SOLUTION

THIS EXAM SHOULD BE TAKEN ONLY BY
STUDENTS REGISTERED FOR SECTION 2

September 27, 2012
Name _________________________________

ECE201 Linear Circuit Analysis I
Fall 2012, Section 2, MWF 7:30-8:20am
Exam 1

This exam corresponds to learning objective 1.

Solve the following problems. The number of points for each problem is shown in the table below.

Use only the space provided to solve each problem, and copy the answers to the space marked "Answer:..." Do not forget to specify units.

Show all the steps of your solution. Final answers alone will not be considered.

Non-integer answers can be written as $a/b$ or as $c.d$ where $d$ is rounded to 2-3 digits.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>/ 25</td>
</tr>
<tr>
<td>2</td>
<td>/ 25</td>
</tr>
<tr>
<td>3</td>
<td>/ 25</td>
</tr>
<tr>
<td>4</td>
<td>/ 25</td>
</tr>
<tr>
<td>Total</td>
<td>/ 100</td>
</tr>
</tbody>
</table>
Problem 1

For the circuit below, compute the following quantities: the power delivered by the independent current source, \( V_2 \), \( V_3 \), the power delivered by the dependent voltage source, and the power dissipated by the 16\( \Omega \) resistor.

\[
\begin{align*}
V_1 &= 1 \cdot 8 = 8V \\
P_{\text{ind}} &= V_1 \cdot I = 8W \\
V_2 &= 2 \cdot 0.5V_1 = 8V \\
V_3 &= 2V_2 = 16V \\
I_{\text{dep}} &= I_{16\Omega} = \frac{V_3}{16} = 1A \\
P_{\text{dep}} &= V_3 \cdot I_{\text{dep}} = 16W \\
P_{16\Omega} &= V_3 I_{16\Omega} = 16W \\
\end{align*}
\]

Answer:

(5 points) Power delivered by the independent current source = 8W

(5 points) \( V_2 = 8V \)

(5 points) \( V_3 = 16V \)

(5 points) Power delivered by the dependent voltage source = 16W

(5 points) Power dissipated by the 16\( \Omega \) resistor = 16W
Problem 2

In the following circuit, determine the variables for nodal analysis as learned in class, write equations for the variables you defined, and solve them.
Using the values of the variables you found, compute the power delivered by the independent voltage source.
Mark the variables you define on the circuit.

\[ I_1 = \frac{1-V_1}{1} = 1-V_1 \]
\[ V_1 - 1 + \frac{V_1}{1} - 4I_1 = 0 \]
\[ 1 - 4(1-V_1) = 0 \]
\[ 6V_1 = 5 \]
\[ V_1 = \frac{5}{6} = 0.833V \]

\[ I_1 = 1-V_1 = \frac{1}{6} = 0.167A \]
\[ P_{1V} = 1 \cdot 0.167 = 0.167W \]

Answer:

(5 points) Variables for nodal analysis: \( V_1 \)

(15 points) Values of variables: \( V_1 = \frac{5}{6} = 0.833V \)

(5 points) Power delivered by the independent voltage source = 1/6W = 0.167W
**Problem 3**

In the following circuit, determine the variables for loop analysis as learned in class, write equations for the variables you defined, and solve them.

Using the values of the variables you found, compute $V_1$.

Mark the variables you define on the circuit.

\[
1 \cdot (I_1 - 2) + 1 \cdot (I_1 - 3) - 1 = 0
\]

\[
2I_1 = 6
\]

\[
I_1 = 3
\]

\[
V_1 = 1 \cdot (I_1 - 2) = 1V
\]

Answer:

(5 points) Variables for loop analysis: $I_1$

(15 points) Values of variables: $I_1 = 3A$

(5 points) $V_1 = 1V$
Problem 4

In the following circuit, the goal is to compute $v_{\text{out}}$ in two different ways. Two different source transformations were performed for this purpose. This yielded the two circuits shown on the next page.

For the circuits on the next page, find the values of all the resistors and the values of all the sources, and mark $v_{\text{out}}$ on each one of the circuits. You do not need to compute $v_{\text{out}}$.

You can use the space below for computations.

Mark all your answers on the circuits.
circuit 1 (15 points)

\[ \begin{align*}
&2.5A \quad &4/3\Omega \quad v_{\text{out}}
\end{align*} \]

Do not forget to mark \( v_{\text{out}} \) on the circuits (show the +/- terminals and write \( v_{\text{out}} \) between them).

circuit 2 (10 points)

\[ \begin{align*}
&4\Omega \quad 2\Omega \quad \quad \quad 2V \quad &4V \quad v_{\text{out}}
\end{align*} \]