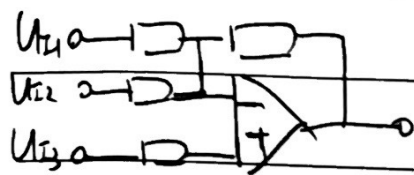


P332. 6.6

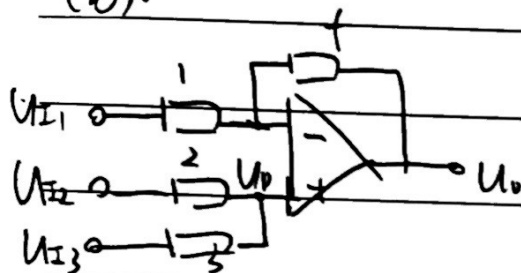
(a)



$$\frac{U_{I1} - U_{I3}}{R_1} + \frac{U_{I2} - U_{I3}}{R_2} = \frac{U_{I3} - U_O}{R_3}$$

$$\Rightarrow U_O = 5U_{I3} - 2(U_{I1} + U_{I2})$$

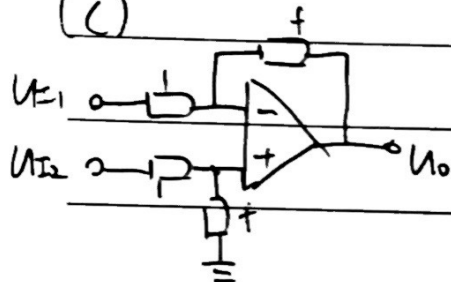
(b).



$$\frac{U_{I2} - U_P}{R_2} = \frac{U_P - U_{I3}}{R_3}$$

$$\Rightarrow U_P = \frac{10}{11}U_{I2} + \frac{1}{11}U_{I3}$$

(c)

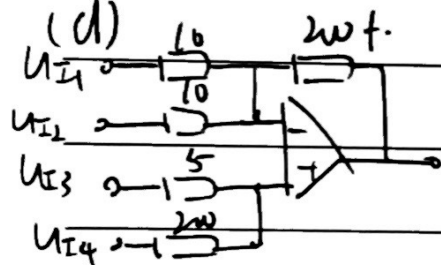


$$\frac{U_{I1} - U_P}{R_1} = \frac{U_P - U_O}{R_2} \Rightarrow U_O = 10U_{I2} + U_{I3} - 10U_{I1}$$

$$U_P = \frac{R_2}{R_1 + R_2} U_{I2}$$

$$\frac{U_{I1} - U_P}{R_1} = \frac{U_P - U_O}{R_2} \Rightarrow U_O = 8U_{I2} - 8U_{I1}$$

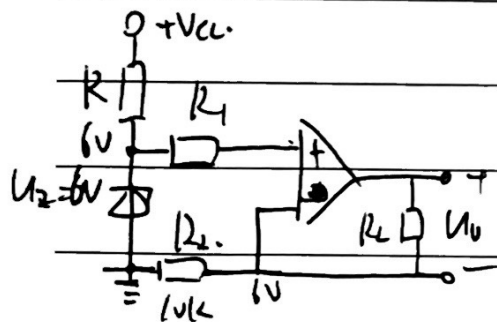
(d)



$$\frac{U_{I3} - U_P}{R_3} = \frac{U_P - U_{I4}}{R_4} \Rightarrow U_P = \frac{40}{41}U_{I3} + \frac{1}{41}U_{I4}$$

$$\frac{U_{I1} - U_P}{R_1} + \frac{U_{I2} - U_P}{R_2} = \frac{U_P - U_O}{R_3} \Rightarrow U_O = 40U_{I3} + U_{I4} - 20(U_{I1} + U_{I2})$$

P333. 6.8



$$U_O = \frac{R_1 + R_2}{R_2} U_{I2}, \quad I_{R1} = I_{R2} = \frac{6-0}{R_2} = 0.6 \text{ mA}$$

$$\frac{6-0}{R_2} \in [1, 10] \Rightarrow R_2 \in [600 \Omega, 6 \text{ k}\Omega]$$

P332.6.9

$$(1). U_{P1} = \frac{R_2}{R_2 + R_4} U_{I2} \quad I_R = \frac{U_{I1} - U_{P1}}{R_1} = \frac{U_{P1} - U_{O2}}{R_4}$$

$$U_{O2} = \frac{R_2}{R_{W}} U_O \Rightarrow U_O = \frac{R_W}{R_1} \cdot 10(U_{I2} - U_{I1})$$

