

部分习题参考答案

第 1 章

- 1.1 (1) $U_{ab} = 5 \text{ V}$; (2) $U_{ab} = 5 \text{ V}$; (3) $I = -2 \text{ A}$; (4) $I = 2 \text{ A}$
- 1.2 (a) -10 W ; (b) -48 W , 30 W ; (c) -50 W , 25 W
- 1.3 (3) $P_1 = -560 \text{ W}$, $P_2 = -540 \text{ W}$, $P_3 = 600 \text{ W}$, $P_4 = 320 \text{ W}$, $P_5 = 180 \text{ W}$
- 1.4 $I_3 = -2 \text{ mA}$, $U_3 = 60 \text{ V}$
- 1.5 $P = 50 \text{ W}$
- 1.6 $U_{ac} = 26 \text{ V}$, $U_{bd} = 7 \text{ V}$
- 1.7 $U_{ab} = 11 \text{ V}$, $I_2 = -3 \text{ A}$, $I_3 = 2 \text{ A}$, $R_3 = 5.5 \Omega$
- 1.8 -18 W , -18 W , 4 W
- 1.9 $U_{ab} = 0 \text{ V}$, $I = 0 \text{ A}$
- 1.10 $U_{S2} = 8.75 \text{ V}$
- 1.11 (a) 8.2Ω ; (b) 12.5Ω ; (c) 2Ω
- 1.12 $U = 4 \text{ V}$
- 1.13 $I = 2.5 \text{ A}$, $U_{ab} = 7 \text{ V}$
- 1.14 $I = 1 \text{ A}$
- 1.15 $U_{ab} = 1 \text{ V}$
- 1.16 $I_1 = 3 \text{ A}$, $I_2 = 8 \text{ A}$, $I_3 = 11 \text{ A}$
- 1.17 $I_1 = -1 \text{ A}$, $I_2 = 1 \text{ A}$
- 1.18 $I_1 = 2 \text{ A}$, $I_2 = -2 \text{ A}$, $I_3 = 0.4 \text{ A}$
- 1.19 $I_1 = 7 \text{ A}$, $I_2 = -11.5 \text{ A}$, $I_3 = 3.5 \text{ A}$, $I_4 = -1 \text{ A}$
- 1.20 (a) $U_{OC} = 7 \text{ V}$, $R_0 = 6 \Omega$; (b) $U_{OC} = 100 \text{ V}$, $R_0 = 15 \Omega$
- 1.20 (a) $I = 1.5 \text{ A}$; (b) $I = 2 \text{ A}$
- 1.22 $I = 4 \text{ A}$
- 1.23 $I = 2 \text{ A}$
- 1.24 (a) $U_{OC} = 14 \text{ V}$, $R_0 = 2 \Omega$
(b) $U_{OC} = 60 \text{ V}$, $R_0 = 6 \Omega$
(c) $U_{OC} = 14 \text{ V}$, $R_0 = 10 \Omega$
- 1.25 (a) $U_{OC} = 4 \text{ V}$, $R_0 = 8 \Omega$; (b) $U_{OC} = 3 \text{ V}$, $R_0 = \frac{4}{3} \Omega$

