(1) $\quad v_{1}=L \frac{d_{i}}{d t} \quad v_{2}=R_{i 2} \quad i_{3}=C \frac{d v}{d t}$
(2) $E_{L}=\frac{1}{2} L i_{1}^{2}$

$$
E_{c}=\frac{1}{2} C v_{3}^{2}
$$

(3) $\quad \mathbb{Z}_{L}=j \omega L \quad \mathbb{Z}_{R}=R \quad \mathbb{Z}_{C}=\frac{1}{j \omega C}$
(4) CURRENT THROUGH INDUCTOR/VATAGE ACROSS CAPACITOR
(s) impedance $\mathbb{Z}$ resistance $R$ reactance $X$
admittance y conductance g suscertance $B$

2
(a)

$$
\begin{aligned}
& 40 \| 80=\frac{40.80}{40+80}=26 \cdot \overline{6} \\
& 26 \cdot \overline{6}+10=36.6 \\
& 36 . \overline{6} 1120=\frac{36.6 \cdot 20}{36.6+20}=12.94 \mathrm{mH}
\end{aligned}
$$

(b)

$$
\begin{aligned}
& 40+80=120 \\
& \frac{120.10}{120+10}=9.231 \\
& 9.231+20=29.23 \mathrm{\mu F}
\end{aligned}
$$

(c) $w=2000 \mathrm{rad} / \mathrm{s}$ :


$$
\begin{aligned}
& \mathbb{Z}_{L A_{2}}=40 \| j 80=\frac{(40)(j 80)}{40+j 80}=35.78 \angle 26.57^{\circ} \\
& \mathbb{Z}_{R L R_{2}}=R_{1}+\mathbb{Z}_{L R_{2}}=44.94 \angle 20.85^{\circ} \\
& \mathbb{Z}^{=}=-j 50 \| 44.94\left(20.85^{\circ}\right. \\
&=\frac{-j 50 \cdot\left(414.94\left(20.85^{\circ}\right)\right.}{-j 50+44.94 \angle 20.85^{\circ}}=41.58<-30.15^{\circ} \\
&=35.96-j 20.88
\end{aligned}
$$

3
$t=0^{-}$

a) $v_{c}\left(0^{-}\right)=R_{1} i_{a}$
b) $i_{c}\left(0^{-}\right)=0$
c) $v_{L}\left(0^{-}\right)=0$
d) ii $\left(0^{-}\right)=-v b / R_{2}$

e)

$$
\begin{aligned}
& v_{c}\left(0^{+}\right)=V_{c}\left(0^{-}\right)=R_{1} i_{a} \\
& k\left(c_{1} n_{1}:-i a+i\left(0^{+}\right)+\frac{v_{1}\left(0^{-}\right)}{R_{1}}+i\left(0^{-}\right)+\frac{v_{c}\left(0^{0}\right)-\left(-v_{b}\right)}{R_{2}}=0\right. \\
& c_{c}\left(0^{+}\right)=i_{a}-\frac{v_{c}\left(0_{1}^{-}\right)}{R_{1}}-i_{1}\left(0^{+}\right)-\frac{v_{c}\left(0^{-}\right)}{R_{2}}-\frac{v_{b}}{R_{2}} \\
& =i_{a}-\frac{R_{1 i a}}{i_{a}}-(-) \frac{v_{b}}{R_{2}}-\frac{R_{i a}}{R_{2}}-\frac{v_{b}}{R_{2}}=-\frac{R_{1 j_{a}}}{R_{2}}
\end{aligned}
$$

f)
g) $k V_{1} s_{21}:-v_{C}\left(0^{-}\right)+v_{L}\left(0^{+}\right)=0 \quad v_{L}\left(0^{+}\right)=v_{C}\left(0^{-}\right)=R_{1} i_{a}$
h) $i i\left(0^{+}\right)=i c\left(0^{-}\right)=-N b / R_{2}$

$$
t \rightarrow \infty
$$


i) $v_{r}(0)=0$ (INDUCTOR SHORTS)
j) $i_{c}(\infty)=0$
k) $v_{L}(\infty)=0$
l) $i_{L}(\infty)=\Gamma_{a}-\frac{N b}{R_{2}}$

4

$$
\begin{array}{r}
5 \frac{d i v}{d t}+2 i_{0}=-12 \\
\hat{\text { nor malize }}
\end{array}
$$



$$
t_{0}=0 \quad i_{0}=20
$$

$$
i(t)=i f+\left(i_{0}-i j\right) e^{-\left(t-t_{0}\right) / \tau}
$$

$$
=-6+26 e^{-t / 2 \cdot s}
$$



5
(1)

(2)


$$
\begin{gathered}
\left(\frac{(j \omega R C+1)(j \omega L)}{}=\frac{(j \omega)^{2} L R C+j \omega L}{(j \omega)^{2} L(+j \omega R C+1}\right. \\
\mathbb{I}_{x}=\frac{\mathbb{I}_{b} \mathbb{Z}_{C q}}{\mathbb{Z}_{R C}}=\frac{\mathbb{I}_{b} \quad \frac{(j \omega)^{2} L R C+j \omega L}{(j \omega)^{2} L C+(j \omega) R C+1} \times \frac{j \omega C}{(j \omega R C+1)}=\frac{\mathbb{I}_{b}(j \omega)^{2} L C}{(j \omega)^{2} L C+j \omega R C+1}}{\mathbb{V}_{R}=R \mathbb{I}_{x}=\frac{\mathbb{I}_{b}(j \omega)^{2} L R C}{(j \omega)^{2} L C+j \omega R C+1} \quad H_{b}=\frac{\mathbb{V}_{R}}{\mathbb{I}_{b}}=\frac{(j \omega)^{2} L R C}{(j \omega)^{2} L C+j L R C+1}}
\end{gathered}
$$

6

(1)

$$
\begin{aligned}
& \mathbb{Z}_{\text {eq }}=j \omega L+R+\frac{1}{j \omega C}=\frac{(j \omega)^{2} L C+j \omega R C+1}{j \omega C} \\
& =j\left(w L-\frac{1}{w} C\right)+R \\
& \text { y\{ } \mathbb{Z}=00 \text { RESSNANT } \\
& \omega L-\frac{1}{\omega C}=0 \quad \omega^{2} L C=1 \quad \omega=\frac{1}{\sqrt{2 C}}
\end{aligned}
$$

(2) YES
(1) $\quad H(j 0)=1 \quad H(j \infty)=0 \quad$ LPG FOR IST ORDER

MAX GAIN $=\left.1 \quad H|P \cdot \quad| H\right|^{2}=\frac{1}{2} \cdot 1$

$$
\frac{2000^{2}}{2000^{2}+\omega^{2}}=\frac{1}{2} \quad w^{2}=2000^{2} \quad w_{H P}=2000 \mathrm{rad}_{\mathrm{s}} \mathrm{~s}
$$

(2) $\begin{array}{cccc}w & V_{\text {in }} & H(j(j w) & \mathbb{V}_{\text {out }}=\mathbb{V}_{\text {in }} H(H(j w) \\ 0 & 5 & \frac{200}{200050}=1 & 5\end{array}$

$$
\begin{array}{ccccc} 
& 500 & 6 \angle 12^{\circ} & \frac{2004}{2000 t, 500}=0.970<-14.04^{\circ} & 5.821 \angle-2.04^{\circ} \\
\Rightarrow 7 \sin \left(5000 t+51 y^{\circ}\right)= & 5000 & 7 \angle 174^{\circ} \quad \frac{2000}{2000-55000}=0.371 \angle-68.20^{\circ} & 2.600<105.8^{\circ} \\
7 \cos \left(5000 t+17 y^{\circ}\right)
\end{array}
$$

(3)


$$
\begin{aligned}
& \frac{\frac{1}{j \omega C}}{R+j K C}=\frac{1}{1+j \omega R C}=\frac{\frac{1}{R C}}{\frac{1}{R C}+j \omega} \\
& \frac{1}{R C}=2000 \\
& C=\frac{1}{2000 \cdot R}=5 \cdot 10^{-7}=500 \mathrm{nF}
\end{aligned}
$$

$$
\frac{R}{j \omega L+R}=\frac{R / L}{R N+j \omega}
$$

$$
R=2000
$$

$$
L=\frac{\pi}{2000}=0.5 \mathrm{H}
$$

(1)

$$
\begin{aligned}
& (2000+j w) V_{\text {out }}=2000 \mathrm{~V} \text { in } \\
& \frac{d v_{\text {out }}}{d t}+2000 N_{\text {out }}=2000 \mathrm{~N}_{\text {in }}
\end{aligned}
$$