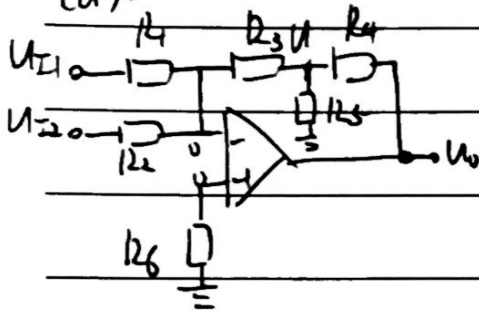
$$(2). R_1 = R_W, U_{I2} = 20\text{mV}, U_{I1} = 10\text{mV} \Rightarrow U_O = 1\text{V}$$

$$(3) 10 \times 30 \times \frac{R_W}{R_1} \leq 14\text{k} \Rightarrow R_1 \geq \frac{300}{14\text{k}} \cdot R_W = \frac{3000}{14} = \frac{1500}{7} \Omega$$

$$\therefore R_2 \leq 9785.7 \Omega$$

P332.6.10

(a).

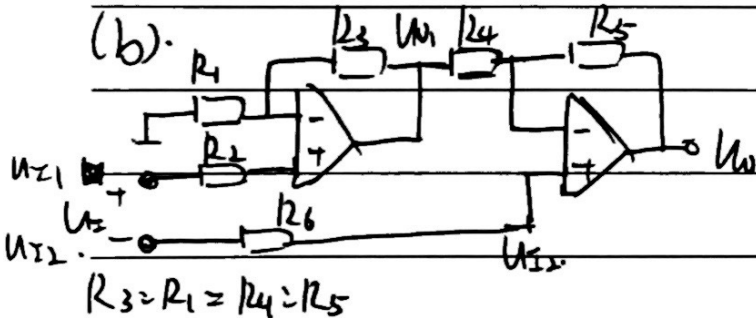


$$\frac{U_{I1}}{R_1} + \frac{U_{I2}}{R_2} = \frac{0 - U_O}{R_3} = \frac{U_O}{R_5} + \frac{U_O}{R_4}$$

$$\Rightarrow U_O = - \left( 1 + \frac{R_4}{R_5} + \frac{R_4}{R_3} \right) R_3 \left( \frac{U_{I1}}{R_1} + \frac{U_{I2}}{R_2} \right)$$

$$= - \left( R_4 + R_3 + \frac{R_3 R_4}{R_5} \right) \left( \frac{U_{I1}}{R_1} + \frac{U_{I2}}{R_2} \right)$$

(b).



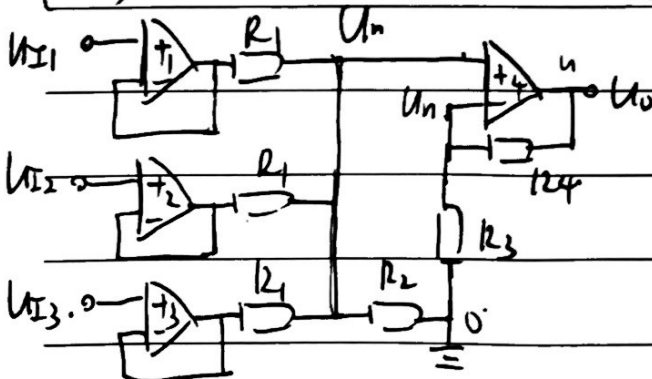
$$U_{I1} - U_{I2} = U_I$$

$$\frac{U - U_{I1}}{R_1} = \frac{U_{I1} - U_{O1}}{R_3}$$

$$\frac{U_{O1} - U_{I2}}{R_4} = \frac{U_{I2} - U_O}{R_5}$$

(c).

