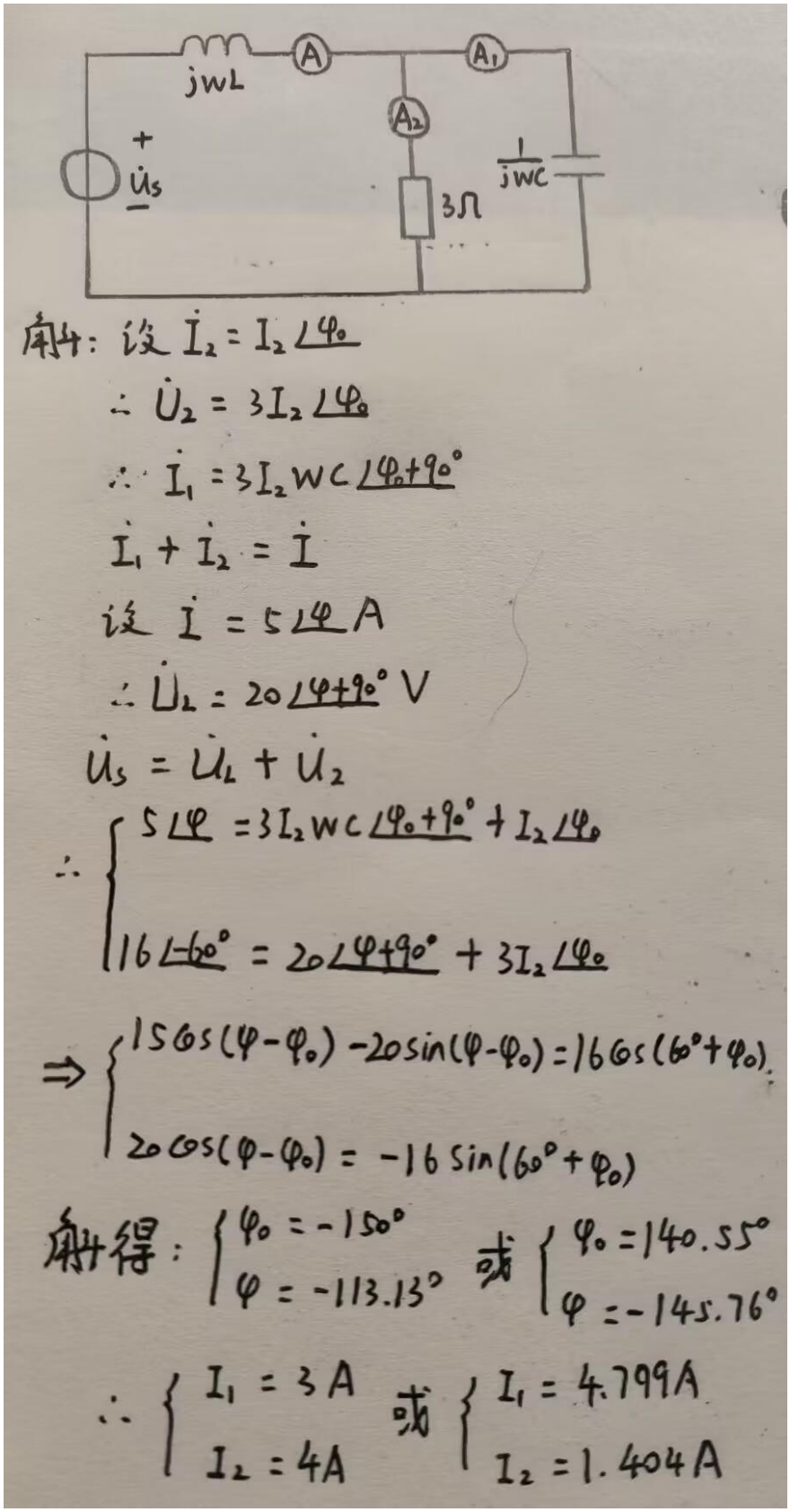
电路作业（八）

9-4



解：设 $\dot{I}_2 = I_2 \angle \varphi_0$

$\therefore \dot{U}_2 = 3I_2 \angle \varphi_0$

$\therefore \dot{I}_1 = 3I_2 wC \angle \varphi_0 + 90°$

$\dot{I}_1 + \dot{I}_2 = \dot{I}$

设 $\dot{I} = 5 \angle \varphi A$

$\therefore \dot{U}_2 = 20 \angle \varphi + 90° V$

$\dot{U}_S = \dot{U}_1 + \dot{U}_2$

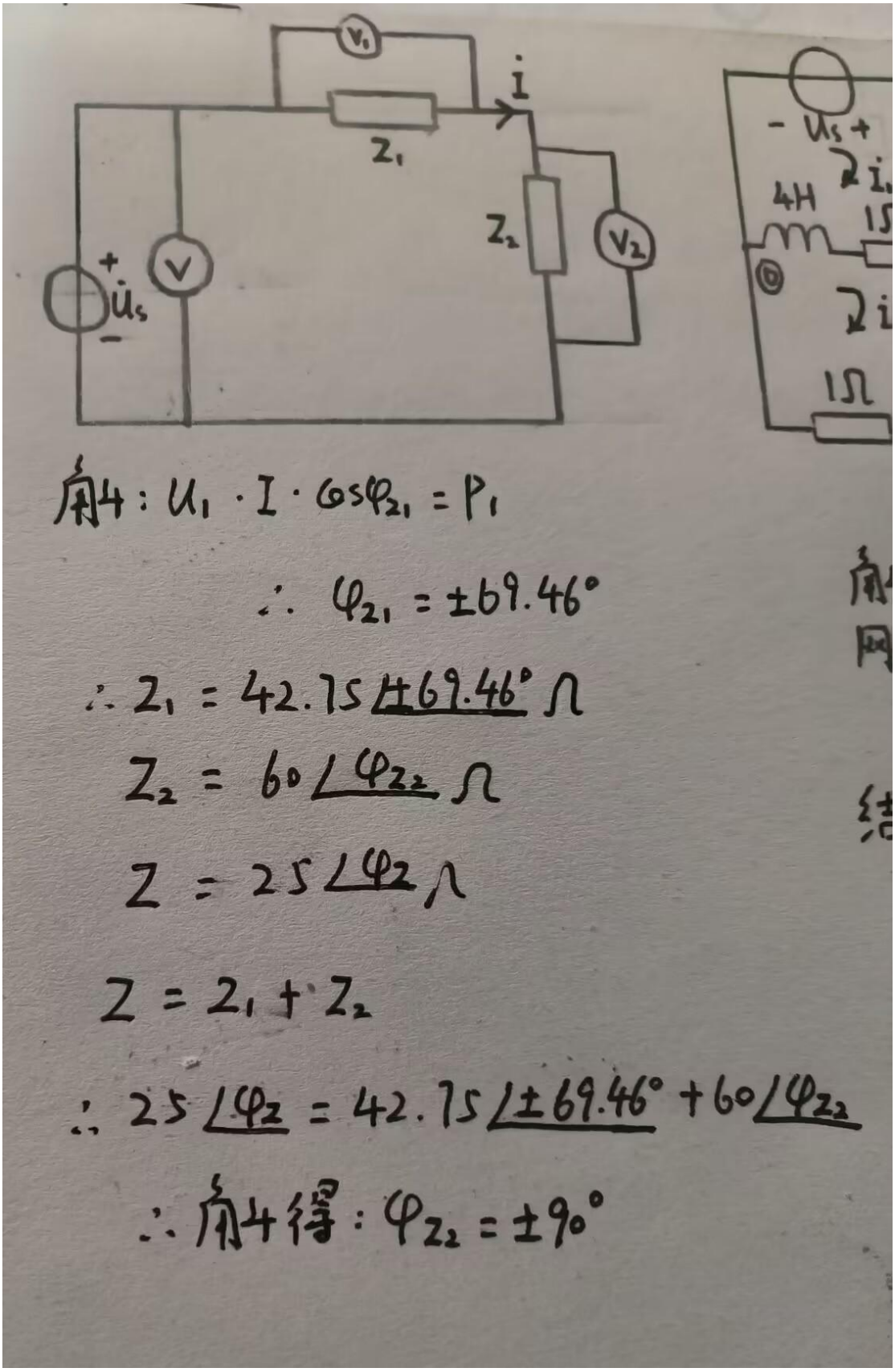
$$\therefore \begin{cases} 5\angle\varphi = 3I_2 wC \angle \varphi_0 + 90° + I_2 \angle \varphi_0 \\ 16\angle -60° = 20\angle \varphi + 90° + 3I_2 \angle \varphi_0 \end{cases}$$

$$\Rightarrow \begin{cases} 15\cos(\varphi - \varphi_0) - 20\sin(\varphi - \varphi_0) = 16\cos(60° + \varphi_0) \\ 20\cos(\varphi - \varphi_0) = -16\sin(60° + \varphi_0) \end{cases}$$

