Date

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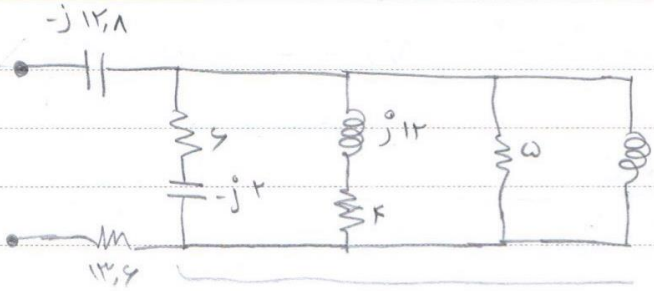


$$\frac{1}{Z_1} = \frac{1}{15j} + \frac{1}{5} + \frac{1}{4+j12} + \frac{1}{6-j2} = \frac{-j}{15} + \frac{1}{5} + \frac{4-j12}{160} + \frac{6+j2}{40}$$

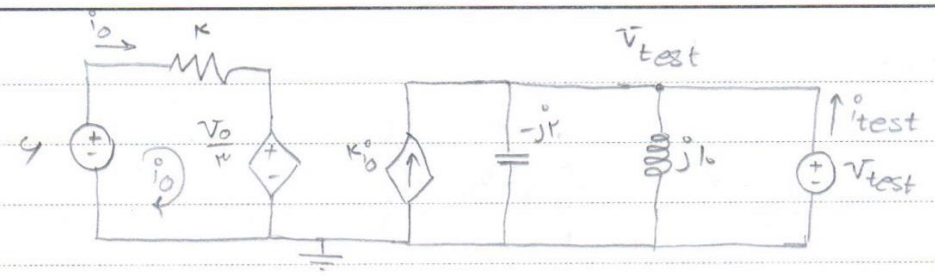
$$= \frac{-j16 + 32 + 4 - j12 + 24 + j8}{160} = \frac{60 - j20}{160} = \frac{3-j}{8}$$

$$\Rightarrow Z_1 = \frac{8}{3-j} = \frac{24+8j}{10} = 2,4 + 0,8j$$

$$\rightsquigarrow Z_{eq} = 13,6 + 2,4 + 0,8j - 12,8j = 16 - 12j$$

$$\Rightarrow Y_{ab} = \frac{1}{16-12j} = \frac{16+12j}{400} = 0,04 + 0,03j$$

Date



$$KCL_{test}: \quad -۲\dot{i}_0 + j\frac{\dot{V}_{test}}{۲} - j\frac{\dot{V}_{test}}{۱۰} - \dot{i}_{test} = ۰$$

$$KVL_0: \quad -۶ + ۴\dot{i}_0 + \frac{\dot{V}_{test}}{۲} = ۰ \Rightarrow -۴\dot{i}_0 = \frac{\dot{V}_{test}}{۲} - ۶$$

$$\Rightarrow \frac{\dot{V}_{test}}{۲} - ۶ + j\frac{۲\dot{V}_{test}}{۵} - \dot{i}_{test} = ۰$$

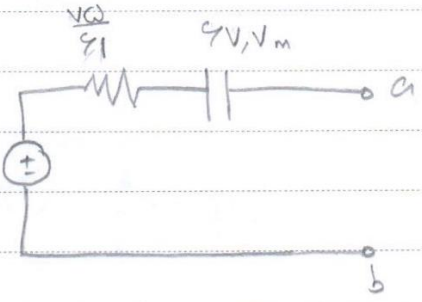
$$\Rightarrow \frac{۵ + j۶}{۱۵}\dot{V}_{test} = \dot{i}_{test} + ۶$$

$$\Rightarrow \dot{V}_{test} = \frac{۱۵(۵ - j۶)}{۶۱}\dot{i}_{test} + \frac{۹۰(۵ - j۶)}{۶۱}$$

$$\frac{-j \times ۶ \times ۵}{۶۱} = \frac{۱}{j \times C \times ۵} \Rightarrow C = ۲$$

مدار معادل تونن:

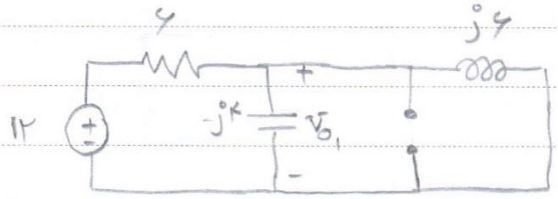
$$\frac{۹۰}{\sqrt{۶۱}}\sin(۵t - ۰/۸۷V)$$



