

北京邮电大学 2017—2018 学年第二学期

《电路与电子学基础》期末试题答案 (2 学分 B 卷)

一、填空题 (每空 2 分, 共 30 分)

1. -8 2. 18V

3. $\dot{A}\dot{F} = -1$ 4. 100J

5. $6(1-e^{-5t})V, (12-8e^{-5t})V$ 6. 2

7. $U_o = (1 + \frac{R_f}{R})U_i = 11U_i, 14V$ 8. 导通, 截止

9. 相同, 相反, $-1.5\cos\omega t$ 10. $\frac{1}{f}$

二、选择题 (每题 2 分, 共 20 分)

1	2	3	4	5	6	7	8	9	10
D	A	B	A	B	A	C	C	B	D

三、计算题 (8 分)

解: $t=0^-$ 时开关未闭合, 电感短路: $i_L(0^-) = \frac{16}{3+1} = 4A$ 。 -----1 分

由换路定则, 有: $i_L(0^+) = i_L(0^-) = 4A$ 。 -----1 分

求时间常数: $R_{eq} = 3 // 3+1 = 2.5\Omega$, $\tau = L/R_{eq} = \frac{10}{2.5} = 4s$ -----2 分

$$i_L(\infty) = \frac{16}{3+\frac{3\times1}{3+1}} \times \frac{3}{3+1} = \frac{16}{5} = 3.2A \quad \text{-----2 分}$$

$$i_{L,i.r}(t) = i_L(0^+) e^{-\frac{1}{\tau}t} = 4e^{-\frac{1}{4}t} A, \quad t \geq 0^+ \quad \text{-----1 分}$$

$$i_{L,s.r}(t) = i_L(\infty)(1 - e^{-\frac{1}{\tau}t}) = 3.2(1 - e^{-\frac{1}{4}t}) A, \quad t \geq 0^+ \quad \text{-----1 分}$$

四、计算题 (8 分)

解: 集成运放虚短、虚断, $V_n = V_p = 0$ (2 分)

$$i_{\Sigma} + \frac{v_o}{R_F} = 0$$

$$v_o = -R_F \cdot i_{\Sigma} = -R_F (I_3 + I_2 + I_1 + I_0) \quad (2 \text{分})$$

$$I_3 = \frac{V_{REF}}{R} d_3$$

$$I_2 = \frac{V_{REF}}{2R} d_2$$

$$I_1 = \frac{V_{REF}}{2^2 R} d_1$$

$$I_0 = \frac{V_{REF}}{2^3 R} d_0$$

$$v_o = -\frac{V_{REF} R_F}{2^3 R} (d_3 2^3 + d_2 2^2 + d_1 2^1 + d_0 2^0)$$

$$R_F = R$$

$$v_o = -\frac{V_{REF}}{2^3} (d_3 2^3 + d_2 2^2 + d_1 2^1 + d_0 2^0) \quad (2 \text{分})$$

$$= -\frac{-1.6}{2^3} \times (1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0)$$

$$= \frac{1.6}{2^3} \times 13 = 2.6 \text{V} \quad (2 \text{分})$$

五、计算题 (10 分)

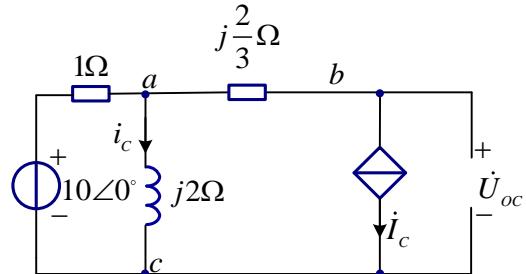
解: $u_s(t) = 10\sqrt{2} \cos 10^4 t \Rightarrow \dot{U}_s = 10\angle 0^\circ, \omega = 10^4 \text{ rad/s}$

$$j\omega L = j10^4 \times 50 \times 10^{-6} = j\frac{1}{2}\Omega, \quad \frac{1}{j\omega C} = \frac{1}{j10^4 \times 50 \times 10^{-6}} = -j2\Omega$$

电感的等效阻抗为: $Z_1 = j\omega L = j10^4 \times 0.2 \times 10^{-3} = j2$

电容电感的并联等效阻抗为: $Z_2 = \frac{j\frac{1}{2} \times (-j2)}{j\frac{1}{2} - j2} = j\frac{2}{3}$ (3 分)

