

参考(标准)答案及评分标准

华东交通大学 2017—2018 学年第二学期考试卷

(A) 卷

课程名称: 电路原理I 考试时间: 120 分钟 考试方式: 闭卷

专业: 2017 级电气工程、自动化、建筑电气、电子信息、轨道交通信号。

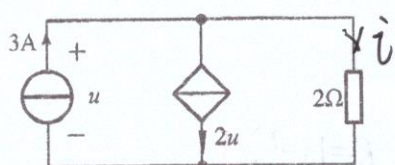
学生姓名: 学号: 教学班级: 教学小班序号:

题号	一	二	三	四	五	六	七	八	九	十	总分
得分											
阅卷人											

一、计算题(每题 4 分, 共 16 分)

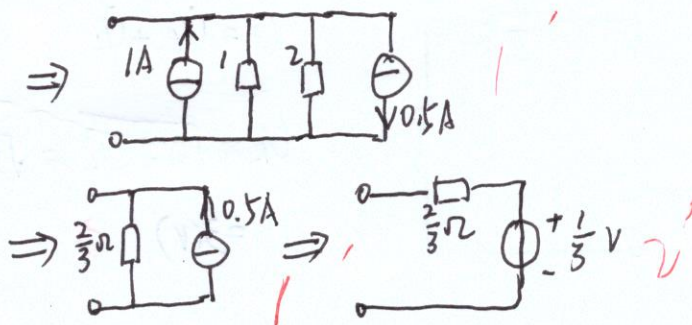
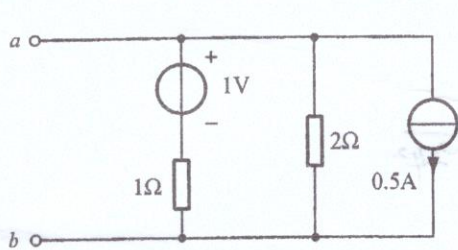
得分

1. 电路如图, 求电流源电压 u 。

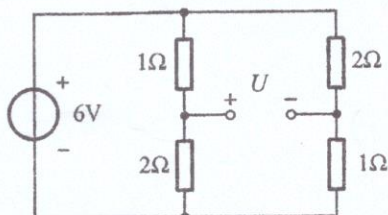


$$\begin{aligned} \text{KCL: } 3 &= 2u + i \\ \text{KVL: } u &= 2i \\ \Rightarrow \begin{cases} i = \frac{3}{5} \text{ A} \\ u = \frac{6}{5} = 1.2 \text{ V} \end{cases} \end{aligned}$$

2. 电路如图所示, 将电路化简为一个电压源与一个电阻相串联的组合。

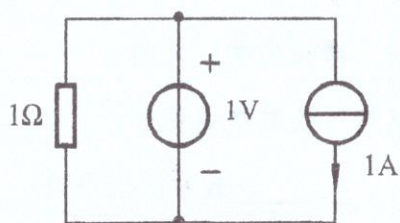


3. 电路如图, 求电压 U 。



$$\begin{aligned} U &= 6 \times \frac{2}{2+1} - 6 \times \frac{1}{2+1} \\ &= 2 \text{ V} \end{aligned}$$

4. 电路如图，求电压源功率（说明是吸收还是发出）。



$$i = \frac{1}{1} = 1A$$

$$\Rightarrow i_s = 1 + 1 = 2A$$

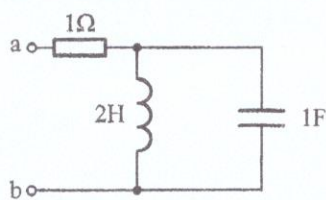
$$P_{U_s} = 1 \times 2 = 2W \text{ (发出)}$$

二、计算题(每题 5 分, 共 25 分)

