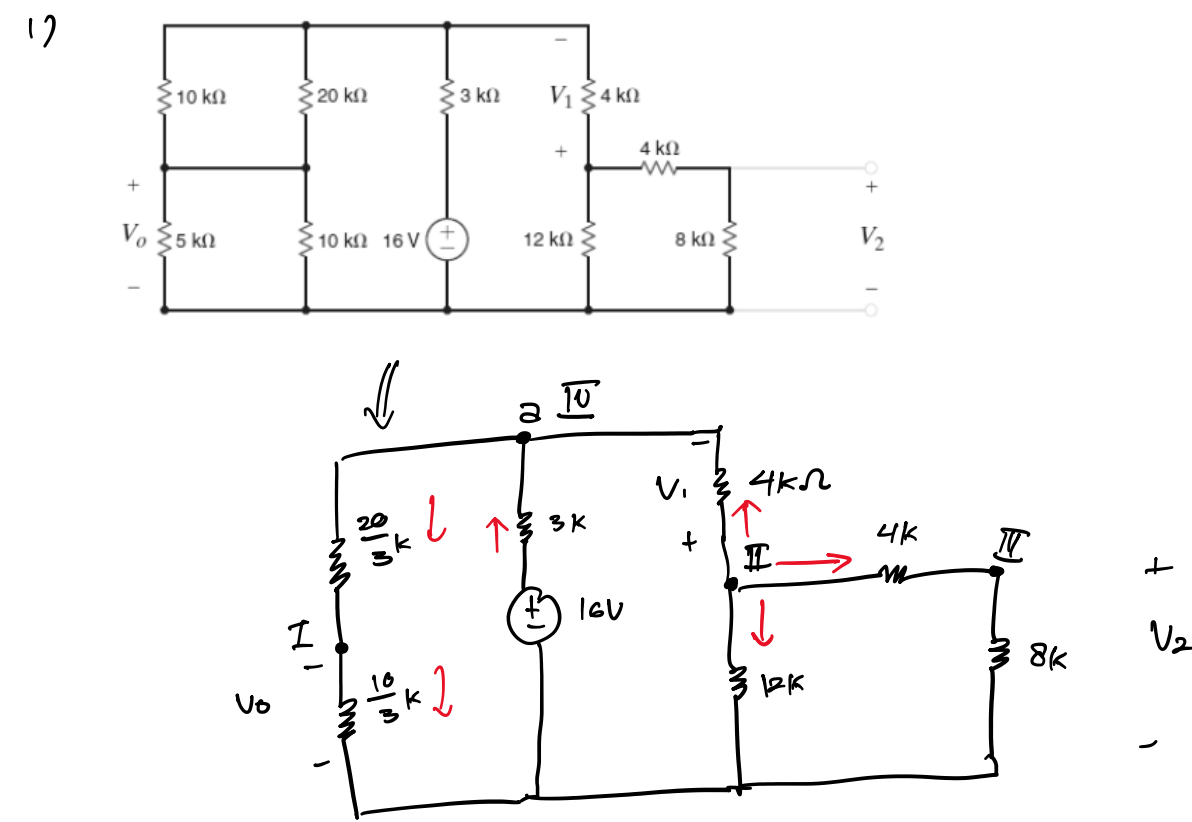


Qlue intern



Analisa Node

Node I $\frac{V_0 - V_0}{20/3k} = \frac{V_0}{10/3k}$

Node II $\frac{V_1 - V_0}{4k} + \frac{V_1}{12k} + \frac{V_1 - V_2}{4k} = 0$

Node III $\frac{V_1 - V_2}{4k} = \frac{V_2}{8k}$

Node IV $\frac{16 - V_0}{3k} + \frac{V_1 - V_0}{4k} = \frac{V_0 - V_0}{20/3k}$

ELIMINASI

$\frac{V_0 - V_0}{20/3k} = \frac{V_0}{10/3k}$

$\frac{1}{20} (V_0 - V_0) = \frac{1}{10} V_0$

$V_0 - V_0 = 2V_0$

$V_0 = 3V_0$

$\frac{V_1 - 3V_0}{4k} + \frac{V_1}{12k} + \frac{V_1 - V_2}{4k} = 0$

$3(V_1 - 3V_0) + V_1 + 3(V_1 - V_2) = 0$

$3V_1 - 9V_0 + V_1 + 3V_1 - 3V_2 = 0$

$V_1 - 3V_2 - 4V_0 = 0 \quad (1)$

$\frac{V_1 - V_2}{4k} = \frac{V_2}{8k}$