$$\Rightarrow U_O = - \left( 1 + \frac{R_5}{R_4} \right) U_{O1}$$



$$\frac{(U_{I1} + U_{I2} + U_{I3}) - 3U_n}{R_1} = \frac{U_n - 0}{R_2}$$

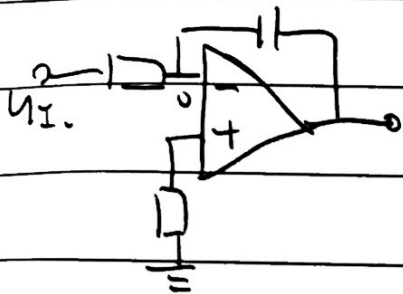
$$\frac{U_O - U_n}{R_4} = \frac{U_n - 0}{R_3}$$

$$\Rightarrow U_O = 10 (U_{I1} + U_{I2} + U_{I3})$$

$$R_1 = 33\text{k} \quad R_2 = 330\text{k}$$

$$R_3 = 11\text{k} \quad R_4 = 230\text{k}$$

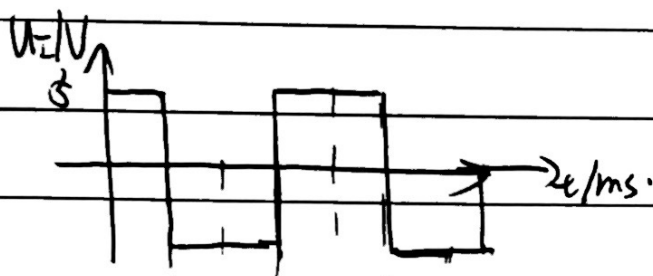
P334. 6.11



$$\frac{U_I}{R} = -C \frac{dU_O}{dt}$$

$$\Rightarrow U_O = -\frac{1}{RC} \int U_I dt$$

$$U_O = -\frac{1}{RC} \int U_I dt$$

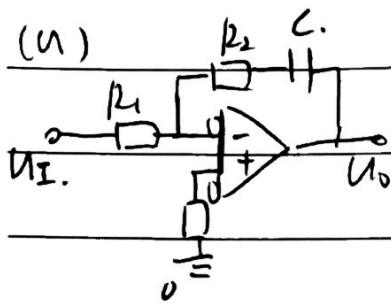


$$\frac{U_I}{R} = -U_O \frac{1}{RC}$$

$$\Rightarrow U_O = -\frac{1}{RC} \int U_I dt$$



P334. 6.13



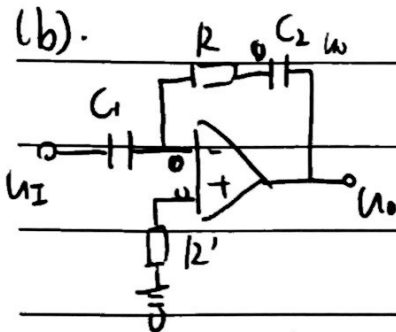
$$\frac{U_I - U}{R_1} = \dot{U}_C = C \frac{dU_C}{dt}$$

$$U - U_O = \dot{U}_C \cdot R_2 + U_C$$

$$\Rightarrow \frac{dU_C}{dt} + \frac{1}{R_2 C} U_C = \frac{U_O}{R_2} \quad \left( \frac{dU_O}{dt} \neq 0 \right)$$

$$\Rightarrow \frac{R_2}{R_1} \frac{dU_O}{dt} + \frac{1}{R_2 C} U_O = -\frac{U_I}{R_2} \Rightarrow U_O = -\frac{R_2}{R_1} U_I - \int \frac{1}{R_1 C} U_I dt$$

$$U_O = -U_I - \omega^3 \int U_I dt \quad / \quad U_O = -e^{\omega^3 t} \cdot U_I$$

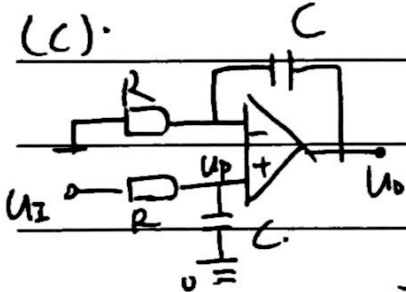


$$U_C = U_I, \quad \dot{U}_C = \dot{U}_2 = C \frac{dU_C}{dt} = C_2 \frac{dU_C}{dt}$$

$$R \dot{U}_2 + U_C = -U_O$$

$$\Rightarrow R C \frac{dU_I}{dt} + \frac{C_1}{C_2} U_I + \text{const} = -U_O$$

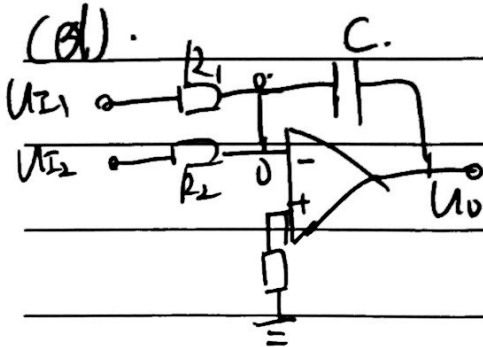
$$\lim_{t \rightarrow 0} \Rightarrow \frac{C_1}{C_2} U_I + \text{const} = -U_O \Rightarrow U_O = -2U_I - \omega^3 \frac{dU_I}{dt}$$



