Lab #4 – Pre-lab Assignment

DC Attenuator Design and Measurement

Name ____________________  Grade _____/10

Introduction
Attenuators are circuits that are commonly used in radio frequency (RF) applications to both reduce the level of the signal and to match the resistance of the source ($R_S$) to that of the load ($R_L$). One of the reasons that you want to match the source and load resistances is to eliminate standing waves on the transmission lines, thereby reducing distortion. Another reason is to transfer maximum power to the load. Shown below is a circuit called a π-attenuator whose name is derived from its visual architecture.

1) In the circuit at the right, $V_S$ is an AC source with a value of 6.0 V peak-to-peak and $R_S = 50 \, \Omega$. Place a load resistor $R_L$ between the + and − terminals and fill in the table below for the indicated values of $R_L$. Note that this circuit behaves like a voltage divider for the AC source, just like it does for a DC source.

<table>
<thead>
<tr>
<th>$R_L$</th>
<th>1000</th>
<th>500</th>
<th>200</th>
<th>100</th>
<th>80</th>
<th>60</th>
<th>50</th>
<th>40</th>
<th>30</th>
<th>20</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_O(\text{calc})$ (V)</td>
<td></td>
<td></td>
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</tbody>
</table>
2) Using the values for the \( \pi \)-attenuator circuit shown above, calculate the input resistance to the attenuator stage (the resistance seen to the right of \( R_S \)) for load values of \( R_L = 0 \ \Omega \), \( R_L = 50 \ \Omega \), and \( R_L = \infty \ \Omega \). You may draw your circuits on the right and below to aid your computations.

For \( R_L = 0 \ \Omega \)

\[ R_{in, \text{calculated}} = \ \underline{\phantom{0000}} \ \Omega \]

For \( R_L = 50 \ \Omega \)

\[ R_{in, \text{calculated}} = \ \underline{\phantom{0000}} \ \Omega \]

For \( R_L = \infty \ \Omega \)

\[ R_{in, \text{calculated}} = \ \underline{\phantom{0000}} \ \Omega \]