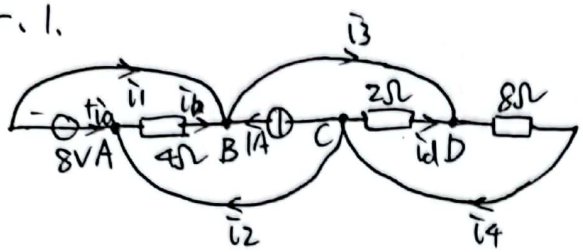
样卷1

一、1.

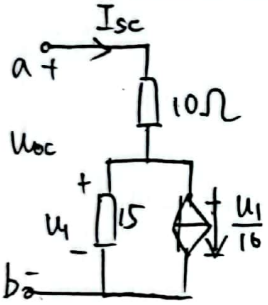


由ABCD结点KCL有：$\begin{cases} i_a + i_2 = i_b \\ i_1 + i_b + 1A = i_3 \\ i_4 = 1 + i_2 + i_d \\ i_3 + i_d = i_4 \end{cases}$

由KVL有：$\begin{cases} 8 - 4i_b = 0 \\ u_A = 2i_d = 4i_b \\ -8i_4 = 8 \quad (\text{参考方向!}) \end{cases} \Rightarrow \begin{cases} i_4 = -1A \\ i_b = 2A \\ i_d = 4A \end{cases}$

$\therefore \boxed{\begin{cases} i_1 = -8A \\ i_2 = -6A \\ i_3 = -5A \\ i_4 = -1A \end{cases}}$

2、



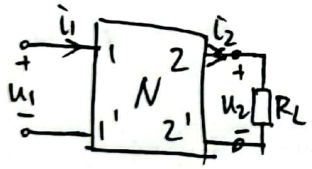
$R_{eq} = \frac{U_{oc}}{I_{sc}}$（等效电阻）.

$\therefore I_{sc} = \frac{u_1}{15} + \frac{u_1}{10} = \frac{u_1}{6}$

$U_{oc} = 10 I_{sc} + u_1 = \frac{8}{3} u_1$

$\therefore R_{eq} = \frac{\frac{8}{3}u_1}{\frac{u_1}{6}} = 16\Omega$

3、



$\therefore \begin{cases} u_1 = 7i_1 - 3i_2 \\ u_2 = 3i_1 - 3i_2 \\ u_2 = i_2 R_L = 2i_2 \end{cases}$

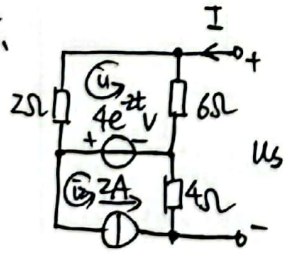
即：$i_2 = \frac{3}{5} i_1$.

$\therefore u_1 = 7i_1 - \frac{9}{5} i_1$

$= 5.2 i_1$

$\therefore R_{in} = \frac{u_1}{i_1} = \underline{5.2\Omega}$.

4、

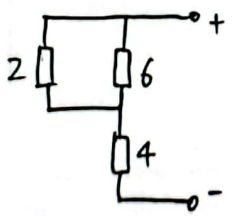


回路1.2有：$\begin{cases} 4e^{-2t} + 8i_1 = 0 \\ i_2 = 2A \end{cases}$.

$\therefore u_s = -6i_1 - 4i_2$

$= (3e^{-2t} - 8)V$.

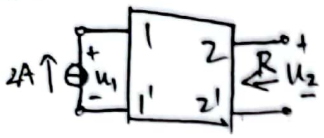
$\downarrow I = 0 \quad u = 0$.



$R_{eq} = 6 // 2 + 4$

$= 5.5\Omega$.

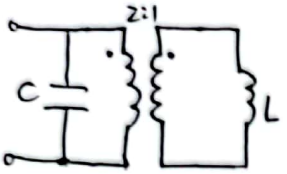
5.



$U = u_2 = 5V$

$R_{eq} = \frac{U_1}{I} = 5\Omega$.

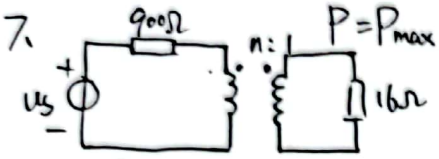
6.



$L_{eq} = 2^2 L = 4L$.

$\therefore f = \frac{1}{2\pi\sqrt{L_{eq}C}} = 1000Hz$

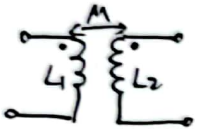
7.



$P = P_{max}$ $R_{00} = n^2 \times 16$.

$\therefore n = \sqrt{\frac{900}{16}} = \frac{15}{2}$. 匝数比为7.5.

8. 电感电压定义: $\begin{cases} \dot{U}_1 = j\omega L_1 \dot{I}_1 + j\omega M \dot{I}_2 \\ \dot{U}_2 = j\omega L_2 \dot{I}_2 + j\omega M \dot{I}_1 = 0 \quad (\dot{U}_2 = 0 \text{ 短路}) \end{cases}$



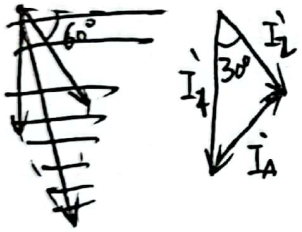
$\therefore \dot{I}_2 = -\frac{3}{4}\dot{I}_1$

$\therefore \dot{U}_1 = j\omega \dot{I}_1 \cdot \frac{15}{4}$ 即: $L_{eq} = 3.75H$

9. $i_1 = I_{1m}\sin\omega t A \longrightarrow \dot{I}_1 = \frac{I_{1m}}{\sqrt{2}} \angle 0°$ $\dot{I}_1 = \dot{I}_2 + \dot{I}_A$

$i_2 = 10\sqrt{2}\sin(\omega t + 30°)A \rightarrow \dot{I}_2 = 10\angle -60°$

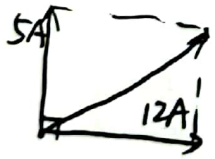
即:



$\therefore I_A = 10A$.

10. C.L 相位相反, 均与R相差90°. 有: $I_A = \sqrt{I_{A_1}^2 + I_{A_2}^2}$

$= 13A$



二、(1) $\begin{cases} U_1 = 10I_1 \\ -\frac{1}{20}U_1 + (\frac{1}{20} + \frac{1}{20})U_2 - \frac{1}{20}U_3 = 1 \\ -\frac{1}{40}U_1 - \frac{1}{20}U_2 + (\frac{1}{40} + \frac{1}{20} + \frac{1}{10})U_3 = \frac{20}{10} \\ U_3 = 20 - 10I_1 \end{cases}$ ① ② ③ ④

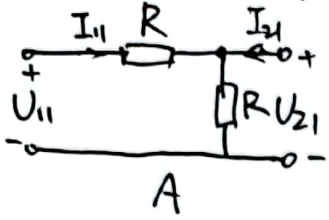
(2) ①④ → $U_3 = 20 - U_1$ ⑤

②③ → $3U_3 - U_1 = 50$ ⑥

⑤⑥ → $\begin{cases} U_1 = 2.5V \\ I_1 = 0.25A \\ U_2 = 20V \\ U_3 = 17.5V \end{cases}$

$\therefore U_A = U_2 + 10 \times 1A = 30V$

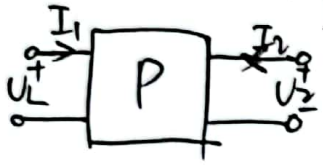
三、该电路由两部分二端口网络级联：



由A电路有：$\begin{cases} U_{11} = 2I_{11} + I_{21} \\ U_{21} = I_{11} + I_{21} \end{cases}$

即：$\begin{cases} U_{11} = 2U_{21} - I_{21} \\ I_{11} = U_{21} - I_{21} \end{cases}$.　即：$T_A = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$

由H矩阵有：$\begin{cases} I_1 = 3U_2 \\ I_2 = 2U_1 - 4U_2 \end{cases}$.



即：$\begin{cases} U_1 = \frac{1}{2}I_2 + 2U_2 \\ I_1 = 3U_2 \end{cases}$.

即：$T_P = \begin{pmatrix} 2 & -\frac{1}{2} \\ 3 & 0 \end{pmatrix}$

∴ 复合二端口矩阵 $T = T_A T_P = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}\begin{pmatrix} 2 & -\frac{1}{2} \\ 3 & 0 \end{pmatrix} = \begin{pmatrix} 7 & -1 \\ 5 & -\frac{1}{2} \end{pmatrix}$.

四、(1) $U_S = \sqrt{12^2 + 15^2 + 16^2} = 25V$

(2) C、L_1并联谐振频率：$w = \sqrt{\frac{1}{LC}} = 10^3\ rad/s$.

~~L_1、L_2串联谐振频率~~

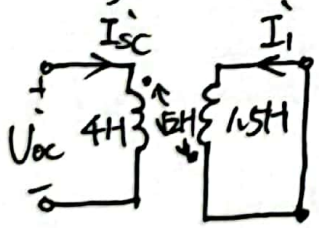
当 $w = 1000\ rad/s$ 时，其无法通过C、L_1系统(发生谐振)

∴ $u_R(t) = 12 + 16\sqrt{2}\cos(2wt)V$

(3) $P = \frac{U_R^2}{R} = 12^2 + (\frac{16\sqrt{2}}{\sqrt{2}})^2 = 400W$

五、$t<0$ 时，$i(0_-) = 0A$

$t>0$ 时，列写回路方程(戴维宁)：



$\begin{cases} \dot{U}_{OC} = -jwM\dot{I}_1 + jwL_1\dot{I}_{SC} \\ 0 = jwL_2\dot{I}_1 + jwM\dot{I}_{SC} \end{cases}$

∴ $L_{eq} = \frac{\dot{U}_{OC}}{jw\dot{I}_{SC}} = \frac{8}{3}H$.

∴ $\tau = \frac{L}{R} = \frac{2}{3}s$

∵ $i(\infty) = \frac{U}{R} = \frac{24}{4}A = 6A$

∴ $i(t) = 6(1 - e^{-1.5t})A$. $(t>0)$