$2V_1 - 2V_2 = V_2$

$2V_1 = 3V_2$

$V_1 = \frac{3}{2} V_2$

$V_1 - \frac{3}{2} V_2 = 0 \quad (2)$

$\frac{16 - 3V_0}{3k} + \frac{V_1 - 3V_0}{4k} = \frac{3}{20} V_0 - V_0$

$\frac{16 - 3V_0}{3} + \frac{V_1 - 3V_0}{4} = \frac{3}{20} 3V_0 - V_0$

$\frac{16 - 3V_0}{3} + \frac{V_1 - 3V_0}{4} = \frac{3}{20} V_0$

$\frac{16 - 3V_0}{3} + \frac{V_1 - 3V_0}{4} = \frac{3}{10} V_0$

$\times 120$

$40(16 - 3V_0) + 30(V_1 - 3V_0) = 36V_0$

$640 - 120V_0 + 30V_0 - 40V_0 = 36V_0$

$246V_0 - 30V_1 = 640$

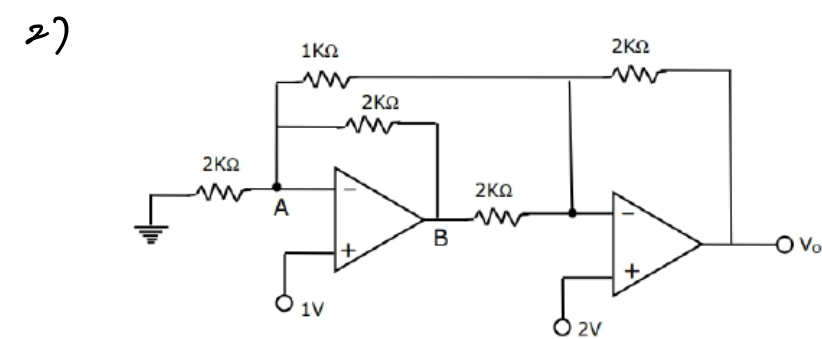
$$\begin{pmatrix} -4 & 7 & -3 \\ 0 & 1 & -3/2 \\ 246 & -30 & 0 \end{pmatrix} \begin{pmatrix} V_0 \\ V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 640 \end{pmatrix}$$