- 1.26 $I = 1 \text{ A}$
 1.27 $I = 0.25 \text{ A}$
 1.28 $I = 0.5 \text{ A}$

第 2 章

- 2.2 (1) $i = 10\sqrt{2} \sin(100\pi t + 45^\circ) \text{ A}$; (2) 90° , $10\sqrt{2} \text{ A}$
 2.4 $A + B = 14.66 + j13$, $A - B = -2.66 + j3$, $AB = 100 \angle 83.1^\circ$, $A/B = 1 \angle 23.1^\circ$
 2.7 $i_1 + i_2 = 12.8 \sin(314t + 21.34^\circ) \text{ A}$, $i_1 - i_2 = 12.8 \sin(314t + 98.67^\circ) \text{ A}$
 2.8 $u_s = 1000\sqrt{2} \sin(10^6 t + 45^\circ) \text{ V}$
 2.9 $i = 0.707 \sin(t + 45^\circ) \text{ A}$, $u_C = 7.07 \sin(t - 45^\circ) \text{ V}$
 2.10 $i = 20 \sin(2t + 75^\circ) \text{ A}$
 2.11 5 A , 1 A , 7 A
 2.12 (a) 7.07 V ; (b) 7.07 V
 2.13 0.065 H
 2.14 (a) $2\sqrt{2} \angle -45^\circ \Omega$; (b) $\sqrt{2} \angle 45^\circ \Omega$; (c) $2\sqrt{2} \angle -45^\circ \Omega$
 2.15 (1) $i = 2 \sin(10^3 t - 45^\circ) \text{ A}$, $u_R = 20 \sin(10^3 t - 45^\circ) \text{ V}$,
 $u_L = 40 \sin(10^3 t + 45^\circ) \text{ V}$, $u_C = 20 \sin(10^3 t - 135^\circ) \text{ V}$;
 (2) $f = 112.6 \text{ Hz}$, $i = 2\sqrt{2} \sin 10^3 t \text{ A}$, $u_R = 20\sqrt{2} \sin 10^3 t \text{ V}$,
 $u_L = 40 \sin(10^3 t + 90^\circ) \text{ V}$, $u_C = 40 \sin(10^3 t - 90^\circ) \text{ V}$
 2.16 $i = 0.25\sqrt{2} \sin(10^4 t + 45^\circ) \text{ A}$, $i_R = 0.25 \sin 10^4 t \text{ A}$,
 $i_L = 0.25 \sin(10^4 t - 90^\circ) \text{ A}$, $i_C = 0.5 \sin(10^4 t + 90^\circ) \text{ A}$
 2.17 $\dot{I}_1 = 10 \angle 45^\circ \text{ A}$, $\dot{I}_2 = 10\sqrt{2} \angle 90^\circ \text{ A}$, $\dot{I}_3 = 10 \angle -45^\circ \text{ A}$, $\dot{U}_S = 100 \angle -8.1^\circ \text{ V}$
 2.18 $\dot{I}_1 = 0.5\sqrt{2} \angle 45^\circ \text{ A}$, $\dot{I}_2 = 1 \angle 90^\circ \text{ A}$, $\dot{I}_3 = 0.5\sqrt{2} \angle -45^\circ \text{ A}$
 1.19 $P = 880 \text{ W}$, $Q = 660 \text{ Var}$, $S = 1100 \text{ VA}$, $Z = 44 \angle 36.9^\circ$
 2.20 $r = 200 \Omega$, $L = 3.12 \text{ H}$
 2.21 (1) $P = 2528 \text{ W}$, $\cos 40^\circ = 0.766$; (2) $C = 60 \mu\text{F}$
 2.22 $\cos \varphi = 0.55$, $R = 6 \Omega$, $X = 9.22 \Omega$
 2.23 $R = 350 \Omega$, $L = 5 \text{ mH}$
 2.24 $\dot{U} = 22.36 \angle 26.6^\circ \text{ V}$, $P = 150 \text{ W}$, $Q = -50 \text{ Var}$, $S = 158 \text{ VA}$, $\lambda = 0.95$
 2.25 $R = 100 \Omega$, $L = 57.3 \text{ mH}$, $C = 17.6 \mu\text{F}$
 2.26 $X_C = 120 \Omega$
 2.27 $\omega_0 = 10^4 \text{ rad/s}$, $I = 2 \text{ A}$, $U_L = 8000 \text{ V}$, $Q = 160$
 2.28 $L = 19 \text{ mH}$, $C = 0.05 \mu\text{F}$

- 2.30 $I_P = 44 \text{ A}$, $I_L = 44 \text{ A}$, $I_N = 0$
 2.31 $I_L = 4.18 \text{ A}$, $I_{YP} = 4.18 \text{ A}$, $I_{\Delta P} = 2.42 \text{ A}$
 2.32 $Z = 61.5 + j46.2 \Omega$
 2.33 8687 W , 26061 W

