Department of Electronics and Electrical Engineering
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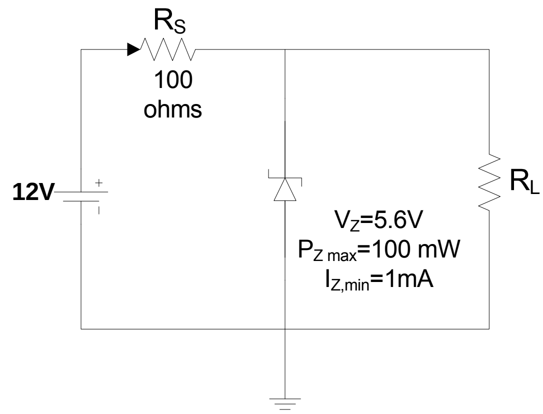
EE101 **Quiz1** **Maximum Marks: 10** **Time: 45Minutes**

1. In the circuit shown in figure1, the load resistance R_L is allowed to vary.
(a) What would be the range of R_L for which this circuit will operate properly? **[3]**
(b) When R_L varies over the range where the circuit works properly, what will be the minimum and maximum values of the current through the Zener diode (I_Z) and the power dissipated (P_Z) dissipated by it? [**2**]



Solution:

(a) To satisfy the condition that $I_Z > I_{Z,min}$, we need

$$\frac{12-5.6}{100} - \frac{5.6}{R_L} > 0.001$$ or $\mathbf{R_L > 88.89\ \Omega}$

(1+0.5)

To satisfy the condition that $P_{Zmax} < 0.1$ W, we need

$$\left[\frac{12-5.6}{100} - \frac{5.6}{R_L}\right] 5.6 < 0.1$$ or $\mathbf{R_L < 121.48\ \Omega}$ **(1+0.5)**

(b) $I_{Z,min}$=1 mA
$I_{Z,max} = \frac{12-5.6}{0.1} - \frac{5.6}{0.12148}$ = 17.8 mA (or trivially, $\frac{100}{5.6}$)
$P_{Z,min}$= 5.6x0.0.001 =0.0056 W
$P_{Z,max}$= 0.1 W

4x0.5

2. Consider the active linear network shown in figure 2.

(a) Find the Thevenin equivalent circuit of the network at terminal a-b. **[3]**

(b) Find the maximum power that the network can deliver to a resistive load at a-b. **[2]**

Figure 1

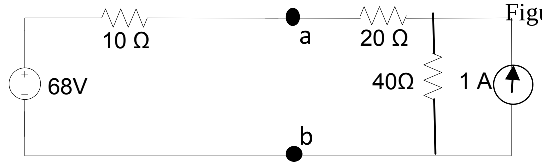
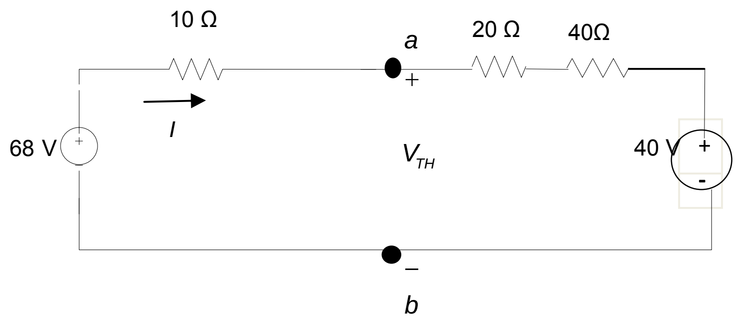


Figure 2

Solution:

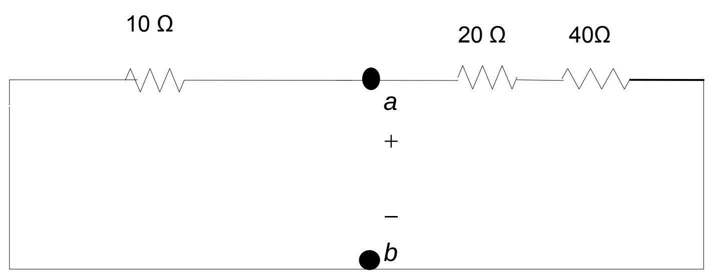
(a) To find the Thevenin equivalent circuit:

(i) First apply source transformation to the right-hand current source



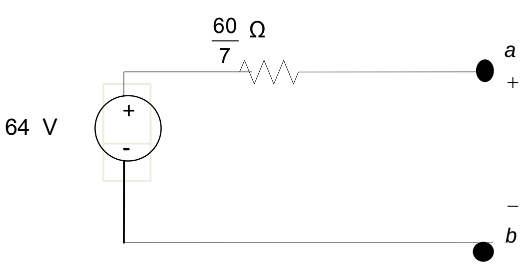
$$I = \frac{68-40}{10+20+40} = 0.4A \quad \Rightarrow \therefore V_{TH} = 68 - 10\times 0.4 = 64V$$

(ii) Switch off the voltage and current source to get the circuit below:



$$\therefore R_{TH} = (20+40)\,||\,10 = \frac{60}{7}\Omega$$

Therefore, the Thevenin equivalent circuit is as shown in the figure below:



(b) The maximum power that can be delivered by the network

$$= \frac{V_{TH}^2}{4R_{TH}} = 64\times 64/(4\times 60/7) = 119.47W$$