解得：$\begin{cases} \varphi_0 = -150° \\ \varphi = -113.13° \end{cases}$ 或 $\begin{cases} \varphi_0 = 140.55° \\ \varphi = -145.76° \end{cases}$

$$\therefore \begin{cases} I_1 = 3A \\ I_2 = 4A \end{cases} \text{ 或 } \begin{cases} I_1 = 4.799A \\ I_2 = 1.404A \end{cases}$$

9-11



角4：$U_1 \cdot I \cdot \cos\varphi_{z1} = P_1$

$\therefore \varphi_{z1} = \pm 69.46°$

$\therefore Z_1 = 42.75 \angle \pm 69.46° \Omega$

$Z_2 = 60 \angle \varphi_{z2} \Omega$

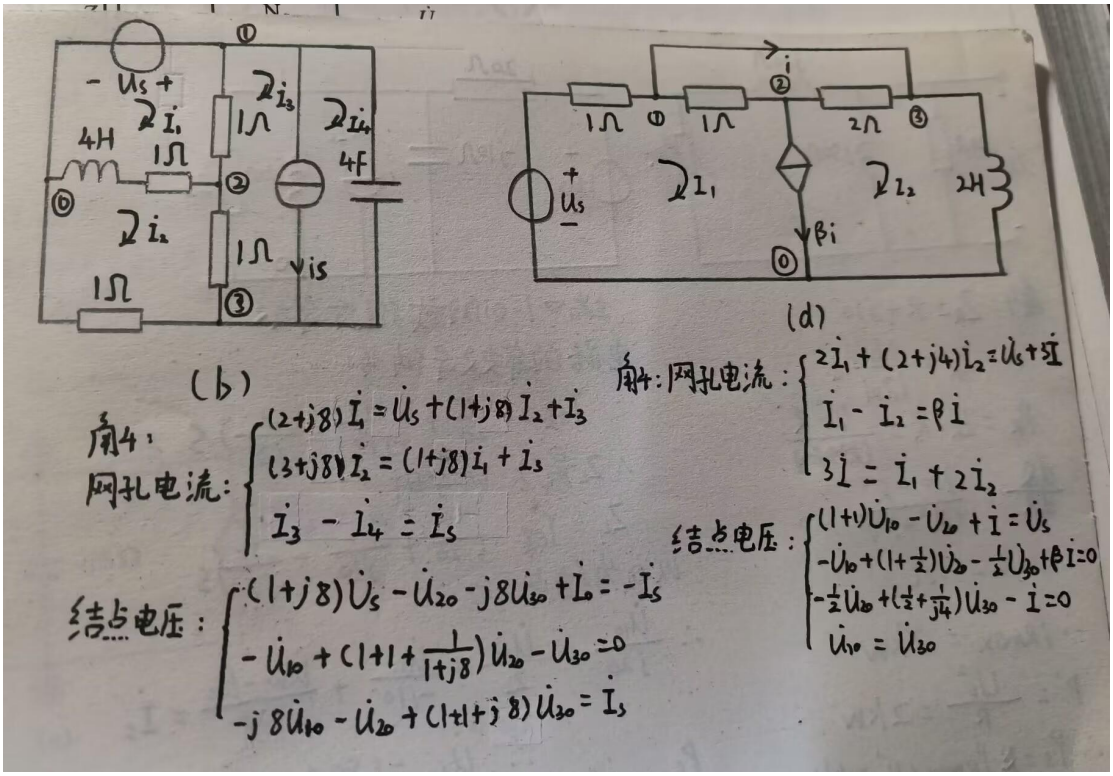
$Z = 25 \angle \varphi_z \Omega$

$Z = Z_1 + Z_2$

$\therefore 25 \angle \varphi_z = 42.75 \angle \pm 69.46° + 60 \angle \varphi_{z2}$

$\therefore$ 角4得：$\varphi_{z2} = \pm 90°$

9-17



(b)

解：网孔电流：
$$\begin{cases}(2+j8)\dot{I}_1=\dot{U}_S+(1+j8)\dot{I}_2+\dot{I}_3\\(3+j8)\dot{I}_2=(1+j8)\dot{I}_1+\dot{I}_3\\\dot{I}_3-\dot{I}_4=\dot{I}_S\end{cases}$$

