

## EEE210: Electronic Circuits and Devices

### Lab #3: Diodes – Circuits with capacitors

**Experimental work:** Use diodes 1N4148 or an equivalent (1N914). All oscilloscope readings are done with DC coupling of the input channels unless otherwise noted. Measurements can also be done (more conveniently) with the *Analog Discovery* gizmo by *Digilent*.

1. Build the circuit of figure 1 with  $R_1 = 1 \text{ k}\Omega$ ,  $R_2 = 2.2 \text{ k}\Omega$  and  $C = 0.1 \text{ }\mu\text{F}$ . Apply on  $V_i(t)$  a square wave of amplitude 5 volts (10 V peak-to-peak), frequency 200 Hz and 0-DC offset. Measure the time constants  $\tau_1$  and  $\tau_2$  corresponding to the rise and the fall of the output signal  $V_o(t)$  (use the cursors for better accuracy).
2. Build the circuit of figure 2 with  $R_1 = 1 \text{ k}\Omega$ ,  $R_2 = 2.2 \text{ k}\Omega$  and  $C = 0.033 \text{ }\mu\text{F}$ . Apply on  $V_i(t)$  a square wave of amplitude 5 volts (10 V peak-to-peak), frequency 200 Hz and 0-DC offset. Adjust the *trigger* to a level of approximately -2 V with a negative slope. Accurately measure the minimum value of  $V_o(t)$  and the width of the *triangular pulse* at  $V_o(t)$  or, if you are using the *Analog Discovery* gizmo, export the data to a `csv` file; this can be opened in a spreadsheet.
3. Build the circuit of figure 3 with  $C = 0.1 \text{ }\mu\text{F}$  (do not connect resistor  $R$ ; this resistor is in the oscilloscope's input circuitry). Apply on  $V_i(t)$  a sinewave of amplitude 3 volts (6 V peak-to-peak), frequency 200 Hz. Observe the waveform  $V_o(t)$  and its maximum values for  $V_R = 0, 1, 5 \text{ V}$ , and when the DC offset of  $V_i(t)$  is 0,  $\pm 1$ ,  $\pm 2 \text{ V}$ . Repeat with a triangular wave and a square wave at  $V_i(t)$ . Briefly describe the operation that the circuit performs on the input waveform  $V_i(t)$ .
4. *Do not use the gizmo; use the oscilloscope, a function generator and a voltmeter.* Build the circuit of figure 4 with capacitors of  $0.1 \text{ }\mu\text{F}$ . Apply on  $V_i(t)$  a sinewave of amplitude 10 volts (20 V peak-to-peak), frequency 200 Hz and 0-DC offset. Measure voltage  $V_o(t)$  with the oscilloscope. Measure the voltage across each of the capacitors WITH A DC VOLTMETER.

**Report:** Compare the experimental measurements and observations with the results predicted by the theory as presented in class (and the course notes).

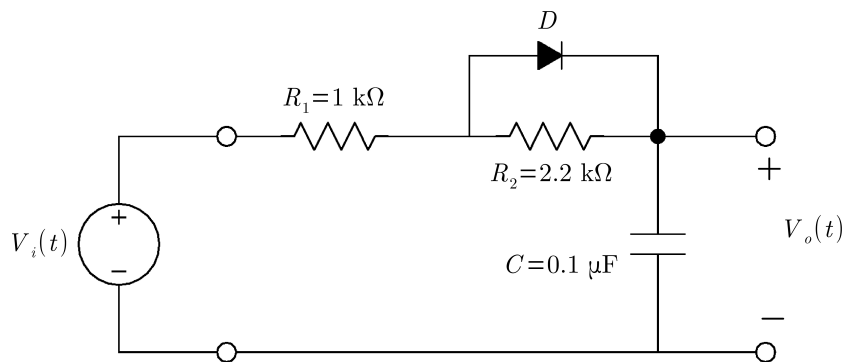


Figure 1:

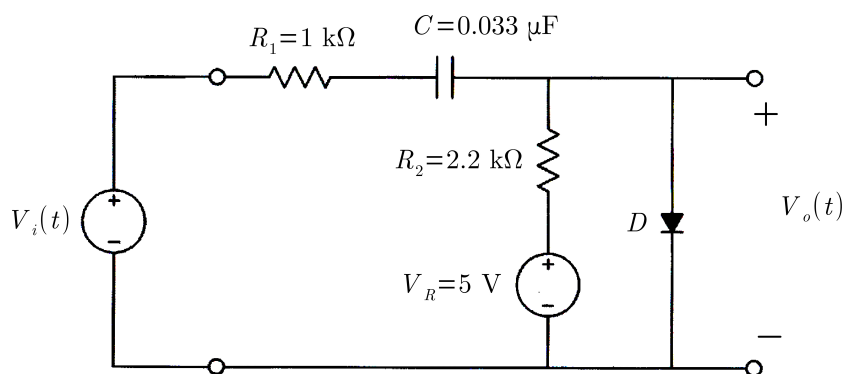


Figure 2:

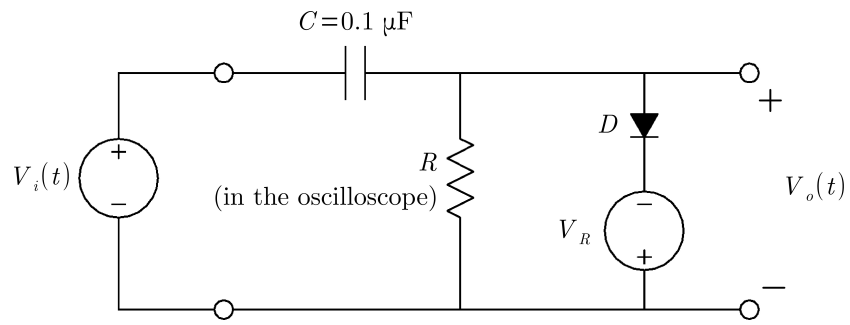


Figure 3:

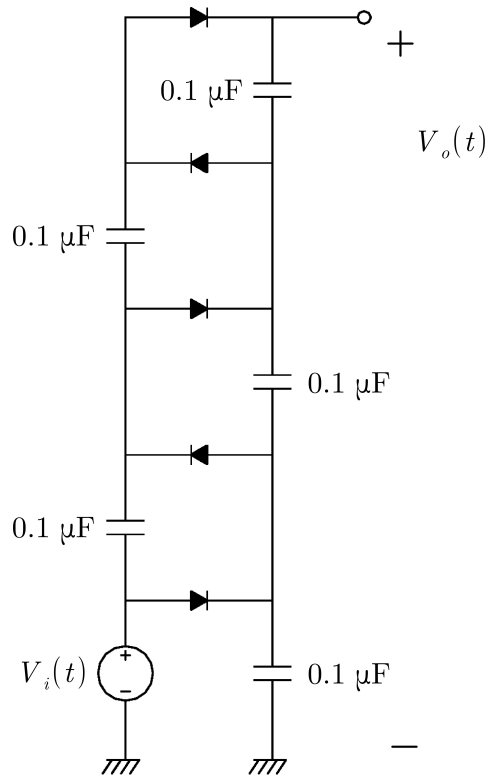


Figure 4: