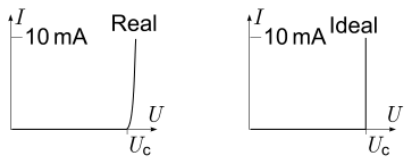
4. Electric experiment (12 p)

Find the capacitance of an unknown capacitor and estimate the experimental uncertainty.

Equipment: red light emitting diode (LED), three resistors one of resistance $R_1 = 1.5\,\mathrm{k}\Omega$ one of resistance $R_2 = 6.2\,\mathrm{k}\Omega$, and one of unknown resistance; a battery of unknown electromotive force (internal resistance is smaller than $500\,\Omega$), wires, timer, unknown capacitor.

Remarks: below is provided a typical $V - I$ curve of a LED; during this experiment, the $V - I$ curve of the LED can be approximated with that of an ideal diode, cf. graph. The value of the opening voltage U_c of the LED is not known. When there is a non-zero current through the LED, it emits light.



If a capacitor of capacitance C and resistor of resistance R are connected in series to an electromotive force E then the capacitors voltage will approach exponentially its asymptotic value: $U = E \pm U_0 e^{-t/RC}$.