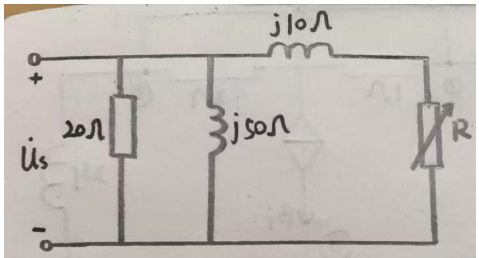
结点电压：
$$\begin{cases}(1+j8)\dot{U}_S-\dot{U}_{20}-j8\dot{U}_{30}+\dot{I}_0=-\dot{I}_S\\-\dot{U}_{10}+(1+1+\frac{1}{1+j8})\dot{U}_{20}-\dot{U}_{30}=0\\-j8\dot{U}_{10}-\dot{U}_{20}+(1+1+j8)\dot{U}_{30}=\dot{I}_S\end{cases}$$

(d)

解：网孔电流：
$$\begin{cases}2\dot{I}_1+(2+j4)\dot{I}_2=\dot{U}_S+5\dot{I}\\\dot{I}_1-\dot{I}_2=\beta\dot{I}\\3\dot{I}=\dot{I}_1+2\dot{I}_2\end{cases}$$

结点电压：
$$\begin{cases}(1+1)\dot{U}_{10}-\dot{U}_{20}+\dot{I}=\dot{U}_S\\-\dot{U}_{10}+(1+\frac{1}{2})\dot{U}_{20}-\frac{1}{2}\dot{U}_{30}+\beta\dot{I}=0\\-\frac{1}{2}\dot{U}_{20}+(\frac{1}{2}+\frac{1}{j4})\dot{U}_{30}-\dot{I}=0\\\dot{U}_{10}=\dot{U}_{30}\end{cases}$$

9-19



解：$Z_R=R+j10$

$$\therefore I_R=\frac{U_R}{|Z_R|}$$

$$P_R=I_R^2\cdot R=\frac{U_S^2R}{R^2+100}$$

$$\frac{dP_R}{dR}=\frac{100-R^2}{(R^2+100)^2}=0$$

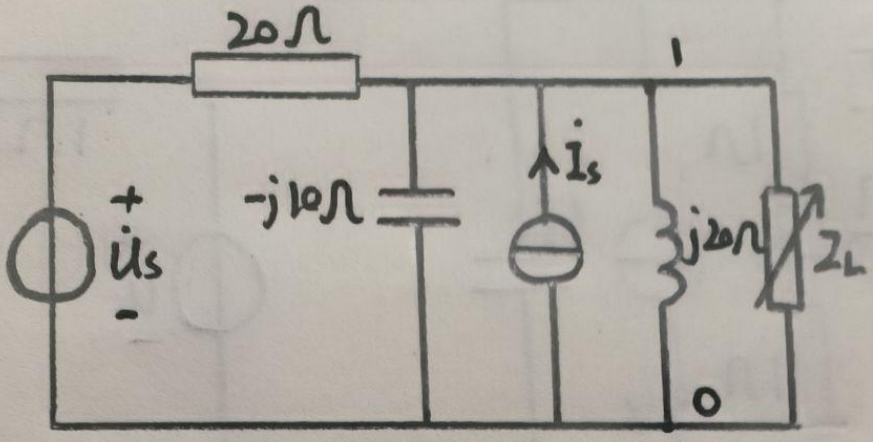
$$\therefore R=10\Omega$$

$$\therefore P_{Rmax}=2kW$$

$$P'=\frac{U_S^2}{R}=2kW$$

$$\therefore P_S=P_{Rmax}+P'=4kW$$

9-27



端口1-0的戴维宁等效

电路的等效导纳为：

$$Y_{eq} = \left(\frac{1}{20} + \frac{1}{-j10} + \frac{1}{j20}\right) S$$

∴ Z_L最大功率时

$$Z_L = Y_{eq}^* = \left(\frac{1}{20} + \frac{1}{j10} - \frac{1}{j20}\right) S$$

以0为结点

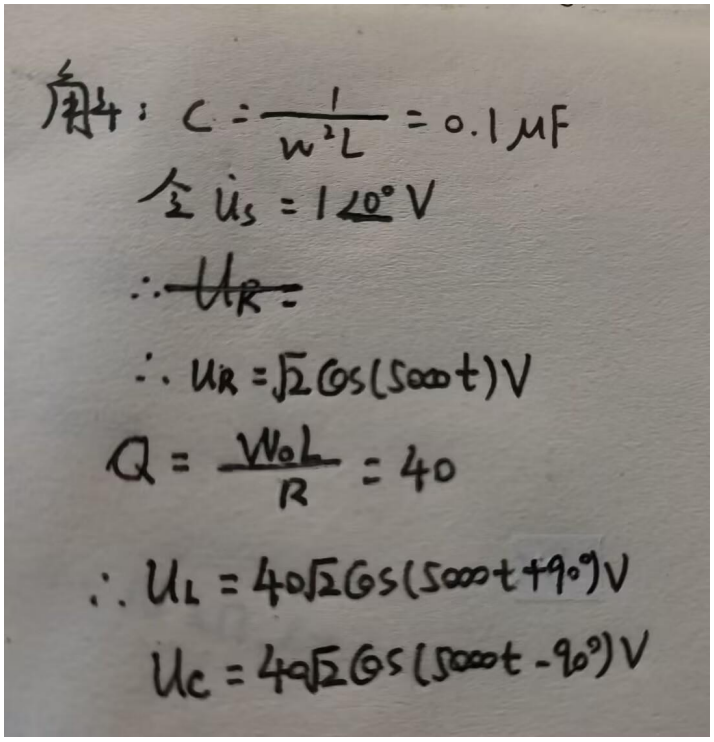
$$\therefore \frac{\dot{U}_{10}}{j20} + \frac{\dot{U}_{10}}{Z_L} + \frac{\dot{U}_{10}}{-j10} + \frac{\dot{U}_{10} - \dot{U}_s}{20} = \dot{I}_s$$

$$\therefore \dot{U}_{10} = (50 + j50) V$$

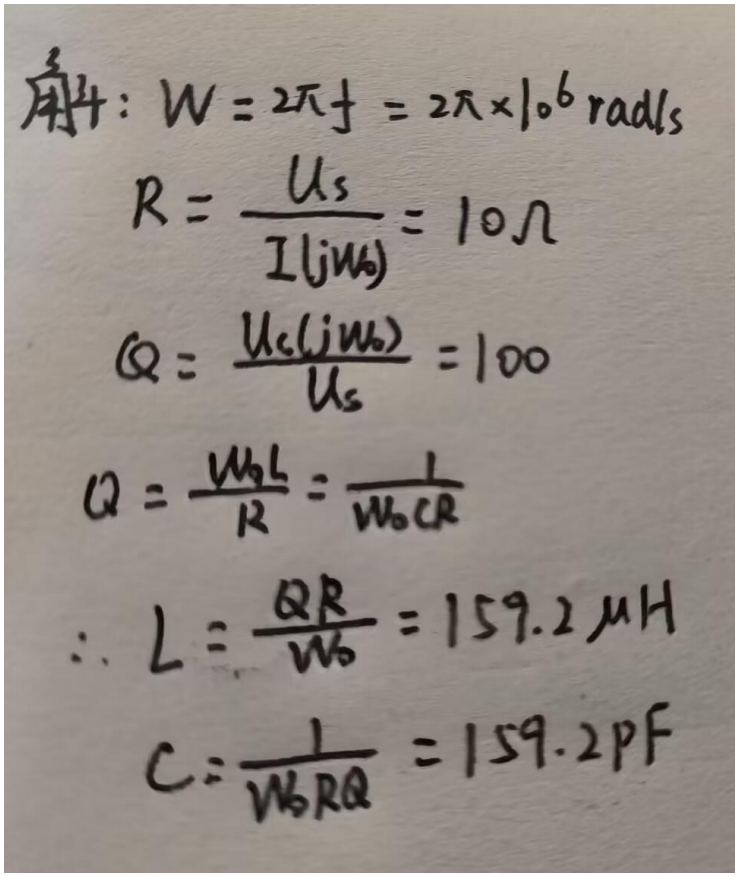
$$\bar{S}_i = \dot{I}_s^* \cdot \dot{U}_{10} = (250 + j250) V \cdot A$$

$$\bar{S}_u = \dot{U}_s \cdot \left(\frac{\dot{U}_{10} - \dot{U}_s}{20}\right)^* = (250 - j250) V \cdot A$$

11-5


解：$C=\frac{1}{\omega^2 L}=0.1\mu F$
$\dot{U}_S=1\angle 0°\ V$
$\therefore U_R=$
$\therefore u_R=\sqrt{2}\cos(5000t)V$
$Q=\frac{\omega_0 L}{R}=40$
$\therefore u_L=40\sqrt{2}\cos(5000t+90°)V$
$u_C=40\sqrt{2}\cos(5000t-90°)V$

11-9


解：$\omega=2\pi f=2\pi\times10^6\ rad/s$
$R=\frac{U_S}{I(j\omega_0)}=10\Omega$
$Q=\frac{U_C(j\omega_0)}{U_S}=100$
$Q=\frac{\omega_0 L}{R}=\frac{1}{\omega_0 CR}$
$\therefore L=\frac{QR}{\omega_0}=159.2\mu H$
$C=\frac{1}{\omega_0 RQ}=159.2pF$