得分

1. 求图示电路的输入阻抗, 并求该电路的最简串联等效电路及元件参数。

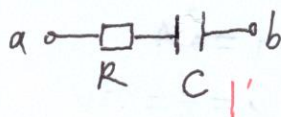
($\omega = 1 \text{ rad/s}$)。



$$Z_{\text{并}} = (j2) \parallel (-j1) = -j2(\Omega)$$

$$Z_{ab} = 1 - j2(\Omega)$$

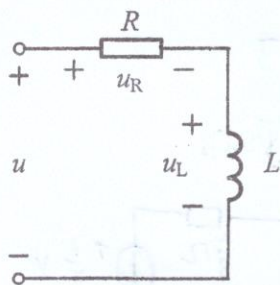
最简串联等效电路为:



$$\text{其中 } R = 1(\Omega)$$

$$C = 0.5(F)$$

2. 在图示电路中, 已知 $U = 5V$, $U_L = 4V$, 求 U_R 。

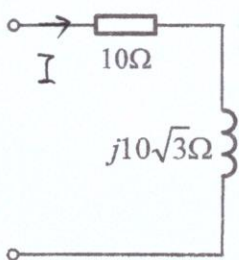


$$\dot{U} = \dot{U}_R + \dot{U}_L$$

$$U_R = \sqrt{U^2 - U_L^2} = \sqrt{5^2 - 4^2}$$

$$= 3(V)$$

3. 图示电路中, 若电路有功功率 $P = 1000W$, 求电路的无功功率 Q 、视在功率 S 。



$$I = \sqrt{\frac{P}{10}} = 10(A)$$

$$Q = I^2 \times 10\sqrt{3} = 1000\sqrt{3} \text{ (Var)}$$

$$S = \sqrt{P^2 + Q^2} = 2000 \text{ (VA)}$$

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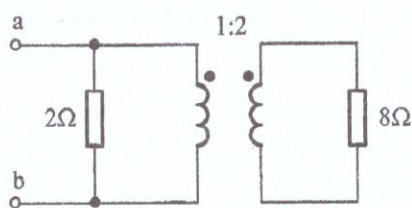
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4. 求 ab 端等效电阻。

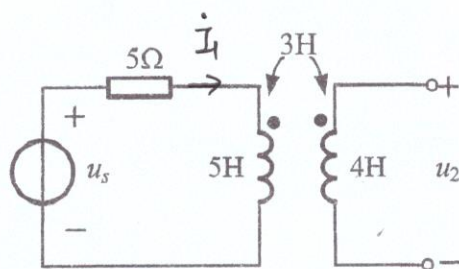


等8Ω电阻等效到左侧。

$$R' = (\frac{1}{2})^2 \times 8 = 2(\Omega) \quad 3'$$

$$\therefore R_{ab} = 2 \parallel 2 = 1(\Omega) \quad 2'$$

5. 电路如图，已知电压 $u_s(t) = 10\cos(t)$ V，求开路电压 $u_2(t)$ 。



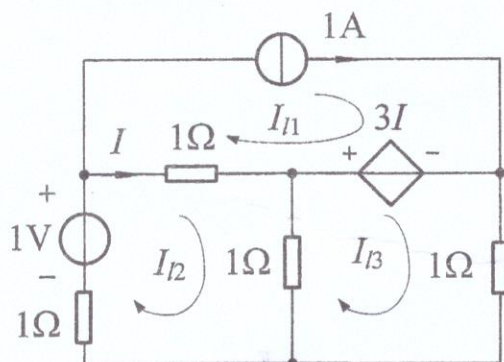
$$\begin{cases} \dot{U}_s = 5\dot{I}_1 + j5\dot{I}_1 & 2' \\ \dot{U}_2 = j3\dot{I}_1 & 2' \end{cases}$$

$$\Rightarrow \dot{U}_2 = 3\angle 45^\circ (V)$$

$$\therefore u_2(t) = 3\sqrt{2}\cos(t+45^\circ) V \quad 1'$$

三. 用回路电流法求图示电路中的电流 I 。(10分)

得分

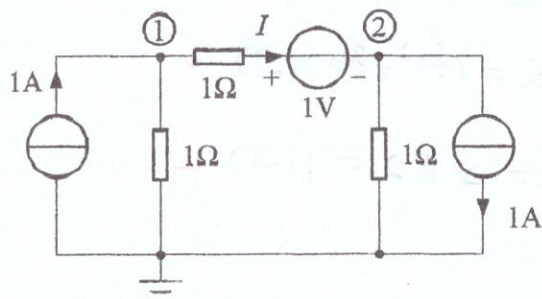


$$\begin{cases} I_{l1} = 1 & 1' \\ -I_{l1} + (1+1+1)I_{l2} - I_{l3} = 1 & 2' \\ -I_{l2} + 2I_{l3} = -3I & 2' \\ I = I_{l2} - I_{l1} & 2' \end{cases}$$

$$\text{解得: } \begin{cases} I_{l2} = \frac{7}{8}A \\ I_{l3} = \frac{5}{8}A \\ I = -\frac{1}{8}A \end{cases} \quad 3'$$

