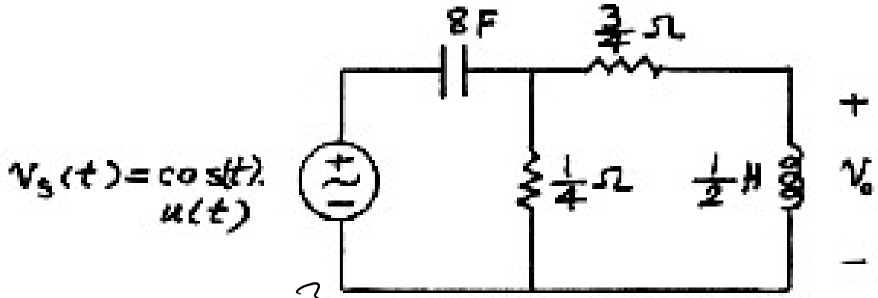
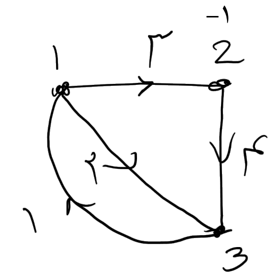
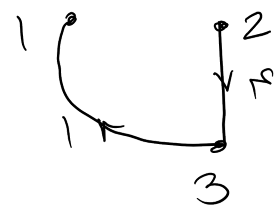
پاسخ امتحان میان ترم مدار ۲   ۱۴۰۳/۱/۲۵

۱-



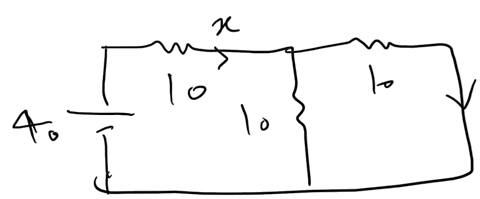




ترتیب شاخه ها : ۱۲۳۴

$$B=\begin{bmatrix}1 & 1 & 0 & 0\\ 1 & 0 & 1 & 1\end{bmatrix},\quad Q=\begin{bmatrix}1 & -1 & -1 & 0\\ 0 & 0 & -1 & 1\end{bmatrix}$$

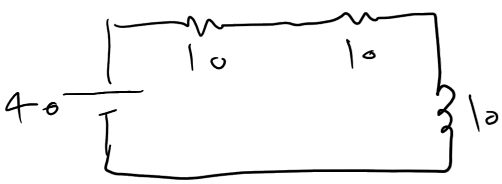
۲- در $t<0$ مدار به حالت نهایی خود رسیده است و داریم :



$$\rightarrow x=\frac{40}{10+10\|10}=\frac{40}{15}=\frac{8}{3}$$

$$i_L(0^-)=x\,\frac{10}{10+10}=\frac{4}{3}$$

در $t>0$ شکل مدار چنین است :

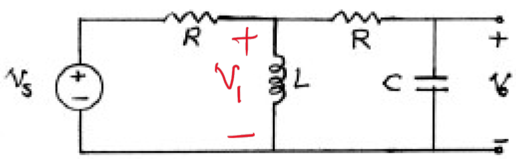


$$\frac{40}{s}=20\,I_L+10s\,I_L-10\,i_L(0^-)$$

$$\frac{40}{s}+\frac{40}{3}=(20+10s)\,I_L$$

$$I_L(s)=\frac{12+4s}{3s(s+2)}=\frac{A}{s}+\frac{B}{s+2}\ ,\ A=\lim_{s\to 0}\frac{12+4s}{6s+6}=2\ ,\ B=\lim_{s\to -2}\frac{12+4s}{6s+6}=-\frac{2}{3}\rightarrow i_L(t)=2-\frac{2}{3}e^{-2t}$$

۳-



$$\frac{V_o}{V_1}=\frac{\frac{1}{Cs}}{R+\frac{1}{Cs}}=\frac{1}{1+RCs}\ ,\ \frac{V_1}{V_s}=\frac{Z}{Z+R}\qquad Z=Ls\,\|\,(R+\frac{1}{Cs})=\frac{Ls(R+\frac{1}{Cs})}{Ls+R+\frac{1}{Cs}}=\frac{Ls(1+RCs)}{LCs^2+RCs+1}\rightarrow$$

$$H(s)=\frac{V_o}{V_s}=\frac{V_o}{V_1}\frac{V_1}{V_s}=\frac{Ls}{2RLCs^2+(R^2C+L)s+R}\rightarrow H(j\omega)=\frac{jL\omega}{-2RLC\omega^2+j(R^2C+L)\omega+R}\rightarrow$$

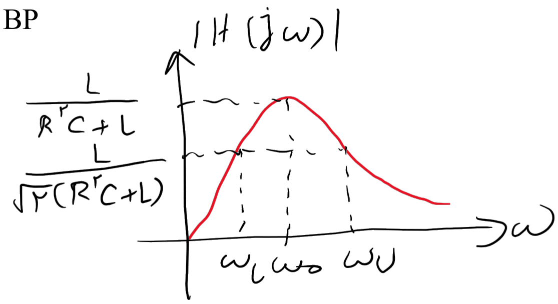
$$|H(j\omega)|=\frac{L\omega}{\sqrt{(R-2RLC\omega^2)^2+(R^2C+L)^2\omega^2}}\ ,\ u=(R-2RLC\omega^2)^2+(R^2C+L)^2\omega^2\rightarrow$$

$$|H(j\omega)|'=L\frac{\sqrt{u}-0.5\frac{u'}{\sqrt{u}}\omega}{u}=0\rightarrow u-0.5\omega u'=0\rightarrow$$

$$(R-2RLC\omega^2)^2+(R^2C+L)^2\omega^2-0.5\omega[-4RLC\omega 2(R-2RLC\omega^2)+2(R^2C+L)^2\omega]=0\rightarrow$$

$$(R-2RLC\omega^2)=0\ ,\ (R-2RLC\omega^2)+4RLC\omega^2=0$$

$$\omega_0=\frac{1}{\sqrt{2LC}}\rightarrow|H(j\omega)|=\frac{L}{R^2C+L}\ ,\ |H(j0)|=|H(j\infty)|=0\rightarrow BP$$



$$|H(j\omega)|=\frac{L\omega}{\sqrt{(R-2RLC\omega^2)^2+(R^2C+L)^2\omega^2}}=\frac{L}{(R^2C+L)\sqrt{2}}\rightarrow(R-2RLC\omega^2)=\pm(R^2C+L)\omega\rightarrow$$

$$2RLC\omega^2-(R^2C+L)\omega-1=0\rightarrow\omega_U,-\omega_L\rightarrow\omega_U+(-\omega_L)=\frac{R^2C+L}{2RLC}=0.2\ \boxed{1}$$

$$\omega_0=\frac{1}{\sqrt{2LC}}=3\rightarrow\boxed{2}$$