Electronics

Laboratory Exercise 1

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Introduction

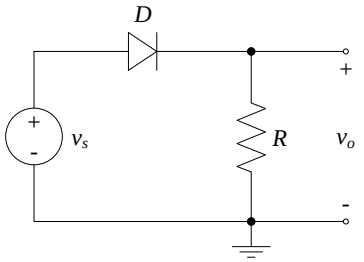
The purpose of this exercise is to examine basic diode and operational amplifier circuits. The exercise consists of several tasks; each of them requires performing the following steps:

1. Setting up a circuit,
2. Setting up supply voltages/currents and/or input signals,
3. Preparing measuring devices,
4. Taking measurements,
5. Storing the results.

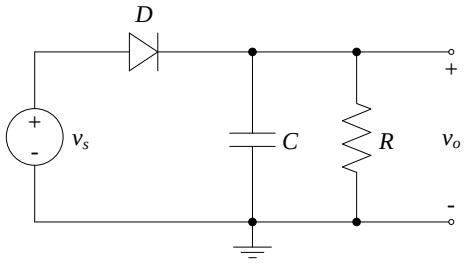
A report containing the description of the performed measurements, circuit diagrams, results in the form of tables and plots should be prepared. The report should also contain, if applicable, comparison between the theory and experimental results, as well as comments and conclusions.

Task 1: Half-Wave Rectifier

1. Build a half-wave rectifier as shown below using a diode and resistor R = 33 kΩ. Input signal v_s should be taken from the function generator. Use sinusoidal signal of frequency 100 Hz and amplitude about 2.5 V.



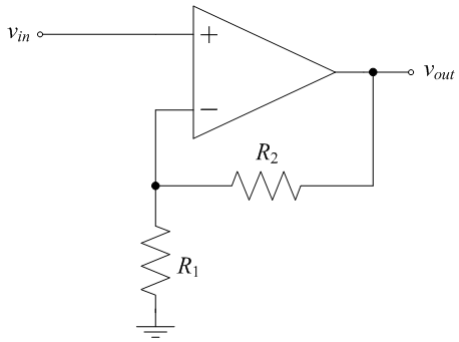
2. Observe the input signal v_s and output signal v_o using the oscilloscope. Determine the voltage drop across the diode.
3. Modify the rectifier circuit as shown below:



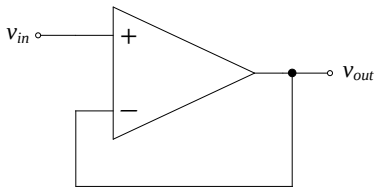
4. For each of the following capacitance values C = 0.22 µF and C = 1 µF observe the input and output signals using the oscilloscope. Determine the value of the ripple voltage in each case.
5. Compare the values of the ripple voltages obtained experimentally with the theoretical ones.

Task 2: Parameters of Operational Amplifier LM741

1. Build a noninverting amplifier circuit as shown below. Use R_1 = 100 Ω and R_2 = 10 kΩ so that the amplifier gain is about 100.



2. Using a Bode Analyzer measure the AC characteristics of the circuit in the frequency range 100 Hz to 50 kHz. Use 10 steps per decade and input signal amplitude of 20 mV. Find the gain-bandwidth product (GBW) of the operational amplifier and compare it to the nominal value (1 MHz).
3. Build a voltage follower circuit as shown below:



4. Apply a rectangular waveform (amplitude around 2.5 V) to the input of the circuit and observe both the input and the output signal using the oscilloscope. Determine the slew-rate (SR) of the operational amplifier and compare it to the nominal value (0.5 V/μs).