四. 用结点电压法求结点电压 U_{n1} 、 U_{n2} 和电流 I 。(10 分)

得分



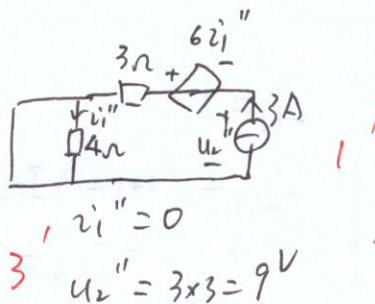
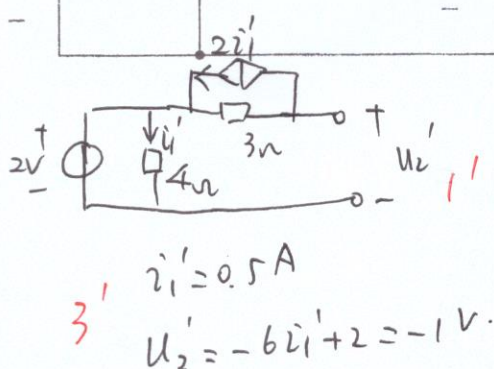
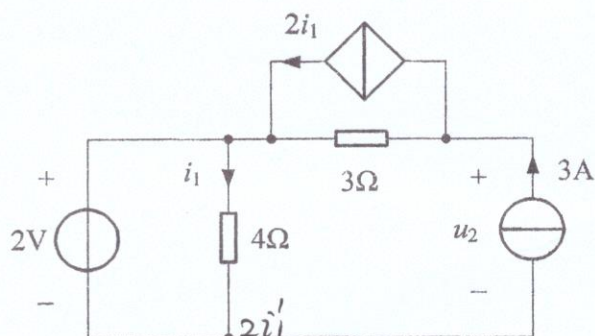
$$\begin{cases} (1+1)U_{n1} - U_{n2} = 1+1 & 3' \\ -U_{n1} + (1+1)U_{n2} = -1 & 3' \\ U_{n1} - U_{n2} = I+1 & 2' \end{cases}$$

解得:

$$\begin{cases} U_{n1} = \frac{2}{3}V \\ U_{n2} = -\frac{2}{3}V & 2' \\ I = \frac{1}{3}A \end{cases}$$

得分

五. 用叠加定理求电压 u_2 。(10 分)



$$u = u' + u'' = -1 + 9 = 8V \quad 2'$$

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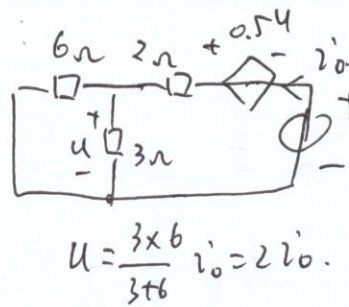
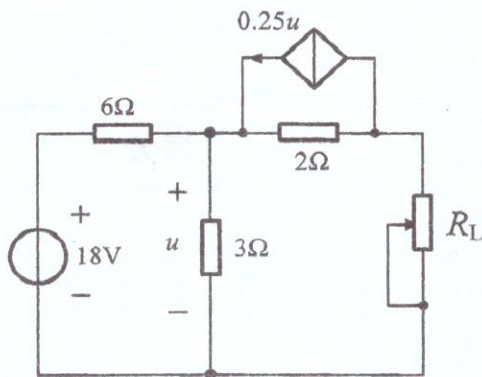
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六. 图中 R_L 可变, 问当 R_L 为多大时可获得最大功率, 并求此最大功率。(12 分)

