیگنال از 10% به 90% مقدار دامنه خود می‌رسد

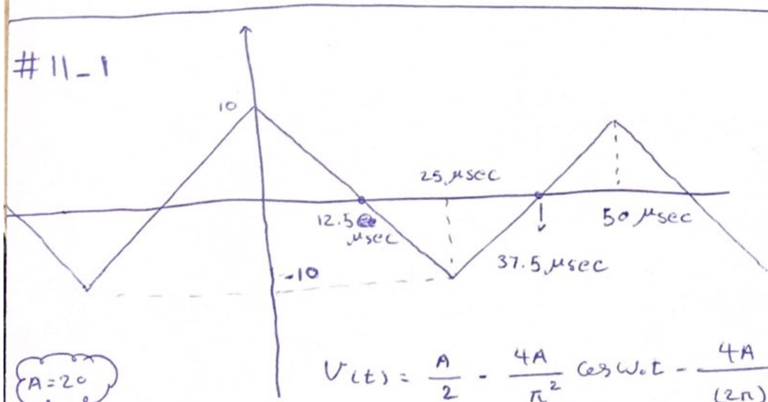
زمان نزول: مدت ״ ״ ״ ״ از 90% به 10% ״ ״ ״

ب) درصد کجی شکل 5-1:

$$\%\,tilt = \frac{\overset{max}{E_1} - \overset{min}{E_2}}{E} = \frac{3 - 2}{2.5} \times 100 = \boxed{40\%}$$

$$E = \frac{E_1 + E_2}{2} = \frac{\left[3\,(div) \times 1\,(\frac{v}{div})\right] + \left[2\,(div) \times 1\,(\frac{v}{div})\right]}{2} = \frac{5}{2} = \boxed{2.5^{v}}$$

11-1



$$T = 50\,\mu sec = 50 \times 10^{-6}\, sec$$

$$\omega_0 = \frac{2\pi}{T} = \frac{2\pi}{50 \times 10^{-6}\, s} = 0.04 \times 10^{6}\pi$$

$$\Rightarrow \boxed{\omega_0 = 4 \times 10^{4}\pi}$$

A = 20

$$V(t) = \frac{A}{2} - \frac{4A}{\pi^2}\cos\omega_0 t - \frac{4A}{(2\pi)^2}\cos(2\omega_0 t) - \frac{4A}{(3\pi)^2}\cos(3\omega_0 t) - \dots$$

$$\Rightarrow V(t) = \frac{20}{2} - \frac{4(20)}{\pi^2}\cos(4 \times 10^4 \pi t) - \frac{20(4)}{4\pi^2}\cos(8 \times 10^4 \pi t) - \frac{80}{9\pi^2}\cos(12 \times 10^4 \pi t) \dots$$

$$\Rightarrow V(t) = 10 - \frac{80}{\pi^2}\cos(4 \times 10^4 \pi t) - \frac{80}{4\pi^2}\cos(8 \times 10^4 \pi t) - \frac{80}{9\pi^2}\cos(12 \times 10^4 \pi t) - \dots$$

با فرض اینکه سیگنال dc صفر شیفت یعنی سیگنال 10v به بالا شیفت خورده است

#15-1

$$\begin{cases} f = 1^{KHZ} \\ t_r = 350^{ns} \\ \text{tilt} = 5\% \end{cases}$$

f_{cH} & $f_{cL} = ?$

$$f_H = \frac{0.35}{t_r} = \frac{0.35}{350^{ns}} = \boxed{1^{MHZ}}$$

$$f_L = \frac{f \times \text{fractional tilt}}{\pi} = \frac{1^{KHZ} \times 0.05}{\pi} = \frac{50}{\pi}$$

$$\simeq \boxed{16\ HZ}$$

#16-1

$$\begin{cases} f_L = 10^{HZ} \\ f_H = 500^{KHZ} \\ f = 5^{KHZ} \end{cases} \Rightarrow t_r = ?\ ,\ \text{tilt} = ?$$

$$t_r = \frac{0.35}{f_H} = \frac{0.35}{500^K} = 0.7^S$$

$$\text{fractional tilt} = \pi \frac{f_L}{f} = \pi \cdot \frac{10}{5^K}$$

$$= 0.00628 = 6.28 \times 10^{-3}$$

#20-1

$$\begin{cases} f_H = 10^{MHZ} \\ a) = t_r = ? \\ b) \text{ if } t_{r_i} = 30^{ns} \longrightarrow t_{r_o} = ? \end{cases}$$

$$a)\ t_r = \frac{0.35}{10^M} = \boxed{35^{ns}}$$

$$b)\ t_{r_o} = \sqrt{(t_{r_i})^2 + \left(\frac{0.35}{f_H}\right)} = \sqrt{(30^{ns})^2 + (35)^{ns\,2}}$$

$$= \boxed{40^{ns}}$$

#7-2

$$\begin{cases} C = 1000^{\mu F} \\ t = 1\ hr \\ V_c(t=0) = 0 \\ V_c(t = 1hr) = 3^V \end{cases}$$

$$V_c(t) = V_c(t = 1^{hr}) + \left[V_c(t=0) - V_c(t = 1hr)\right] e^{\frac{-t}{\tau}}$$

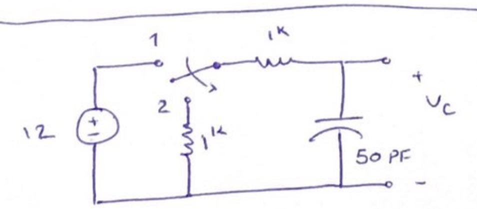
$$\Rightarrow V_c(t) = 3 + [0 - 3]\, e^{\frac{-t}{\tau}}$$

$$= 3\left(1 - e^{-\frac{t}{\tau}}\right)$$

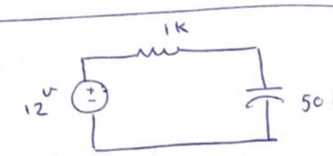
$$\tau = RC \Rightarrow R = \frac{1 \times 60 \times 60}{1000 \mu F} = \boxed{3.6^{M\Omega}}$$

$$\Rightarrow i_c = \frac{V_c(t = 1^{hr}) - V_c(t=0)}{R} = \frac{3}{3.6^{M\Omega}} = \boxed{0.83^{\mu A}}$$

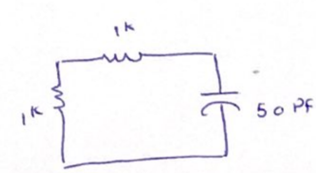
#9-2



for $t < 0$:



(I)

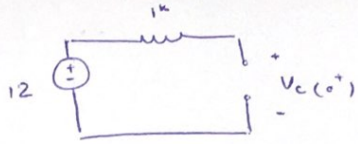


$$V_c(t) = V_c(t = \infty) + \left[V_c(t = 0^+) - V_c(t = \infty)\right] e^{\frac{-t}{RC}}$$

for $t > 0$:

(II)

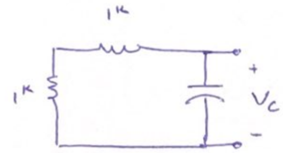
(I) : $V_c(t=\infty) = V_c(0^+)$ $\Rightarrow$



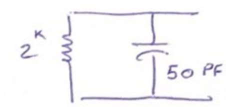
KVL: $-12 + 1^k I + V_c(0^+) = 0$

$\Rightarrow \boxed{V_c(0^+) = 12\ v}$

II)



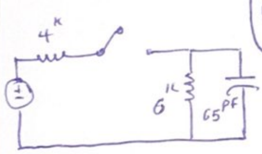
$\Rightarrow \boxed{V_c(t=\infty) = 0}$ $\Rightarrow$