第 3 章

- 3.1 $u_C(0_+) = 4 \text{ V}$, $i_1(0_+) = 1 \text{ A}$, $i_C(0_+) = 1 \text{ A}$, $i_2(0_+) = 0 \text{ A}$
 3.2 $u_L(0_+) = 3 \text{ V}$, $i_L(0_+) = 3 \text{ A}$, $i_1(0_+) = 1.5 \text{ A}$, $i_2(0_+) = 1.5 \text{ A}$
 3.3 $u_C(0_+) = 6 \text{ V}$, $u_L(0_+) = 6 \text{ V}$, $i_L(0_+) = 0 \text{ A}$, $i_C(0_+) = 0 \text{ A}$, $i(0_+) = 0 \text{ A}$
 3.4 $u_C(0_+) = 0 \text{ V}$, $u_L(0_+) = 0 \text{ V}$, $i_L(0_+) = 3 \text{ A}$, $i_C(0_+) = 0 \text{ A}$, $i(0_+) = 3 \text{ A}$
 3.5 $u_C = 2(1 + e^{-t}) \text{ V}$, $i_C = -2e^{-t} \text{ A}$
 3.6 $i_L = 1 - e^{-5t} \text{ A}$, $u_L = 5e^{-5t} \text{ V}$
 3.7 $u_C = 4(1 + e^{-4000t}) \text{ V}$
 3.8 $u_C = 8 - 4e^{-2000t} \text{ V}$
 3.9 $u_C = 20e^{-1000t} \text{ V}$
 3.10 $u_C = 4(1 + e^{-0.25t}) \text{ V}$
 3.11 $u_C = 45(1 - e^{-\frac{2000}{9}t}) \text{ V}$, $i_C = 30e^{-\frac{2000}{9}t} \text{ mA}$,
 $i_1 = 7.5 + 22.5e^{-\frac{2000}{9}t} \text{ mA}$, $i_2 = 7.5(1 - e^{-\frac{2000}{9}t}) \text{ mA}$
 3.12 $u_C = 2 + 3e^{-0.5t} \text{ V}$
 3.13 $i_L = e^{-1.5t} \text{ A}$, $u_L = -1.5e^{-1.5t} \text{ V}$
 3.14 $i_L = 2 + 8e^{-\frac{4}{3}t} \text{ A}$, $u_L = -\frac{32}{3}e^{-\frac{4}{3}t} \text{ V}$
 3.15 $i_L = 5 - 3e^{-2t} \text{ A}$, $u_L = 6e^{-2t} \text{ V}$, $i_1 = 2 - e^{-2t} \text{ A}$, $i_2 = 3 - 2e^{-2t} \text{ A}$
 3.16 $i_L = 1 - 2e^{-\frac{4}{3}t} \text{ A}$

第 4 章

- 4.2 33 盏 ; $I_1 = 2.25 \text{ A}$, $I_2 = 13.75 \text{ A}$
 4.3 $k = 10$, $P = 0.78 \text{ W}$
 4.4 $k = 7.1$; $U_1 = 5 \text{ V}$, $U_2 = 0.71 \text{ V}$; $I_1 = 12.5 \text{ mA}$, $I_2 = 89 \text{ mA}$, $P = 63 \text{ mW}$

- 4.5 (1) $N_1=1000$ 匝, $N_2=164$ 匝; (2) $I_1=0.197$ A, $I_2=1.2$ A
4.6 (1) $U_2=36$ V, $U_3=24$ V; (2) $I_1=1.69$ A, $I_2=5$ A, $I_3=8$ A; (3) $130\ \Omega$
4.8 230V, 133V; 133V, 133V
4.9 10; $10\sqrt{3}$; 10; $10/\sqrt{3}$
4.10 (1) $I_{1N}=5.77$ A, $I_{2N}=144.3$ A; (2) 1000 盏; (3) 500 盏
4.11 500 匝, $I_1=22.7$ A, $I_2=20$ A
4.13 (1) 280A; (2) 4.375A

第 5 章

- 5.4 $p=2$, 转速为 0 时 $s=1$, 转速为 1440 r/min 时 $s=0.04$
5.5 $p=3$
5.6 $s_N=0.04$, $f_2=2$ Hz
5.15 (1) $s_N=0.04$, $I_N=11.6$ A, $T_N=36.5$ N·m;
(2) $I_{st}=81.2$ A, $T_{\max}=80.2$ N·m, $T_{st}=80.2$ N·m, $P_1=6.43$ kW
5.18 (1) $T_N=131.3$ N·m; (2) $\cos\varphi=0.89$;
(3) $I_{Yst}=106.7$ A, $T_{Yst}=56.9$ N·m; (4) 不能起动

第 7 章

- 7.4 (1) 1V, 0.5%; (2) 0.5 级
7.5 5%; 2.5%
7.6 电流量程为 0.5A 时: 0.125W/div, 0.25W/div, 0.5W/div, 1W/div;
电流量程为 1A 时: 0.25W/div, 0.5W/div, 1W/div, 1W/div;
7.7 $41\ \Omega$, $959\ \Omega$
7.8 $249.975\text{k}\ \Omega$, $2250\text{k}\ \Omega$

