Experiment 2: Zener Diodes and their Regulator Applications
In this experiment, properties of zener diodes will be investigated, their regulator applications will be introduced.

Preliminary Work
1. Plot the typical zener diode characteristics and specify the breakdown voltage $V_z$, the minimum zener current $I_{z, \text{min}}$, and the threshold voltage $V_0$.

The following questions are related with the regulator circuit shown in the figure. Zener diode characteristics are: $V_z = 7.5V$, $I_{z, \text{min}} = 20mA$, and $P_{z, \text{max}} = 500mW$

2. Assume that ripple voltage is zero and calculate the voltage denoted as $V_1$.
3. For load resistance ($R_L$) varying between 220 and 5220 ohms, calculate maximum ($I_{L, \text{max}}$) and minimum ($I_{L, \text{min}}$) load currents.
4. Assuming the zener diode is dissipating its maximum power, load current values are as calculated in part 3, and load voltage ($V_L$) is constant at 7.5V, what should be the value of the resistor $R$?
5. Assuming that $R = 150 \Omega$, calculate the maximum value of $V_1$ that will cause the zener diode to be burnt.

Experimental Work
1. With the available components on the desk, design and set up a circuit to obtain the characteristic curve of a zener diode on the oscilloscope. Plot the curve indicating critical points.
2. Set up the circuit in figure for $R = 150 \Omega$, $C = 100 \mu F$. For maximum and minimum values of $R_L$, measure the maximum and minimum values of $I_L$ and $V_L$.
3. Connect a $R_p = 1K \Omega$ potentiometer in series with the resistor $R$. Varying the $R_p$, determine the values of $V_{\text{max}}$ and $V_{\text{min}}$;
   For $V = V_{\text{max}}$, measure $V_{L, \text{min}}$ and $V_{L, \text{max}}$ by changing $R_L$
   For $V = V_{\text{min}}$, measure $V_{L, \text{min}}$ and $V_{L, \text{max}}$ by changing $R_L$

Conclusion and Comments
1. Compare the theoretical and experimental results for each step. Shortly comment on the differences.