$\tau = RC = 2^k \times 50^{PF} = \boxed{100^{ns}}$

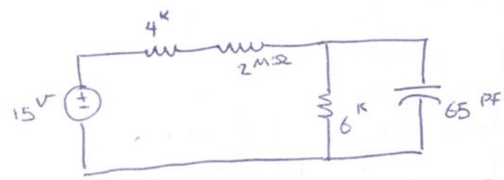
$\Rightarrow V_c(t) = 0 + [12 - 0]\, e^{\frac{-t}{100}} = \boxed{12 e^{\frac{-t}{100}}}$ $\Rightarrow 12 e^{\frac{-t}{100}} = 6 \Rightarrow \boxed{t = 69.3^{ns}}$

~~10~~ 10-2



$\begin{cases} R_{b\text{-}ON} = 100\,\Omega \\ R_{b\text{-}off} = 2^{M\Omega} \\ R_L = 6^{K\Omega} \\ C_L = 65\ PF \end{cases}$

a) if button is open:



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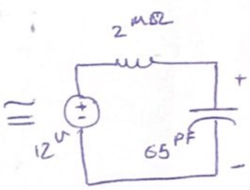
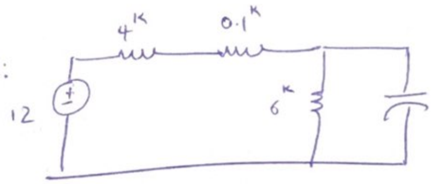


if Button is closed:



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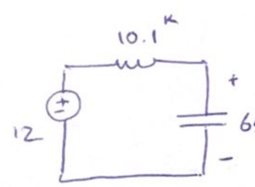


KVL: $-12 + 10.1^k I + V_c(\infty) = 0$

$\boxed{V_c(\infty) = 12}$

b) کلید باید بسته شود

c) $tr = ?$ $V_c(t) = \underbrace{V_c(\infty)}_{=12V} + [\underbrace{V_c(0^+)}_{=0} - V_c(\infty)]\, e^{\frac{-t}{RC}} = 12\left(1 - e^{\frac{-t}{656.5^{ns}}}\right)$

$0.1 \times 12 = 12\left(1 - e^{\frac{-t_1}{656.5}}\right) \longrightarrow t_1 = 69.1^{ns}$

$0.9 \times 12 = 12\left(1 - e^{\frac{-t_2}{656.5}}\right) \longrightarrow t_2 = 1511.6^{ns}$

$\Rightarrow \boxed{tr = t_2 - t_1 = 1442.5^{ns}}$

15_2

$$\begin{cases} f = 5^{HZ} \\ tilt = 6\% \end{cases}$$

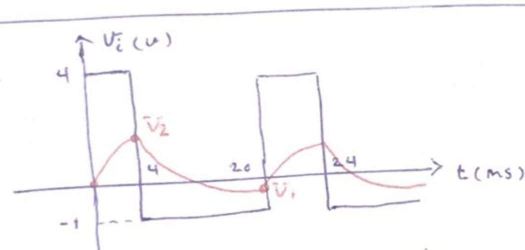
$$tilt = \frac{E_{max} - E_{min}}{0.5(E_{max} + E_{min})} = \frac{6}{100} \quad (I)$$

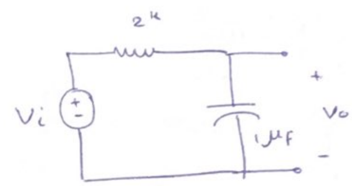
$$\Rightarrow \frac{2(E_{max} - E_{min})}{E_{max} + E_{min}} = \frac{6}{100} \Rightarrow 22\, E_{max} = 28\, E_{min}$$

$$\Rightarrow \boxed{E_{min} = \frac{22}{28} E_{max} \quad (II)} \xrightarrow{(II)\ in\ (I)} \frac{E_{max} - \frac{22}{28}E_{max}}{0.5(E_{max} + \frac{22}{28}E_{max})} = \frac{6}{100}$$

$$\Rightarrow \cancel{E_{max} =} \frac{E_{max}(1 - \frac{22}{28})}{E_{max}(0.5 + \frac{22}{28})} \overset{?}{=} \frac{6}{10} \quad ??? \quad \times$$

