

标准答案

华东交通大学 2016 — 2017 学年第一学期考试卷

(A) 卷

课程名称: 电路原理 II 考试时间: 120 分钟 考试方式: 闭卷

学生姓名: _____ 学号: _____ 教学班级: _____ 教学小班序号: _____

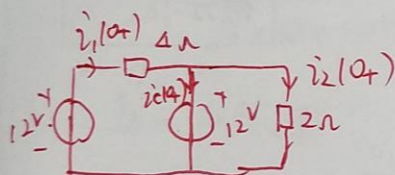
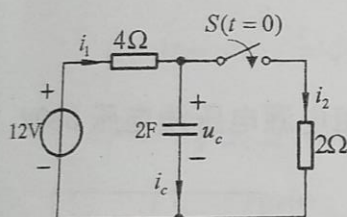
题号	一	二	三	五	六	七	八	九	十	总分
得分										
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一、计算题(每题 8 分, 共 32 分)

1、电路如题图所示, 开关闭合前电路已达稳态, $t=0$ 时闭合开关

得分

关, 求 $u_c(0_+)$, $i_c(0_+)$, $i_1(0_+)$, $i_2(0_+)$ 。



$$u_c(0_+) = u_c(0_-) = 12V$$

2'

$$i_c(0_+) = -6A$$

2'

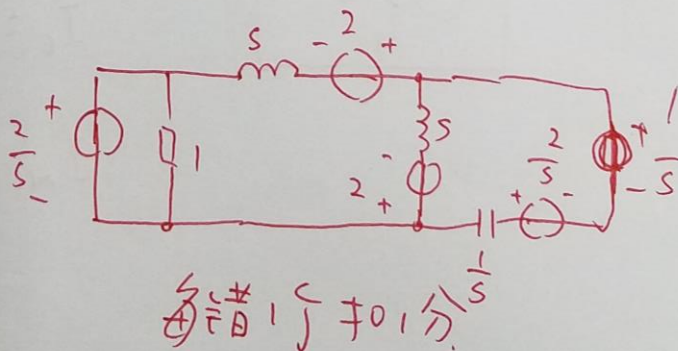
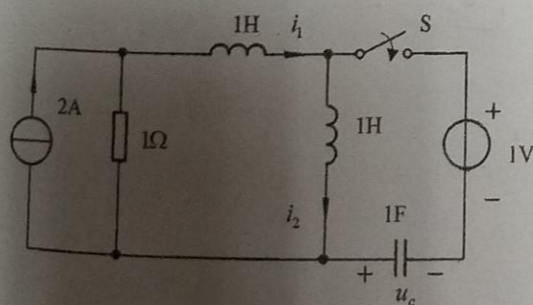
$$i_1(0_+) = 0$$

2'

$$i_2(0_+) = 6A$$

2'

2、图示电路原处于稳态, $u_c(0_-) = 2V$, $t=0$ 时闭合开关, 作出换路后的运算电路。



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3、已知某函数的象函数 $F(s) = \frac{(s+2)(s+6)}{s(s+1)(s+3)}$ ，求其原函数。

$$F(s) = \frac{4}{s} - \frac{5}{2} \frac{1}{s+1} - \frac{1}{2} \frac{1}{s+3} \quad 4'$$

$$f(t) = 4 - \frac{5}{2} e^{-t} - \frac{1}{2} e^{-3t} \quad 4'$$

4、某支路电压为 $u = \cos(t + 60^\circ) + 2\cos(2t + 45^\circ) + 5\cos(3t - 60^\circ) \text{ V}$ ， $i = 5\cos t + 2\cos(2t + 15^\circ)$ 求电压、电流的有效值和支路的平均功率。

$$U = \sqrt{\left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{2}{\sqrt{2}}\right)^2 + \left(\frac{5}{\sqrt{2}}\right)^2} = 3.873 \text{ V} \quad 3'$$