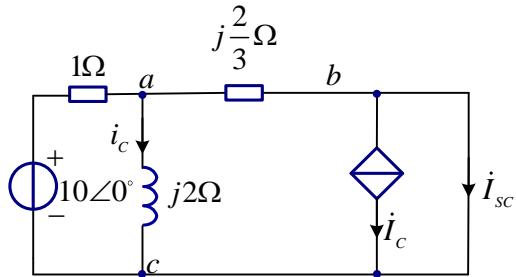
求 \dot{U}_{oc} 。首先画出等效相量模型。



列方程: $2i_c \times 1 + i_c \times j2 = 10\angle 0^\circ$

$$\text{所以: } i_c = \frac{10}{2+j2} = \frac{5}{1+j}, \quad U_{oc} = i_c \times j2 - i_c \times j \frac{2}{3} = \frac{5}{1+j} \times j \frac{4}{3} = \frac{10+10j}{3} \quad (2 \text{ 分})$$

求 \dot{I}_{sc}



$$\textcircled{1} \quad (2i_c + \dot{I}_{sc}) \times 1 + i_c \times j2 = 10\angle 0^\circ$$

$$\textcircled{2} \quad i_c \times j2 = (i_c + \dot{I}_{sc}) \times j \frac{2}{3}$$

$$\Rightarrow i_c = 2 - j \quad \dot{I}_{sc} = 2i_c = 4 - j2 \quad (2 \text{ 分})$$

$$\Rightarrow Z_{eq} = \frac{\dot{U}_{oc}}{\dot{I}_{sc}} = \frac{\frac{10+j10}{3}}{4-j2} = \frac{1+j3}{3} \Omega$$

$Z_x = \frac{1-j3}{3} \Omega$ 时获得最大功率, (1 分)

$$\text{最大功率为: } P_{L\max} = \frac{U_{oc}^2}{4R_x} = \frac{\left(\frac{10\sqrt{2}}{3}\right)^2}{4 \times \frac{1}{3}} = \frac{50}{3} W \quad (2 \text{ 分})$$

六、计算题 (10 分)

(1)

$$V_{BQ} = V_{CC} \times \frac{R_{B2}}{R_{B1} + R_{B2}} = 8 \times \frac{5k}{20k} = 2V, \quad (2 \text{ 分})$$

$$I_{EQ} = \frac{V_{BQ} - 0.7V}{R_E} = 1mA \quad (1 \text{ 分})$$

$$I_{CQ} \approx I_{EQ} = 1mA \quad (1 \text{ 分})$$

$$V_{CEQ} \approx 8 - 1 \times (3 + 1.3) = 8 - 4.3 = 3.7V \quad (2 \text{ 分})$$

(2)

$$R_o = R_c \quad (1 \text{ 分})$$

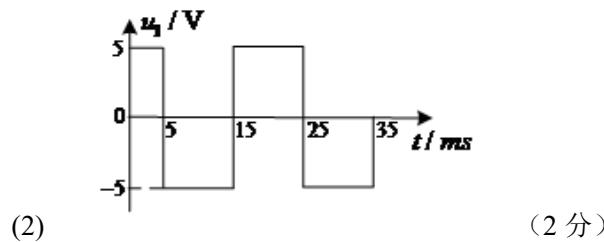
$$R_L' = R_C // R_L = 2k\Omega, \quad A_v = -\frac{\beta_0 R_L'}{r_{be}} \approx -76.9 \quad (2 \text{ 分})$$

$$R_i = R_{B1} // R_{B2} // r_{be} \approx 1.54k\Omega \quad (1 \text{ 分})$$

七、计算题 (14 分)

解：

$$(1) u_1 = -\frac{R_f}{R_1} \cdot u_{i1} - \frac{R_f}{R_2} \cdot u_{i2} = -\frac{1}{2}u_{i1} - \frac{1}{2}u_{i2} \quad (4 \text{ 分})$$



$$(3) u_2 = -\frac{1}{C} \int i_C dt = -\frac{1}{RC} \int u_1 dt = -100 \int u_1 dt \quad (4 \text{ 分})$$