第 8 章

- 8.1 (a) 0.7V; (b) 1.5V; (c) 4.3V
8.5 (a) 放大, 7V; (b) 饱和, 0.3V; (c) 截止, 5V
8.8 (1) $I_B=50\ \mu\text{A}$, $I_C=2\text{mA}$, $U_{CE}=6\text{V}$
8.9 $U_{CE}=3\text{V}$ 时: $R_B=160\text{k}\ \Omega$, $I_B=75\ \mu\text{A}$, $I_C=3\text{mA}$

- $I_C = 1.5 \text{ mA}$ 时: $R_B = 320 \text{ k}\Omega$, $I_B = 37.5 \text{ }\mu\text{A}$, $U_{CE} = 7.5 \text{ V}$
- 8.10 $I_B = 50 \text{ }\mu\text{A}$, $I_C = 4 \text{ mA}$, $U_{CE} = 0.3 \text{ V}$, 三极管饱和
- 8.11 $R_C = 2.5 \text{ k}\Omega$, $R_B = 200 \text{ k}\Omega$
- 8.13 (a) $I_B = 50 \text{ }\mu\text{A}$, $I_C = 2 \text{ mA}$, $U_{CE} = 6 \text{ V}$
 (b) $I_B = 33 \text{ }\mu\text{A}$, $I_C = 1.33 \text{ mA}$, $U_{CE} = 8 \text{ V}$
- 8.14 空载时: $A_u = -180$; 接上负载时: $A_u = -90$
- 8.15 (1) $I_B = 16 \text{ }\mu\text{A}$, $I_C = 0.8 \text{ mA}$, $U_{CE} = 7.2 \text{ V}$
 (3) $r_i = 1.76 \text{ k}\Omega$, $r_o = 3 \text{ k}\Omega$
 (4) $A_u = -37.5$, $A_{us} = -24$
- 8.16 (1) $I_{BQ} = 12 \text{ }\mu\text{A}$, $I_{CQ} = 1.2 \text{ mA}$, $U_{CEQ} = 6 \text{ V}$
 (3) $r_i = 2.3 \text{ k}\Omega$, $r_o = 3 \text{ k}\Omega$
 (4) $A_u = -6.6$, $A_{us} = -6.3$
- 8.17 (1) $I_B = 25 \text{ }\mu\text{A}$, $I_C = 1.5 \text{ mA}$, $U_{CE} = 4.5 \text{ V}$
 (3) $r_i = 92 \text{ k}\Omega$, $r_o = 3 \text{ k}\Omega$
 (4) $A_u = -0.73$
- 8.18 (1) $I_B = 25 \text{ }\mu\text{A}$, $I_C = 2.5 \text{ mA}$, $U_{CE} = 7 \text{ V}$
 (3) $r_i = 85 \text{ k}\Omega$, $r_o = 13 \text{ }\Omega$
 (4) $A_u = 0.99$
- 8.19 (1) $I_{B1} = I_{B2} = 34 \text{ }\mu\text{A}$, $I_{C1} = I_{C2} = 1.7 \text{ mA}$, $U_{CE1} = U_{CE2} = 5.2 \text{ V}$
 (3) $A_{u1} = -30$, $A_{u2} = -50$, $A_u = 1500$
- 8.20 (1) $I_{B1} = 20 \text{ }\mu\text{A}$, $I_{C1} = 1 \text{ mA}$, $U_{CE1} = 4 \text{ V}$
 $I_{B2} = 40 \text{ }\mu\text{A}$, $I_{C2} = 2 \text{ mA}$, $U_{CE2} = 6 \text{ V}$
 (3) $A_{u1} = -116$, $A_{u2} = 0.98$, $A_u = -114$
- 8.21 (1) $I_{B1} = 10 \text{ }\mu\text{A}$, $I_{C1} = 0.5 \text{ mA}$, $U_{CE1} = 10.5 \text{ V}$
 $I_{B2} = 20 \text{ }\mu\text{A}$, $I_{C2} = 1 \text{ mA}$, $U_{CE2} = 5.8 \text{ V}$
 (3) $A_{u1} = 0.95$, $A_{u2} = -153$, $A_u = -146$