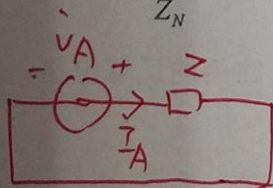
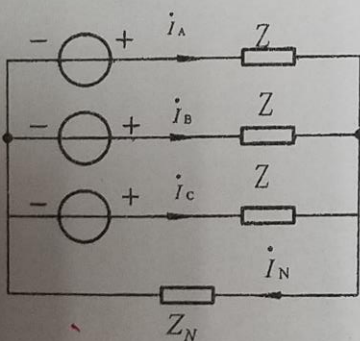
$$I = \sqrt{\left(\frac{5}{\sqrt{2}}\right)^2 + \left(\frac{2}{\sqrt{2}}\right)^2} = 3.808 \text{ A} \quad 3'$$

$$P = 2.982 \text{ W} \quad 2'$$

二、电路如图所示，每相负载 $Z = 6 + j8\Omega$ ，对称三相电源电压线电压 380V，

中线阻抗 $Z_N = 1 + j1\Omega$ ，求 $\dot{I}_A, \dot{I}_B, \dot{I}_C, \dot{I}_N$ 。（10 分）

得分	
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$$\dot{V}_A = 220 \angle 0^\circ \text{ V} \quad 2'$$

$$\dot{I}_A = \frac{\dot{V}_A}{Z} = \frac{220 \angle 0^\circ}{6 + j8} = 22 \angle -53^\circ \text{ A} \quad 2'$$

$$\dot{I}_B = 22 \angle -173^\circ \text{ A} \quad 2'$$

$$\dot{I}_C = 22 \angle 67^\circ \text{ A} \quad 2'$$

$$\dot{I}_N = 0 \quad 2'$$

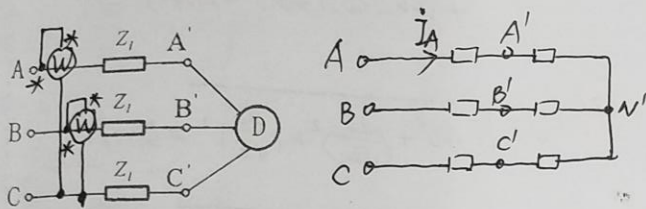
三、电路如图所示，对称三相负载的线电压 $U_{AB} = 380V$ ，输电线路阻抗

$Z_l = -j55\Omega$ ，三相电动机功率为 $1400W$ ，功率因数 $\cos\varphi = 0.866$ （滞后）。

求：(1) 电压 U_{AB} ；三相电源发出的总功率；若要用两表法测量三相电源

的总功率，画出功率表的接线图。(15 分)

得分



(2) 电源端的功率因数

$$\dot{U}_{AB} = 380 \angle 30^\circ V,$$

$$R_1) \dot{U}_{AN'} = 220 \angle 0^\circ V \quad +2$$

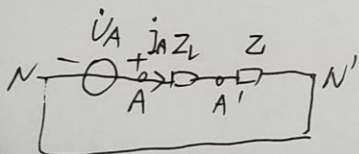
$$\therefore P = 1400W, \cos\varphi = 0.866, U_l = 380V$$