21_2





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

$$V_o(t) = 4 + [0 - 4]\, e^{-\frac{t}{\tau}} = 4(1 - e^{-\frac{t}{\tau}}) \qquad 0 < t < 4 = PW$$

$$V_{out} = -1 + [V_2 + 1]\, e^{-\frac{(t-4)}{\tau}} \quad (I) \qquad 4 < t < 20 = T$$

$$V_2 = \frac{4(1 - e^{-\frac{4}{\tau}}) - 1(e^{-\frac{4}{\tau}} - e^{-\frac{20}{\tau}})}{1 - e^{-\frac{20}{\tau}}} \simeq 3.32^v$$

$$\boxed{\tau = RC = 2^k \times 1^{\mu F} = 2^{ms}} \quad \xrightarrow[t=27]{(I)} \quad V_{out} = -1 + [3.32 + 1]\, e^{-(\frac{27-4}{2})} \simeq -0.99$$

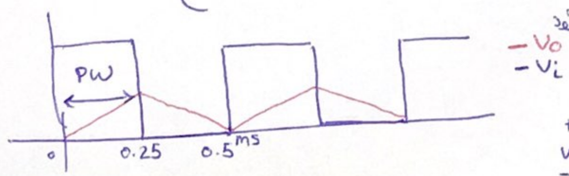
25_2

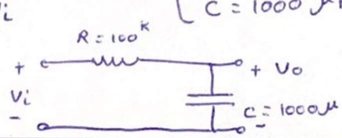
$$\begin{cases} f = 2^{KHZ} \Rightarrow T = 0.5^{ms} \\ D.C = 50\% \end{cases}$$

شرط انتگرال گیر بودن مدار RC : $\tau \gg PW$

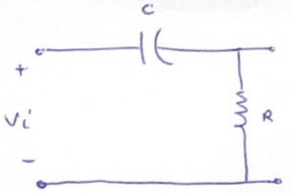
$$DC = \frac{PW}{T} \Rightarrow \frac{5}{10} = \frac{PW}{0.5^m} \Rightarrow \boxed{PW = 0.25^{ms}}$$

فرض می‌شود : $\begin{cases} R = 100^{K\Omega} \\ C = 1000\,\mu F \end{cases} \Rightarrow RC = 1000 \times 10^{-6} \times 100 \times 10^{3} = \underline{100\,S} \gg PW$

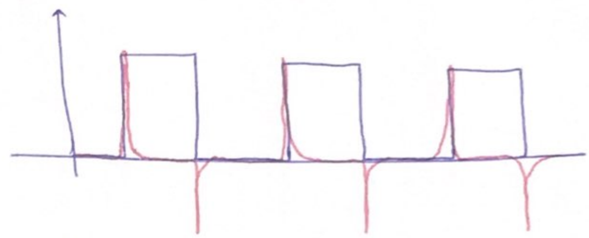




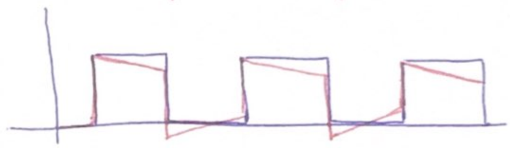
#30_2



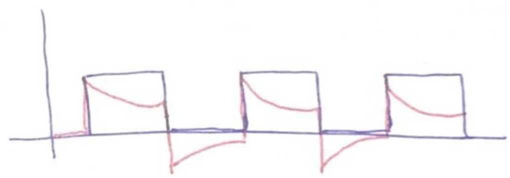
a) $\tau \approx 0.1 . PW$:



b) $\tau \simeq 10\ PW$



c) $\tau \simeq PW$



35_2

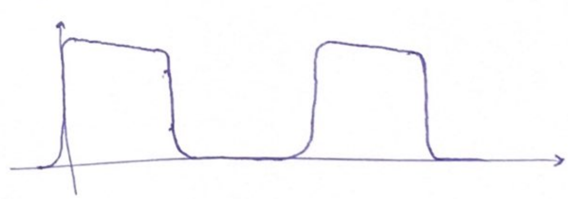
$$\begin{cases} t_r = 500^{ns} \\ t_f = 1^{\mu s} \\ PA = 12^{V} \\ PW = 10^{\mu s} \\ C = 200\ PF\ ,\ R = 470\ \Omega \end{cases}$$

$$t_{ro} = \sqrt{(t_{ri})^2 + \left(\frac{0.35}{f_c}\right)^2} = \sqrt{(500^{n})^2 + \left(\frac{0.35}{1600^{k}}\right)^2} = \cancel{509}\ 0.55^{\mu s}$$

$$f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi \times 470 \times 200^{PF}} = 1600^{KHZ}$$

$$\%\ tilt = 2\pi f_c\ PW = 2\pi \times 1600^{KHZ} \times 10^{\mu s} \times 100\%$$

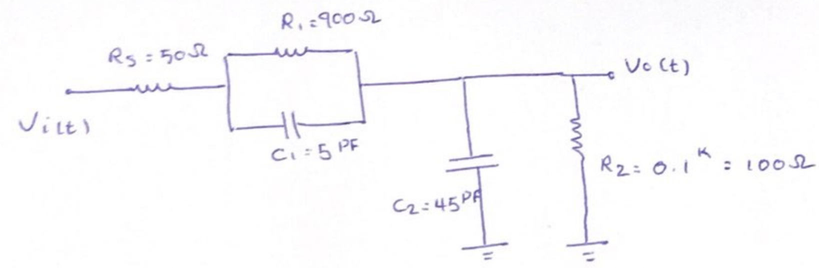
$$= 10048$$

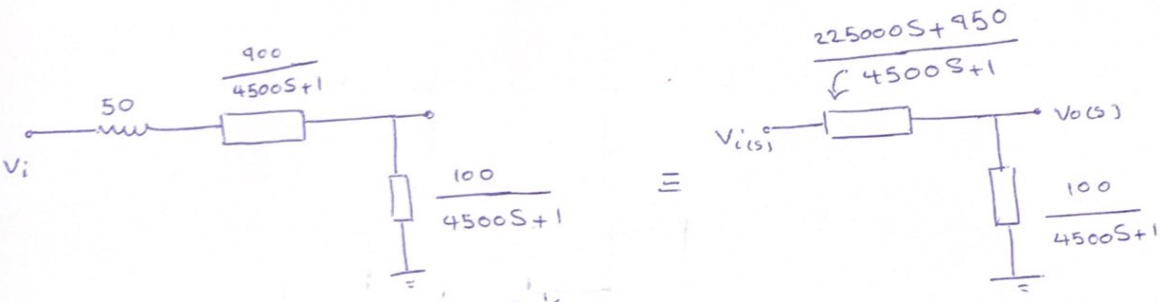


$$tilt = \frac{E_{max} - E_{min}}{0.5\,(E_{max} + E_{min})} \times 100\%$$

$$\Rightarrow 10048 = \frac{12 - E_{min}}{0.5\,(E_{min} + 12)} \times 100$$

38_2





$$V_o(s) = \frac{\frac{100}{4500S+1}}{\frac{100}{4500S+1} + \frac{225000S+950}{4500S+1}} \times \overbrace{V_i(s)}^{=1/S} = \frac{2}{3S(1500S+7)} = \frac{2}{4500S^2+21S}$$

$$L^{-1}\{V_o(s)\} = V_o(t) = \frac{2}{21}\delta(t) - \frac{2}{21}e^{\frac{-7t}{1500}}$$