第 9 章

- 9.1 $u_o = 0 \sim -6 \text{ V}$
- 9.2 $u_o = 6 \sim 12 \text{ V}$
- 9.3 $50 \text{ }\mu\text{A}$
- 9.4 (1) $R_x = 0.5Ru_o$; (2) $R = 10 \text{ k}\Omega$
- 9.5 $i_o = \frac{u_i}{R}$

$$9.6 \quad i_o = \frac{u_i}{R}$$

$$9.7 \quad i_o = \frac{U}{R}$$

$$9.8 \quad u_o = -\frac{1}{R_1} \left(R_{F1} + R_{F2} + \frac{R_{F1}R_{F2}}{R_{F3}} \right) u_i$$

$$9.9 \quad u_o = -(u_{i1} + u_{i2})$$

$$9.10 \quad u_o = 2(u_{i2} - u_{i1})$$

$$9.11 \quad u_o = 30u_i$$

$$9.12 \quad u_o = \left(1 + \frac{R_2}{R_1} \right) u_i$$

$$9.13 \quad u_o = -4(u_{i1} + u_{i2})$$

$$9.14 \quad u_o = 0.5(u_{i1} + u_{i2})$$

$$9.15 \quad u_o = 4(u_{i2} - u_{i1})$$

$$9.16 \quad u_o = 6u_{i1} + 3u_{i2} - 4u_{i3}$$

$$9.18 \quad t=1\text{ s 时 } u_o = 6\text{ V}, \quad t=2\text{ s 时 } u_o = 12\text{ V}, \quad t=3\text{ s 时 } u_o = 12\text{ V}$$

$$9.19 \quad A = 2500, \quad F = 0.01$$

$$9.20 \quad A_f = 100, \quad \frac{dA_f}{A_f} = 0.1\%$$

$$9.26 \quad f = 16\text{ kHz}, \quad R_F \geq 40\text{ k}\Omega$$

第 10 章

$$10.2 \quad U_2 = 56\text{ V}, \quad I_2 = 178\text{ mA}, \quad I_D = 80\text{ mA}, \quad U_{RM} = 79\text{ V}$$

$$10.3 \quad (1) 13.75\text{ mA}; \quad (2) 19.44\text{ mA}; \quad (3) 244\text{ V}$$

$$10.4 \quad (1) 9\text{ V}, 90\text{ mA}; \quad (2) 4.5\text{ V}, 45\text{ mA}; \quad (3) \text{ 短路}; \quad (4) 12\text{ V}$$

$$10.6 \quad (1) 24\text{ V}; \quad (2) 20\text{ V}$$

$$10.9 \quad \text{二极管: } I_D = 75\text{ mA}, \quad U_{RM} = 35.3\text{ V}; \quad \text{电容: } C = 250\text{ }\mu\text{F}, \quad \text{耐压大于 } 35.3\text{ V}$$

$$10.11 \quad (1) U_{\text{omin}} = 4.9\text{ V}, \quad U_{\text{omax}} = 21.3\text{ V}; \quad (2) R_1 = R_2 = R_p$$

$$10.12 \quad (2) k = 15.5, \quad I_D = 250\text{ mA}, \quad U_{RM} = 20\text{ V}, \quad C_1 = C_2 = 1000\text{ }\mu\text{F}$$

第 11 章

$$11.1 \quad 100000011011, \quad 81\text{ B}$$

11.2 5, 257

11.3 $(110111)_2 = (55)_{10} = (37)_{16}$, $(1001101)_2 = (77)_{10} = (4D)_{16}$

11.4 111001101100, 0011 0110 1001 0010

11.5 2345, 929

11.7 (1) 011、101、110、111; (2) 011、100、101;

(3) 001、010、100、111; (4) 000、001、010、100

11.9 (1) $F = AB + \overline{A}C$; (2) $F = 1$; (3) $F = AB + BC + \overline{A}CD + A\overline{C}\overline{D}$;

(4) $F = A\overline{B} + \overline{D}$; (5) $F = B$; (6) $F = \overline{A}\overline{B}$; (7) $F = 0$; (8) $F = A + B$

11.10 (1) $F_1 = ABC$, $F_2 = A + B + C$

11.11 (a) $F = AB$; (b) $F = A + B$

11.12 $F_1 = \overline{AB}$, $F_2 = \overline{A + B}$, $F_3 = A \oplus B$, $F_4 = AB$, $F_5 = A + B$, $F_6 = \overline{A \oplus B}$

11.13 $F_1 = AB + C$, $F_2 = AC + B$, $F_3 = \overline{A \oplus B \oplus C}$, $F_4 = \overline{AB + BC + CA}$

11.14 (a) $F = AB + \overline{A}C + BC$; (b) $AB + \overline{A}\overline{B}\overline{C} + \overline{C}D + B\overline{C}\overline{D}$