Diselenggarakan Menggunakan MATLAB

$V_0 = 3,33V$

$V_1 = 6V$

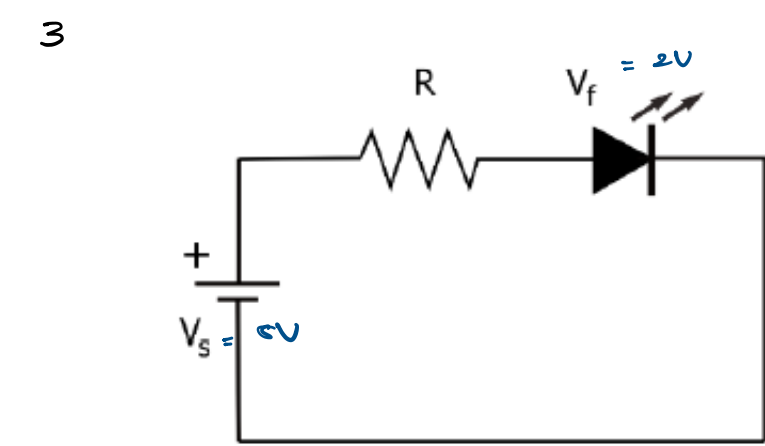
$V_2 = 4V$



$V_0 = \left(1 + \frac{2k}{2k}\right)1 + \left(1 + \frac{2k}{2k}\right)2$

$= (2) \cdot 1 + (1+1)2$

$= 2 + 4 = \underline{6V}$



a) KVL : $V_f - V_s - V_R = 0$

$V_R = V_s - V_f$

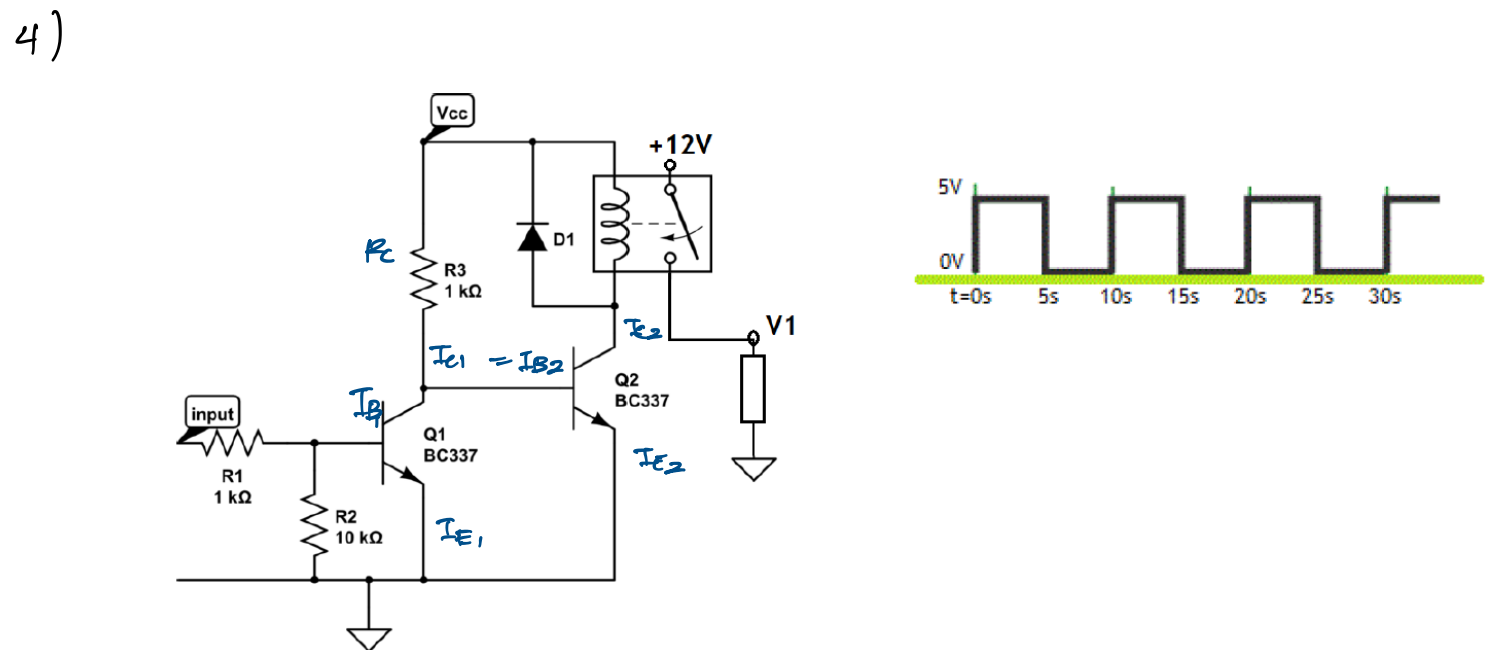
$V_R = 5 - 2 = 3V$

$R = \frac{V_R}{I_R} = \frac{3}{15 \cdot 10^{-3}} = \underline{200\Omega}$

b) $P_{LED} = V_f \cdot I$

$= 2V \cdot 15mA$

$= \underline{30mW}$



$V_{input} = 5V$

$I_B = \frac{5V - 1,2}{10/11k} = \frac{3,8}{10.000} = 4,18mA \rightarrow BJT Q_1 \text{ ON}$

$\frac{1}{R_1 || R_2} = \frac{1}{10} + \frac{1}{1} = \frac{11}{10}$

$R_1 || R_2 = \frac{10}{11}$

BJT Q1 ON

$I_{E1} = I_{C1} + I_{B1}$

$= 4,18 + 5$

$= 9,18$

$I_{C1} = \frac{V_{CC}}{R_C} = \frac{5}{1000} = 5mA$

BJT Q1 akan ON, maka $I_{C1} = I_{B2} = 0$, yang membuat BJT Q2 OFF.

Karena BJT Q2 OFF, maka arus seluruhnya akan mengalir dari VCC kearah BJT Q1. Sehingga beda potensial pada coil relay akan 0 yang membuat relay open

Karena relay open, maka tegangan V1 akan 0 karena rangkaian disebelah kanan akan open