$$P = \sqrt{3} U_l I_l \cos\varphi$$

$$\therefore I_A = \frac{1400}{\sqrt{3} \times 380 \times 0.866} = 2.45 A$$

$$\text{又} \because \varphi = 30^\circ$$

$$\therefore \dot{I}_A = 2.45 \angle -30^\circ A \quad +3$$



$$\dot{U}_{AN} = \dot{I}_A \cdot Z_l + \dot{U}_{AN'} \quad +3$$

$$= 2.45 \angle -30^\circ \cdot 55 \angle -90^\circ + 220 \angle 0^\circ$$

$$= 152.5 - j116.9$$

$$= 192.2 \angle -37.4^\circ$$

$$\therefore \dot{U}_{AB} = \sqrt{3} \dot{U}_{AN} \angle 30^\circ \quad +2$$

$$= 332.8 \angle -7.4^\circ$$

$$U_{AB} = 332.8V$$

$$\cos\varphi' = \cos[-37.4^\circ - (-30^\circ)]$$

$$= \cos(-7.4^\circ)$$

$$= 0.992 \quad (\text{超前})$$

$$P = \sqrt{3} U_{AB} I_A \cos\varphi'$$

$$= \sqrt{3} \times 332.8 \times 2.45 \times 0.992$$

$$= 1400.9W. \quad +2$$

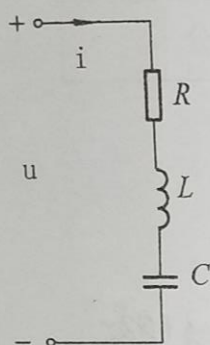
(3) 如题图中所示。

+3.

四、已知 RLC 串联电路中, $u = 40 + 40 \cos(\omega t + 30^\circ) + 20 \cos(3\omega t + 60^\circ)$, $R = 10\Omega$, $C = 200\mu\text{F}$,

$L = 1\text{H}$, $f = 50\text{Hz}$, 求: (1) 电流 i ; (2) 电压 u 和电流 i 的有效值; (3) 电路中消

耗的功率。(14 分)



$$\therefore i = 0.13 \cos(\omega t - 58.1^\circ) + 0.02 \cos(3\omega t - 29.4^\circ) \quad +1$$

$$(2) \quad U = \sqrt{40^2 + \left(\frac{40}{\sqrt{2}}\right)^2 + \left(\frac{20}{\sqrt{2}}\right)^2} = 50.99\text{V} \quad +2$$

$$I = \sqrt{\left(\frac{0.13}{\sqrt{2}}\right)^2 + \left(\frac{0.02}{\sqrt{2}}\right)^2} = 0.09\text{A} \quad +1$$

$$(1) \quad U_0 = 40\text{V}, I_0 = 0\text{A}.$$

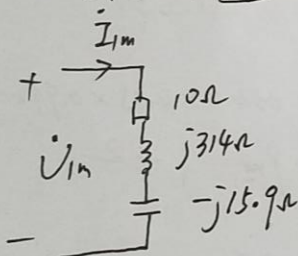
+2

$$(3) \quad p = I^2 R = 0.08\text{W}.$$

+2

$$(2) \quad u_1 = 40 \cos(\omega t + 30^\circ)$$

$$\dot{U}_{1m} = 40 \angle 30^\circ \text{V}$$



$$\dot{I}_{1m} = \frac{40 \angle 30^\circ}{10 + j314 - j15.9} = \frac{40 \angle 30^\circ}{298 \angle 58.1^\circ}$$

+3

$$= 0.13 \angle -58.1^\circ$$

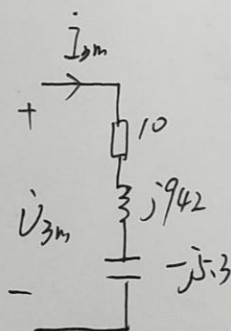
$$(3) \quad \text{当 } u_3 = 20 \cos(3\omega t + 60^\circ), \quad \dot{U}_{3m} = 20 \angle 60^\circ \text{V}$$

$$\dot{I}_{3m} = \frac{\dot{U}_{3m}}{10 + j942 - j5.3}$$

$$= \frac{20 \angle 60^\circ}{10 + j940}$$

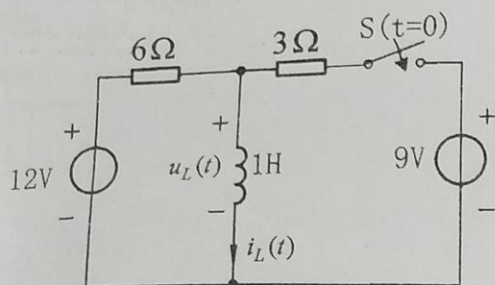
+3

$$= 0.02 \angle -29.4^\circ$$



五、电路如图所示，开关闭合前电路已经稳定。 $t=0$ 时开关 S 闭合，试求开关闭合后的 $i_L(t), u_L(t)$ 。(14 分)