$$\dot{U}_R = \frac{U_I - U_P}{R} = \dot{U}_C = C \frac{dU_P}{dt}$$

$$\frac{U - U_P}{R} = C \frac{d(U_P - U_O)}{dt}$$

$$\Rightarrow U_O = \int \frac{1}{R C} U_I dt = \omega^3 \int U_I dt$$



$$\dot{U}_C = \frac{U_{I1}}{R_1} + \frac{U_{I2}}{R_2} = -C \frac{dU_O}{dt}$$

$$\Rightarrow U_O = -\int (\frac{1}{R_1} U_{I1} + \frac{1}{R_2} U_{I2}) dt$$

P 335. b.14.

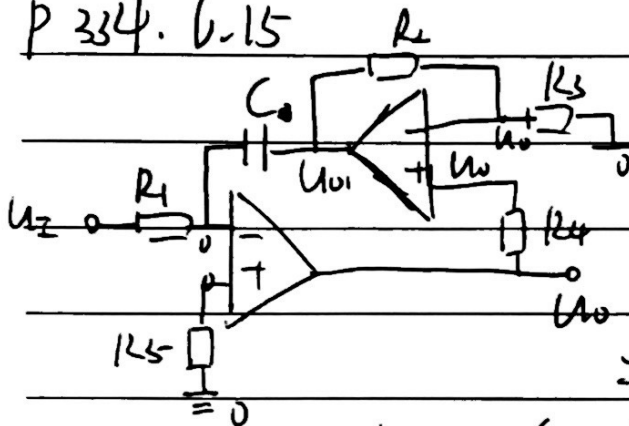
$$(1) \frac{U - U_N}{R'} = \frac{U_N - U_0}{R_2}, \quad \frac{U_I - U_N}{R_1} = \frac{U_N - U_{01}}{R_f}$$

$$\frac{U_{01} - U_c}{R} = C \frac{dU_c}{dt}, \quad U_c = U_0.$$

$$\Rightarrow U_0 = -\int U_I dt = -10 \int U_I dt.$$

$$(2) U_I = -2(t) \quad U_0 = 10 \int 2(t) dt = 10t = 6 \Rightarrow t = 0.6s$$

P 334. b.15

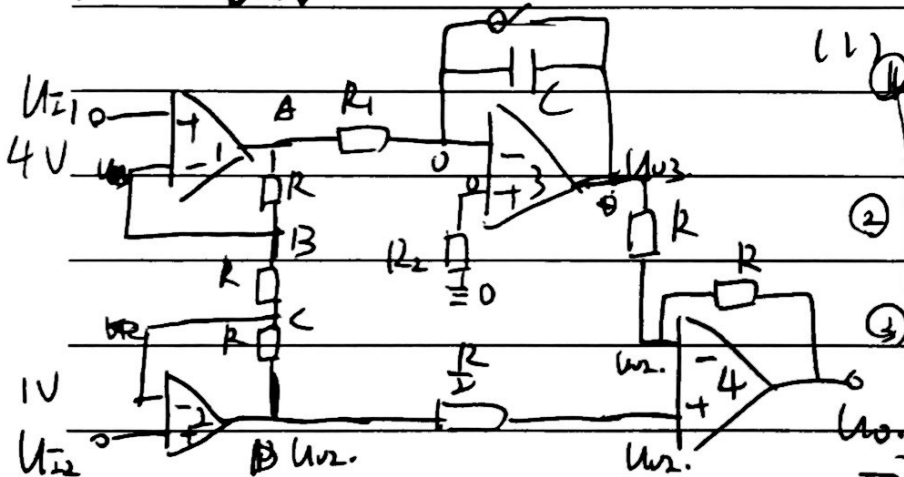


$$\begin{cases} i_{R1} = \frac{U_I - 0}{R_1} = -i_C = -C \frac{dU_{01}}{dt} \\ i_{R3} = \frac{0 - U_0}{R_3} = \frac{U_0 - U_{01}}{R_2} = i_C \end{cases}$$