11.15 (a) $F = AB + \overline{A}\overline{B} + A\overline{C}$; (b) $F = \overline{A}\overline{B} + BCD$

11.16 (a) $F = AB + \overline{A}\overline{B}$; (b) $F = \overline{A \oplus B + C \oplus D}$

11.17 (a) $F = A \oplus B \oplus C \oplus D$; (b) $F_1 = A \oplus B \oplus C$, $F_2 = AB + BC + CA$

11.18 (a) $F = A \oplus B \oplus C \oplus D$

(b) $F_3 = B_3$, $F_2 = B_3 \oplus B_2$, $F_1 = B_2 \oplus B_1$, $F_0 = B_1 \oplus B_0$

(c) $F_2 = B_2 \oplus M$, $F_1 = B_1 \oplus M$, $F_0 = B_0 \oplus M$

11.19 $F_1 = A\overline{C} + B\overline{C}$, $F_2 = \overline{A}\overline{B}C + \overline{A}B\overline{C} + A\overline{B}\overline{C} + ABC$, $F_3 = AB + BC + CA$
 $F_4 = \overline{A}B + BC + \overline{C}A$

11.20 (1) $Y = ABC + ABD + ACD + BCD$

(2) $Y = A \oplus B \oplus C \oplus D$

(3) $Y = \overline{A \oplus B \oplus C \oplus D}$

(4) $Y = \overline{A} \overline{B} \overline{C} \overline{D} + ABCD$

11.21 (1) $Y = \overline{B}_0$

(2) $Y = \overline{B}_3 \overline{B}_2 \overline{B}_1 \overline{B}_0 + \overline{B}_3 B_2 \overline{B}_1 B_0 + B_3 \overline{B}_2 B_1 \overline{B}_0 + B_3 B_2 B_1 B_0$

(3) $Y = B_3 + B_2 B_1 + B_2 B_0$

(4) $Y = \overline{B}_3 + \overline{B}_2 \overline{B}_1 + \overline{B}_2 \overline{B}_0$

11.22 $Y = \overline{A \oplus B \oplus C \oplus D}$

11.23 红灯 $Y_1 = AB$, 黄灯 $Y_2 = AC$, 白灯 $Y_3 = \overline{A}\overline{B}$

11.24 红灯 $Y_1 = \overline{A} \overline{B} + \overline{B} \overline{C} + \overline{C} \overline{A}$, 黄灯 $Y_2 = \overline{A} \overline{B} \overline{C} + \overline{A}BC + A\overline{B}C + ABC$,
 绿灯 $Y_3 = ABC$

11.25 $X = \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}\overline{D} + \overline{A}\overline{C}\overline{D} + \overline{B}\overline{C}\overline{D} + BCD + ABD + ABC + ACD$
 $Y = AB + AC + AD + BC + BD + CD$

第 12 章

12.12 2 位二进制同步可逆计数器

12.13 五进制同步计数器

12.14 六进制异步计数器

12.17 (a) 8421 码 8 进制计数器;

(b) 5421 码 6 进制计数器;

(c) 8421 码 7 进制计数器

12.18 (a) 10 进制计数器; (b) 11 进制计数器

12.19 (a) 50 进制计数器; (b) 137 进制计数器

12.20 (1) $\overline{CR} = \overline{Q_2}$, $\overline{LD} = \overline{Q_2 Q_0}$;

(2) $\overline{CR} = \overline{Q_5 Q_4 Q_0}$, $\overline{LD} = \overline{Q_5 Q_4 Q_1}$;

(3) $\overline{CR} = \overline{Q_6 Q_5 Q_1 Q_0}$, $\overline{LD} = \overline{Q_6 Q_5 Q_2}$;

(4) $\overline{CR} = \overline{Q_7 Q_6 Q_3}$, $\overline{LD} = \overline{Q_7 Q_6 Q_2 Q_1 Q_0}$

12.21 (1) $R_{0A} = R_{0B} = Q_3 Q_0$;

(2) $R_{0A} = R_{0B} = Q_5 Q_4 Q_2 Q_0$;

(3) $R_{0A} = R_{0B} = Q_6 Q_4$;

(4) $R_{0A} = R_{0B} = Q_6 Q_5 Q_4 Q_3$

12.24 11s

12.26 0.05V

12.27 -4.5625V

12.28 -4.98V, -3.75V, -0.0195V

12.29 -3.75V