得分

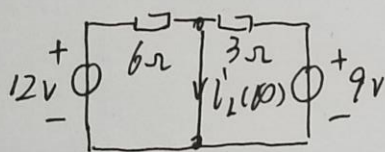


解① 计算 $i_L(0_+)$

换路前，易得 $i_L(0_-) = \frac{12}{6} = 2A$

由换路定则， $i_L(0_+) = i_L(0_-) = 2A$ 3'

② 计算 $i_L(\infty)$ ，等效电路如图



$$i_L(\infty) = \frac{12}{6} + \frac{9}{3} = 5A \quad 3'$$

③ 计算 τ ，从电感两端看进去的等效电阻 $R_{eq} = 6 \parallel 3 = 2\Omega$

$$\therefore \tau = \frac{L}{R_{eq}} = \frac{1}{2} s \quad 3'$$

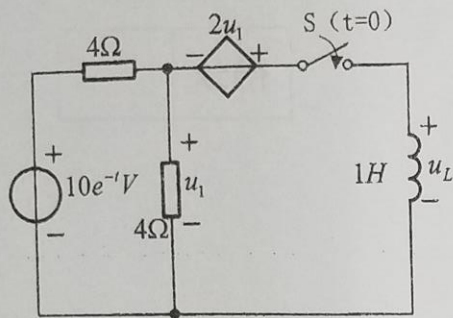
$$\therefore i_L = i_L(\infty) + [i_L(0_+) - i_L(\infty)] e^{-\frac{t}{\tau}} = 5 - 3e^{-2t} A \quad (t \geq 0) \quad 2'$$

$$u_L = L \frac{di_L}{dt} = 6e^{-2t} V \quad (t \geq 0) \quad 3'$$

或者 u_L 也可用三要素法计算： $u_L(0_+) = 6V$

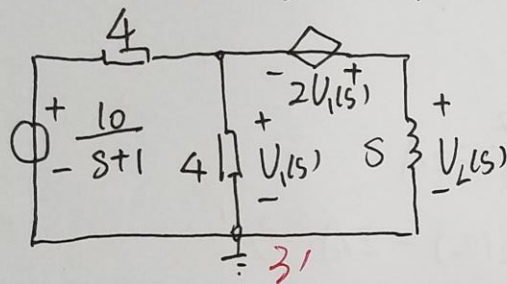
此题还可由运算法计算。

六、电路如图所示，已知 $i_L(0_-) = 0 \text{ A}$ ， $t=0$ 时将开关闭合，求 $t>0$ 时的 $u_L(t)$ 。



得分

解. $t>0$ 时的电路如图



由结点法可得: $(\frac{1}{4} + \frac{1}{4} + \frac{1}{s})U_1(s) = \frac{\frac{10}{s+1}}{4} - \frac{2U_1(s)}{s}$ 3'

$\Rightarrow U_1(s) = \frac{5s}{(s+1)(s+6)}$ 2'

$\therefore U_L(s) = 2U_1(s) + U_1(s) = 3U_1(s)$ 2'

$\therefore U_L(s) = \frac{15s}{(s+1)(s+6)} = \frac{k_1}{s+1} + \frac{k_2}{s+6}$ 1'

$k_1 = \frac{15s}{s+6} \Big|_{s=-1} = -3$ 1'

$k_2 = \frac{15s}{s+1} \Big|_{s=-6} = 18$ 1'

$\therefore u_L = \mathcal{L}^{-1}[U_L(s)] = -3e^{-t} + 18e^{-6t} \text{ V. } (t>0)$ 2'