

华东交通大学 2015—2016 学年第一学期考试卷

(A) 卷

课程名称: 电路原理II 课程类别: 必 考试方式: 闭卷

题号	一	二	三	四	五	六	七	八	九	十	总分	累分人签名
题分	32	15	15	15	15	8					100	
得分												

考生注意事项: 1、本试卷共 4 页, 总分 100 分, 考试时间 120 分钟。

2、考试结束后, 考生不得将试卷、答题纸和草稿纸带出考场。

一、计算以下各小题(每题 8 分, 共 32 分)

得分	评阅人

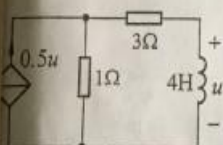
某支路上电压为 $u = 5 + 20\sqrt{2} \cos(10t + 30^\circ) + 10\sqrt{2} \cos(20t + 45^\circ) \text{ V}$, 电流为 $i = 4\sqrt{2} \cos(10t + 10^\circ) + 3\sqrt{2} \cos(20t + 60^\circ) \text{ A}$, 计算电压 u 、电流 i 的有效值及该支路消耗的功率。

$$U = \sqrt{5^2 + 20^2 + 10^2} = 22.91 \text{ V} \quad 3'$$

$$I = \sqrt{4^2 + 3^2} = 5 \text{ A} \quad 3'$$

$$P = 20 \times 4 \times \cos(30^\circ - 10^\circ) + 10 \times 3 \times \cos(45^\circ - 60^\circ) = 104.15 \text{ W} \quad 2'$$

计算电路的时间常数 τ

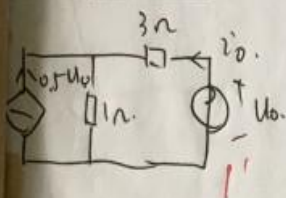


$$u = 3i_o + 1 \times (0.5u_o + i_o)$$

$$0.5u_o = 4i_o$$

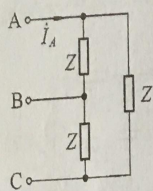
$$R_{eq} = \frac{u_o}{i_o} = 8\Omega \quad 3'$$

$$\tau = \frac{L}{R_{eq}} = 0.5 \text{ s} \quad 2'$$



5. 求

3. 对称三相电路中, 已知 $\dot{U}_{BC} = 380\angle 0^\circ \text{V}$, $\dot{I}_A = 17.32\angle 120^\circ \text{A}$, 计算阻抗 Z .



$$\begin{aligned} \therefore \dot{U}_{BC} &= 380\angle 0^\circ \text{V} \\ \therefore \dot{U}_B &= 220\angle -30^\circ \text{V} \quad \dot{U}_A = 220\angle 90^\circ \text{V} \quad 4' \\ \therefore \dot{U}_A &= \frac{1}{3} Z \cdot \dot{I}_A \quad 2' \\ Z &= \frac{3 \times 220\angle 90^\circ}{17.32\angle 120^\circ} = 38.11\angle -30^\circ \Omega \quad 2' \end{aligned}$$

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

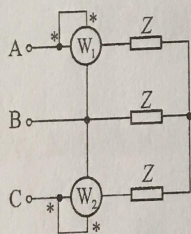
$$\begin{aligned} F(s) &= \frac{K_1}{s+1} + \frac{K_2}{s+2} \quad K_1 = (s+1) \frac{s+3}{(s+1)(s+2)} \Big|_{s=-1} = 2 \quad 2' \\ &= \frac{2}{s+1} + \frac{-1}{s+2} \quad 2' \quad K_2 = (s+2) \frac{s+3}{(s+1)(s+2)} \Big|_{s=-2} = -1 \quad 2' \\ f(t) &= 2e^{-t} - e^{-2t} \quad 2' \end{aligned}$$

二、如图对称三相电路中, 已知线电压为 380V , $Z = 20 + j20\Omega$ 。若用二表法测量三相总的功率, 求二块功率表的读数及三相总的功率。

得分	评阅人

(15分)

解: 设 $\dot{U}_{AN} = 220\angle 0^\circ \text{V}$ $1'$



$$\begin{aligned} \dot{I}_A &= \frac{\dot{U}_{AN}}{Z} = \frac{220\angle 0^\circ}{20+j20} = 7.78\angle -45^\circ \quad 2'' \\ \Rightarrow \dot{I}_C &= 7.78\angle 75^\circ \quad 2'' \end{aligned}$$

$$\therefore \dot{U}_{AB} = 380\angle 30^\circ \quad \Rightarrow \dot{U}_{BC} = 380\angle 90^\circ \Rightarrow \dot{U}_{CB} = -\dot{U}_{BC} = 380\angle 90^\circ \quad 1'$$

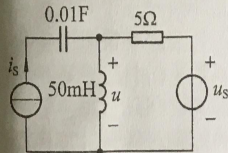
$$3' \text{ 表1读数 } P_1 = \dot{U}_{AB} \cdot \dot{I}_A \cdot \cos \phi_1 = \dot{U}_{AB} \cdot \dot{I}_A \cdot \cos(30^\circ + 45^\circ) = 765 \text{W}$$

$$3' \text{ 表2读数 } P_2 = \dot{U}_{CB} \cdot \dot{I}_C \cdot \cos \phi_2 = \dot{U}_{CB} \cdot \dot{I}_C \cdot \cos(90^\circ - 75^\circ) = 2855 \text{W}$$

