Homework 2

ECE2004 CRN:12898

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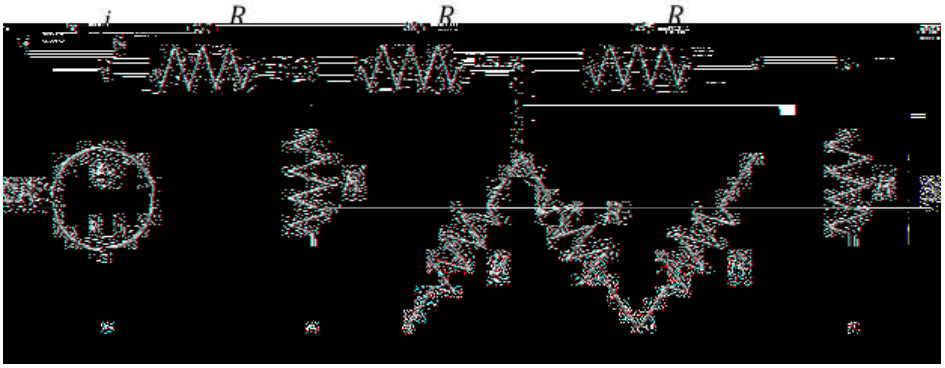
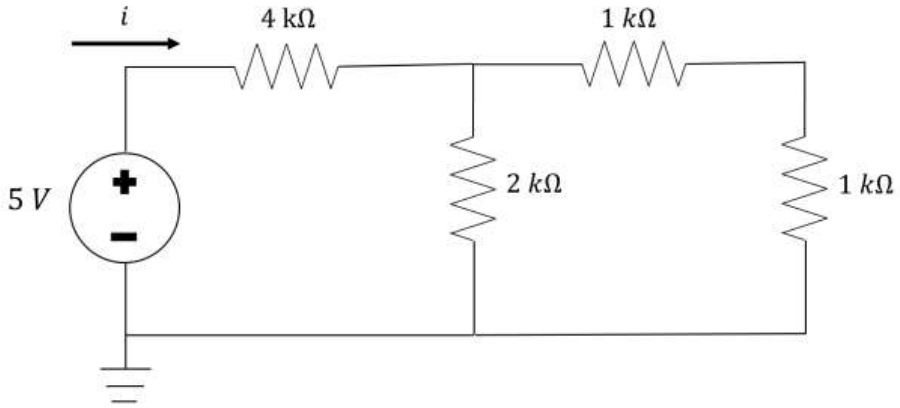
Question 1: Solve for i.



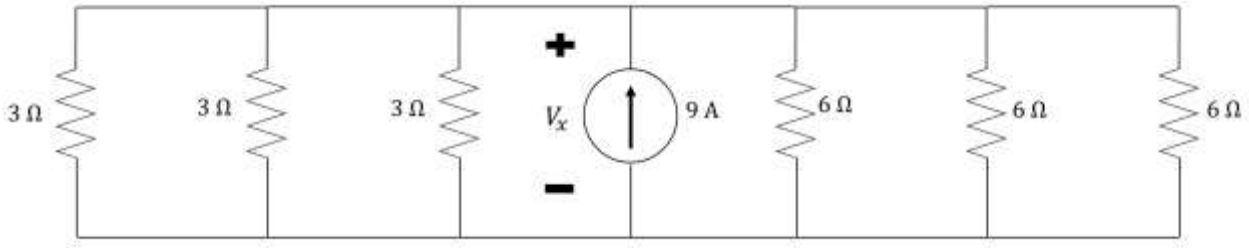
$$
\begin{aligned}
i &= \frac{30R}{R + (R \parallel (R + (R \parallel R \parallel (R + (R \parallel R)))))} \\
&= \frac{30R}{R + (R \parallel (R + (R \parallel R \parallel \frac{R+2R}{2})))} \\
&= \frac{30R}{R + (R \parallel \frac{3R+8R}{8})} \\
&= \frac{30R}{\frac{11R+19R}{19}} \\
&= \frac{30R}{\frac{30R}{19}} \\
&= \frac{30R \times 19}{30R} \\
&= 19A
\end{aligned}
$$

Question 2: If every resistor has a tolerance of $\pm 10\%$ and the nominal values are shown below, find the minimum and maximum current i possible.



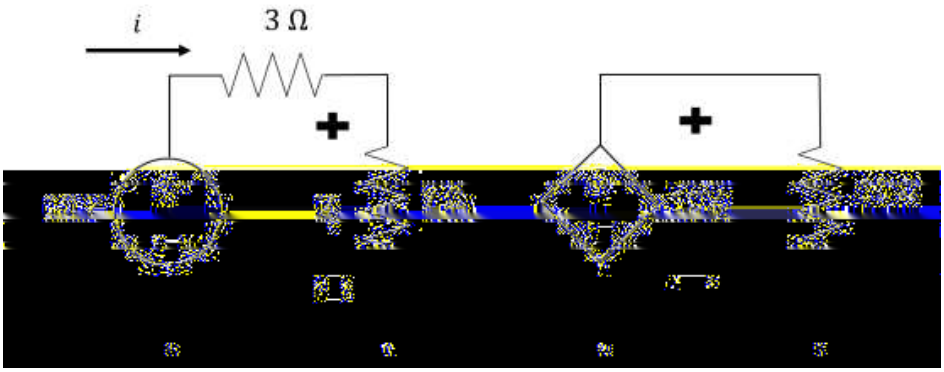
$$
\begin{aligned}
i &= \frac{5V}{4k\Omega \pm 10\% + (2k\Omega \pm 10\% \parallel (1k\Omega \pm 10\% + 1k\Omega \pm 10\%))} \\
&= \frac{5V}{4k\Omega \pm 10\% + (2k\Omega \pm 10\% \parallel 2k\Omega \pm 10\%)} \\
&= \frac{5V}{4k\Omega \pm 10\% + \frac{2k\Omega \pm 10\%}{2}} \\
&= \frac{5V}{4k\Omega \pm 10\% + 1k\Omega \pm 10\%} \\
&= \frac{5V}{5k\Omega \pm 10\%} \\
i_{min} &= 0.\overline{90}A \\
i_{max} &= 1.\overline{11}A
\end{aligned}
$$

Question 3: Find V_x.



$$
\begin{aligned}
V_x &= \frac{9A}{\frac{1}{3\Omega} + \frac{1}{3\Omega} + \frac{1}{3\Omega} + \frac{1}{6\Omega} + \frac{1}{6\Omega} + \frac{1}{6\Omega}} \\
&= \frac{9A}{\frac{3}{3\Omega} + \frac{3}{6\Omega}} \\
&= \frac{9A}{\frac{1}{1\Omega} + \frac{1}{2\Omega}} \\
&= \frac{9A \times 2\Omega}{3} \\
&= \frac{18}{3}V \\
&= 6V
\end{aligned}
$$

Question 4: Find the power consumed by the 10Ω resistor.



$$\begin{aligned}
\frac{V_x - 0}{7\Omega} - \frac{10V - V_x}{3\Omega} &= 0 \\
\frac{10V_x}{21\Omega} &= \frac{10V}{3\Omega} \\
V_x &= 7V \\
\frac{10 \times 7V - 0}{10\Omega} &= 0 \\
i_{10\Omega} &= 7A \\
P_{10\Omega} &= (7A)^2 \times 10\Omega \\
&= 490W
\end{aligned}$$