Date

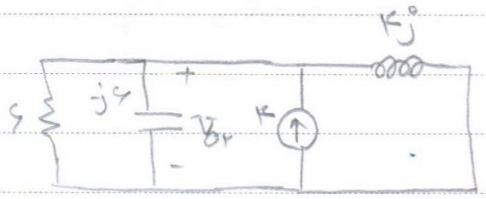
۶ـ

در حضور منبع ولتاژ سینوسی:



$$\bar{V}_{o_1} = \frac{-12j}{6-12j} \times 12 = \frac{2}{2+j} \times 12 = \frac{2-j}{5} \times 24 \xrightarrow{\text{حوزه زمان}} V_{o_1} = 24\frac{\sqrt{5}}{5}\cos(2t - 0.46)$$

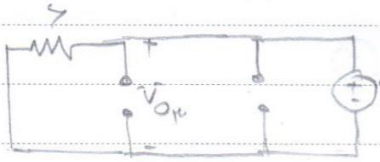
در حضور منبع جریان سینوسی:



$$KCL: \frac{V_{o_2}}{6} + j\frac{V_{o_2}}{6} - 4 - j\frac{V_{o_2}}{4} = 0 \Rightarrow \frac{2-j}{12}V_o = 4 \Rightarrow V_{o_2} = \frac{48}{2-j}$$

$$\Rightarrow V_{o_2} = \frac{4+j}{5} \times 48 \xrightarrow{\text{حوزه زمان}} V_{o_2} = 48\frac{\sqrt{5}}{5}\sin(2t + 0.46)$$

در حضور منبع ولتاژ DC:

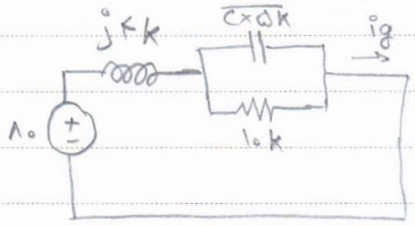


$$V_{o_3} = 20$$

$$\Rightarrow V_o = V_{o_1} + V_{o_2} + V_{o_3}$$

Date

۷ـ الف) قسمت موهومی امپدانس معادل مدار باید برابر صفر باشد. $\frac{-j}{C\times\omega k}$



$$Z_{eq} = j^{\circ}4k + \frac{\frac{-2j^{\circ}}{C}}{\frac{-j^{\circ}}{C\times\omega k} + 10k}$$

$$= j^{\circ}4k + \frac{\frac{-2j^{\circ}}{C}}{\frac{-j^{\circ} + C\times\omega.M}{C\times\omega k}} = j^{\circ}4k + \frac{-j^{\circ}\times 10k}{C\times\omega_0 M - j^{\circ}}$$

$$= j^{\circ}4k - \frac{j^{\circ}\times 10k\,(C\times\omega.M + j)}{(C\times\omega_0 M)^2 + 1} \xrightarrow{Im(Z_{eq})} 4k - \frac{C\times\omega\times 10^{11}}{C^2\times 25\omega\times 10^{14} + 1} = 0$$

$$\Rightarrow 10^{19}\times C^2 - \omega\times 10^{11} C + 4\times 10^{3} = 0 \Rightarrow C^2 - \omega\times 10^{-7} C + 4\times 10^{-19} = 0$$

$$\Rightarrow \begin{cases} C_1 \simeq 5\times 10^{-7} \\ C_2 \simeq 8\times 10^{-10} \end{cases}$$

ب) if $C = C_1 \Rightarrow Z_{eq} = \frac{10\,k}{25\omega^2 + 1} = 14{,}032 \Rightarrow i_g = 4{,}99$

حوزه زمان $\Rightarrow i_g = 4{,}99\cos 5000\,t$

if $C = C_2 \Rightarrow Z_{eq} = \frac{10\,k}{14\times 10^{-4} + 1} = 9{,}983\times 10^{3} \Rightarrow i_g = 8{,}012\,m$

حوزه زمان $\Rightarrow i_g = 8{,}012\times 10^{-3}\cos 5000\,t$