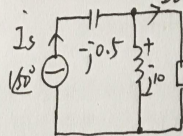
$$1' \quad P = P_1 + P_2 = 3620 \text{W}$$

三、已知 $u_s = 20 \cos(100t + 10^\circ) \text{ V}$, $i_s = \sqrt{2} \cos(200t + 50^\circ) \text{ A}$, 求 u 及两电源各自输出的功率。(15 分)

得分	评阅人

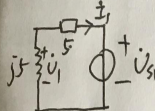


2° $i_s = \sqrt{2} \cos(200t + 50^\circ) \text{ A}$



1° $u_s = 20 \cos(100t + 10^\circ) \text{ V}$

$\dot{U}_s = \frac{20}{\sqrt{2}} \angle 10^\circ \text{ V}$



$\dot{I}_1 = -\frac{\dot{U}_{s1}}{5+j5} = \frac{20 \angle 10^\circ}{5\sqrt{2} \angle 45^\circ} = 2 \angle 145^\circ$

$\dot{U}_1 = \frac{5\dot{I}_1}{5+j5} \dot{U}_{s1} = 10 \angle 55^\circ$

$P_{us} = \frac{20}{\sqrt{2}} \cdot 2 \cdot \cos(145^\circ - 10^\circ) = -20 \text{ W}$

$\dot{I}_2 = \frac{j10}{5+j10} \dot{I}_s = \frac{10 \angle 90^\circ}{11.18 \angle 63.4^\circ} \cdot 1 \angle 50^\circ = 0.894 \angle 76.6^\circ$

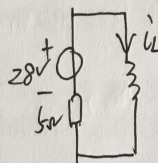
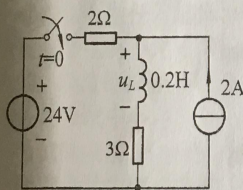
$\dot{U}_2 = 5 \dot{I}_2 = 4.47 \angle 76.6^\circ$

$P = I_2^2 R = 0.894^2 \times 5 = 3.99 \text{ W}$

$u = 10\sqrt{2} \cos(100t + 55^\circ) + 4.47\sqrt{2} \cos(200t + 76.6^\circ)$

四、如图, 开关闭合前电路处于稳态, $t=0$ 时开关闭合, 求电感电压 u_L 。(15 分)

得分	评阅人



$\dot{I}_L(\infty) = \frac{U_{oc}}{R_{eq}} = \frac{28}{5} = 5.6 \text{ A}$

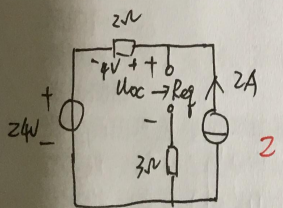
$\dot{I}_L(t) = \dot{I}_L(\infty) + [\dot{I}_L(0+) - \dot{I}_L(\infty)] e^{-\frac{t}{\tau}}$

$= 5.6 + (2 - 5.6) e^{-\frac{t}{0.04}}$

$= 5.6 - 3.6 e^{-25t}$

$u_L(t) = L \cdot \frac{di_L(t)}{dt}$

$= 18 e^{-25t} \text{ (V)}$



$24 = -4 + U_{oc}$

$U_{oc} = 28 \text{ V}$

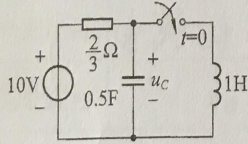
$R_{eq} = 2+3 = 5 \Omega$

$\tau = \frac{L}{R_{eq}} = \frac{0.2}{5} = 0.04 \text{ s}$

人

五、电路如图，开关在闭合前处于稳态，电感原储能为零，在 $t=0$ 时开关闭合，用运算法求 u_C 。(15 分)

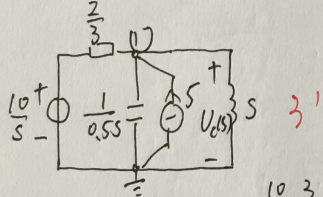
得分	评阅人



1766°

解: $u_C(0-) = 10V$ 2'

运算电路如图



200t + 76.6°

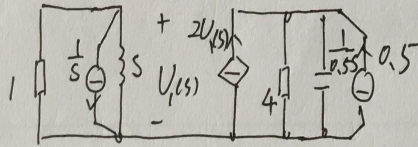
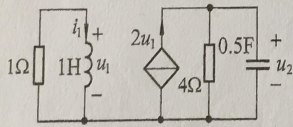
结点法: $U_C(s) = \frac{\frac{10}{s} \times \frac{2}{3} + 5}{\frac{2}{3} + 0.5s + \frac{1}{s}} = \frac{10(s+3)}{s^2+3s+2} = \frac{K_1}{s+1} + \frac{K_2}{s+2}$ 4' 2'

$K_1 = \frac{10(s+3)}{s+2} \Big|_{s=-1} = 20$ 1' $K_2 = \frac{10(s+3)}{s+1} \Big|_{s=-2} = -10$ 1'

$\therefore u_C = \mathcal{L}^{-1}[U_C(s)] = 20e^{-t} - 10e^{-2t} V$ 2'

六、画出下图的运算电路。已知 $i_1(0-) = 1A$, $u_2(0-) = 1V$ 。(8 分)

得分	评阅人



每个元件1分

运算电路也可画成附加电源形式。