

# PHY 240: Basic Electronics

## Homework Problem H11

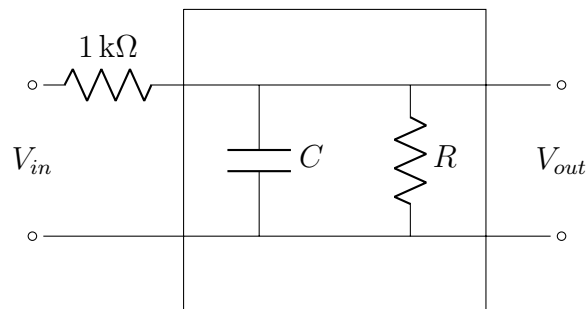
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### 1. RC Detective.

Consider this circuit, in which we wish to determine the values of  $R$  and  $C$ . Unfortunately,  $R$  and  $C$  are locked up inside of a device (represented by the dashed line) that prevents their direct measurement.



In order to determine the values of  $R$  and  $C$  within the device, we place a known resistor of resistance  $1\text{ k}\Omega$  in front of the device, hold the input voltage at  $10\text{ V}$  for a long time, and then allow it to drop suddenly to  $0\text{ V}$  at time  $t = 1\text{ ms}$ . While we do this, we monitor both  $V_{in}$  and  $V_{out}$ . The results are shown in the plot below (in which the dashed curve represents  $V_{in}$  and the solid curve represents  $V_{out}$ ).

Use the plot to determine  $R$  and  $C$ . Here are a few hints:

- You can use the steady state behavior of the circuit to determine  $R$ !
- You can use the capacitor's discharge curve to determine the product  $R_{eff}C$ !
- You can relate  $R$  to  $R_{eff}$  by considering how the two resistors are configured from the point of view of a discharging  $C$ .

Graph here.

**Solution:** Finding  $R$  is easier, so let's do that first.