得分



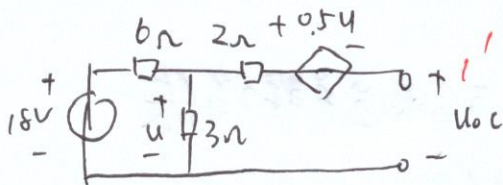
$$u = \frac{3 \times 6}{3+6} i_o = 2i_o$$

$$u_o = -0.5u + 2i_o + u = 3i_o$$

$$R_{eq} = \frac{u_o}{i_o} = 3\Omega$$

$$\Rightarrow R_L = R_{eq} = 3\Omega$$

$$P_{max} = \frac{u_{oc}^2}{4R_{eq}} = 0.75W$$

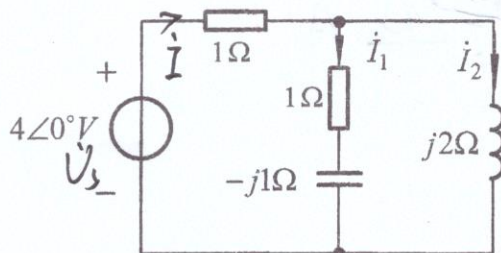


$$u = \frac{3}{6+3} \times 18 = 6V$$

$$u_{oc} = -0.5u + u = 3V$$

七. 如图所示电路, 试求电流 i_1 、 i_2 。(8 分)

得分



求总阻抗 $Z = 1 + (1-j)/j2 = 1+2 = 3\Omega$

$$\therefore I = \frac{U_s}{Z} = \frac{4}{3} \angle 0^\circ A$$

由分流公式可得 $i_1 = \frac{j2}{1-j1+j2} I = \frac{4}{3} \angle 45^\circ A$

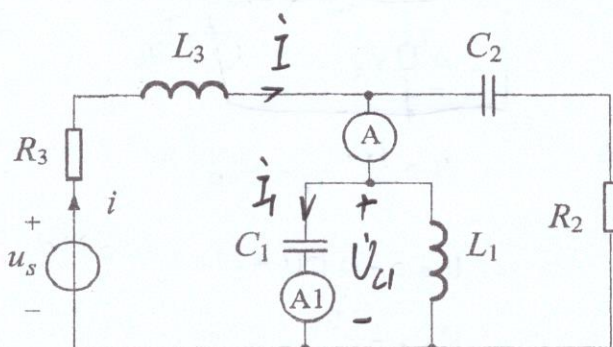
$$i_2 = \frac{1-j1}{1-j1+j2} I = \frac{4}{3} \angle -90^\circ A$$

此题也可用分压公式或基尔霍夫定律计算。

八. 正弦稳态电路, $u_s = 3\sqrt{2} \cos(\omega t) V$, $L_1 = 1H$, $C_1 = \frac{1}{100} F$, $R_2 = 2\Omega$, $C_2 = \frac{1}{20} F$,

$R_3 = 1\Omega$, 已知电流表 A 读数为 0, 并有 u_s 与 i 同相, 求电感 L_3 与电流表 A1 读数。

(9 分)



得分

解 已知电流表 A 读数为 0, 可知 L_3 与 C_2 发生串联谐振

$$\therefore \omega = \frac{1}{\sqrt{L_3 C_2}} = \frac{1}{\sqrt{1 \times \frac{1}{100}}} = 10 \text{ rad/s}$$

又已知 u_s 与 i 同相, $\therefore L_3$ 与 C_2 发生串联谐振

$$\omega L_3 = \frac{1}{\omega C_2} \Rightarrow L_3 = \frac{1}{\omega^2} = 0.2 H$$

$$\dot{U}_s = 3\sqrt{2} \angle 0^\circ V \quad \therefore \dot{I} = \frac{\dot{U}_s}{R_3 + R_2} = \frac{3\sqrt{2} \angle 0^\circ}{2+1} = 1 A$$

$$\dot{U}_{C_1} = (-j \frac{1}{\omega C_1} + R_2) \dot{I} = 2 - j2 V$$

$$\therefore \dot{I}_1 = j\omega C_1 \dot{U}_{C_1} = 0.2 + j0.2 = \frac{\sqrt{2}}{5} \angle 45^\circ A$$

$\therefore A_1$ 读数为 $\frac{\sqrt{2}}{5} A$ 。

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