$$\Rightarrow U_0 = -\frac{R_3}{C R_1 (R_2 + R_3)} \int U_I dt.$$

$$\therefore U_0 = -\int U_I dt.$$

P 335. b.16



$$(1) \frac{U_{01} - U_{I1}}{R_0} = \frac{U_{I1} - U_{I2}}{R} = \frac{U_{I2} - U_{02}}{R}$$

$$(2) \frac{U_{01} - 0}{R_1} \approx I_{R1} (X)$$

$$(3) \frac{U - U_{02}}{R} = \frac{U_{02} - U_0}{R}$$

$$\Rightarrow U_0 = 4U_{I2} - 2U_{I1}$$

$$\therefore U_A = U_{01} = 7V, \quad U_B = U_{I1} = 4V$$

$$U_{01} = 2U_{I1} - U_{I2}, \quad U_{02} = 2U_{I2} - U_{I1}$$

$$U_C = U_{I2} = 1V, \quad U_D = U_{02} = -2V, \quad U_0 = -4V.$$

$$(2) \textcircled{1}, \textcircled{2} \text{ 成立}, \textcircled{3} \text{ 不成立}, \textcircled{4} \text{ 成立} \quad \frac{U_{01} - 0}{R_1} = i_C = C \frac{dU_{03}}{dt}, \text{ 代入初值条件}$$

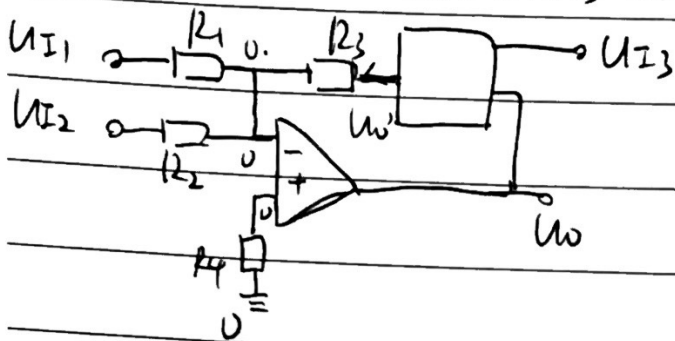
$$\frac{U_{03} - U_{02}}{R} = \frac{U_{02} - U_0}{R} \Rightarrow U_0 = 4U_{I2} - 2U_{I1} + \frac{1}{R_1 C} (2U_{I1} - U_{I2}) = 0$$

$$\Rightarrow t = \frac{1}{35} s$$

P 336. 6.18.

(a).

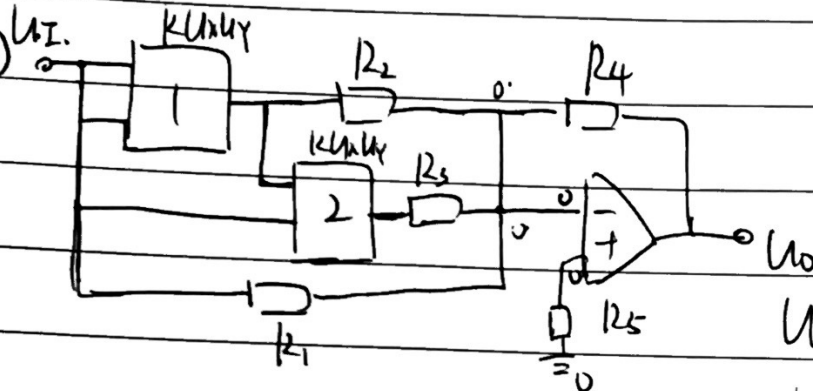
$$U_{0'} = U_1 / U_{I3} \cdot U_0.$$



$$\frac{U_{I1}-0}{R_1} + \frac{U_{I2}-0}{R_2} + \frac{U_{0'}-0}{R_3} = 0.$$

$$\Rightarrow U_0 = -\frac{R_3}{R_1} \left( \frac{U_{I1}}{R_1} + \frac{U_{I2}}{R_2} \right).$$

(b)



$$U_{01} = K U_I^2$$

$$U_{02} = K^2 U_I^3$$

$$\frac{0-U_0}{R_4} = \frac{U_I-0}{R_1} + \frac{U_{02}-0}{R_3} + \frac{U_{01}-0}{R_2}$$

$$\Rightarrow U_0 = -R_4 \left( \frac{U_I}{R_1} + \frac{K^2 U_I^3}{R_3} + \frac{K U_I^2}{R_2} \right).$$