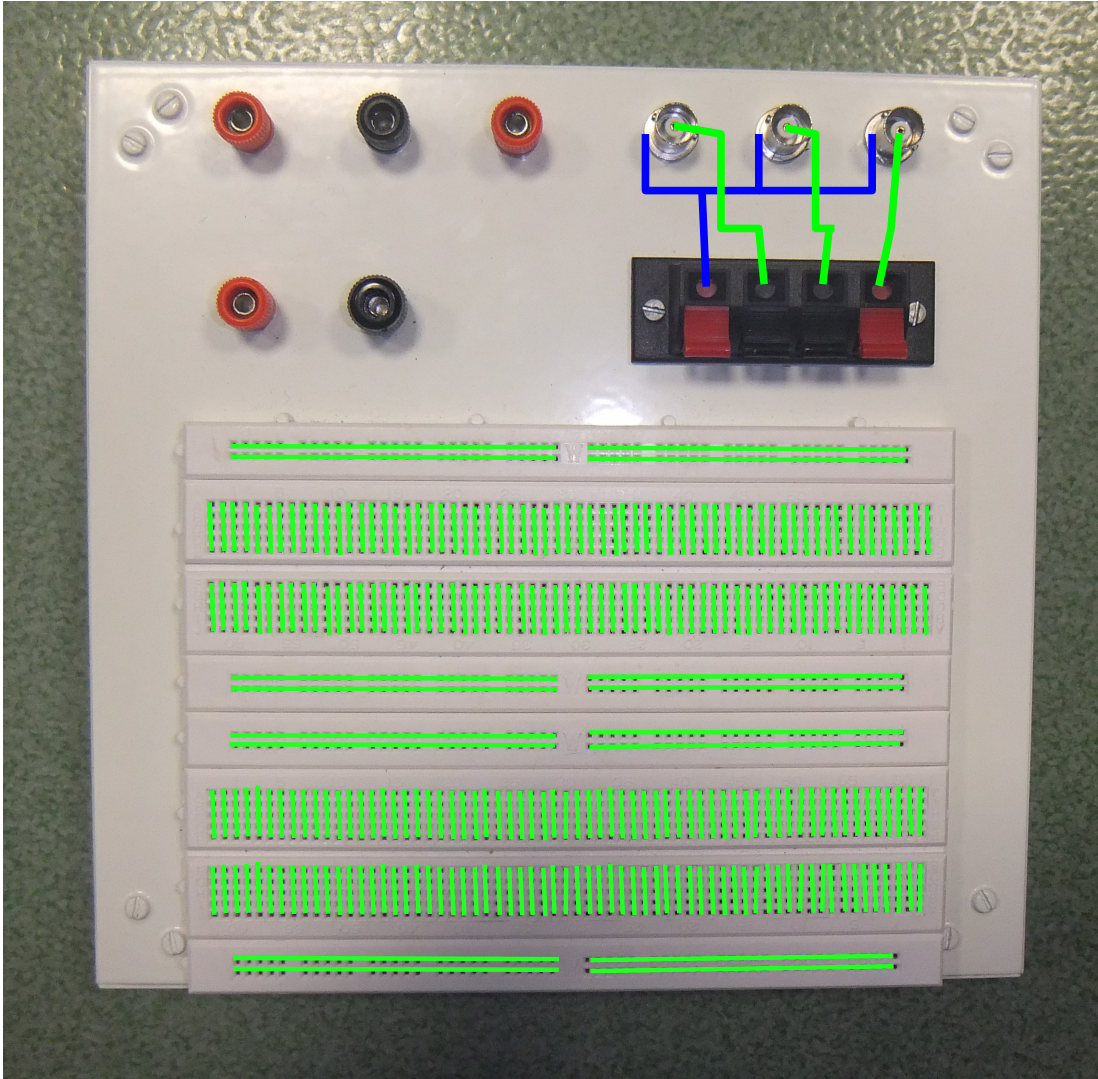


# **Semiconductor Devices and Analog Circuits**

## **Lab 00**

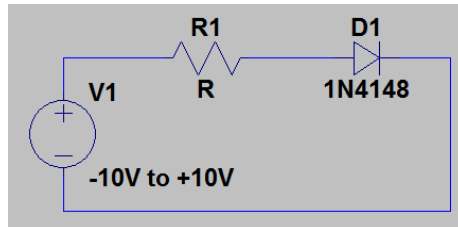


Breadboard connection diagram:

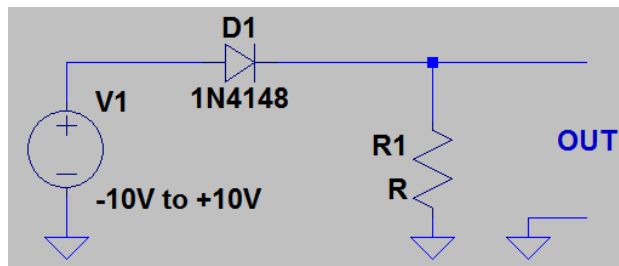


## Diode circuits

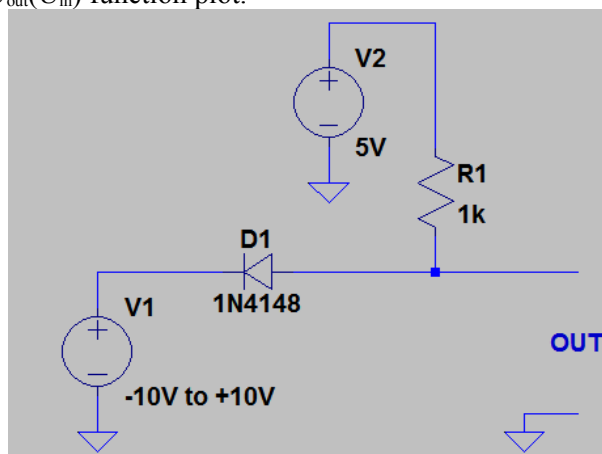
1. Prepare a circuit for measuring the diode  $I_d(U_d)$  curve according to the schematic below. Change the input voltage within the range of  $-10V$  to  $+10V$ . By measuring the voltage across the diode and across the resistor, prepare the necessary data for the plot: for each measurement point the diode voltage and diode current are needed. For negative voltages use  $3.3M\Omega$  resistor, for positive voltages please use the  $1k\Omega$  resistor. Please prepare the plot  $I_d(U_d)$ . Based on the plot, please estimate the forward voltage of the diode. For measurements please use the multimeter on DC voltage range.



2. Please consider the following circuit with a diode and a resistor. What voltages will be present on the output of the circuit when the input voltage range is  $-10V$  to  $+10V$ ? Please assume the forward voltage of the diode to be equal to the one estimated in the previous point and use a simple model of the diode with zero dynamic resistance. Please prepare the  $U_{out}(U_{in})$  function plot.

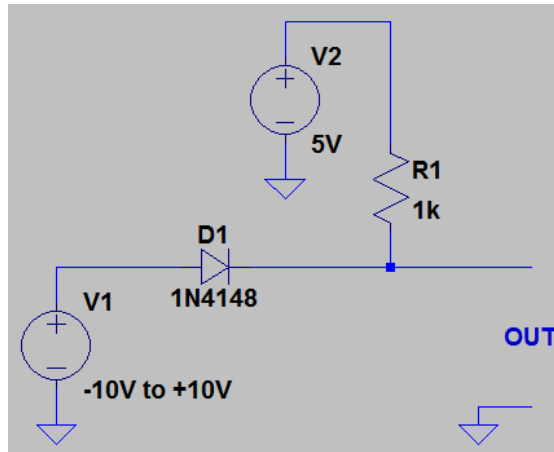


3. Please consider the following circuit with a diode and a resistor. What voltages will be present on the output of the circuit when the input voltage range is  $-10V$  to  $+10V$ ? Please assume the forward voltage of the diode to be equal to the one estimated in the point 1 and use a simple model of the diode with zero dynamic resistance. Please prepare the  $U_{out}(U_{in})$  function plot.



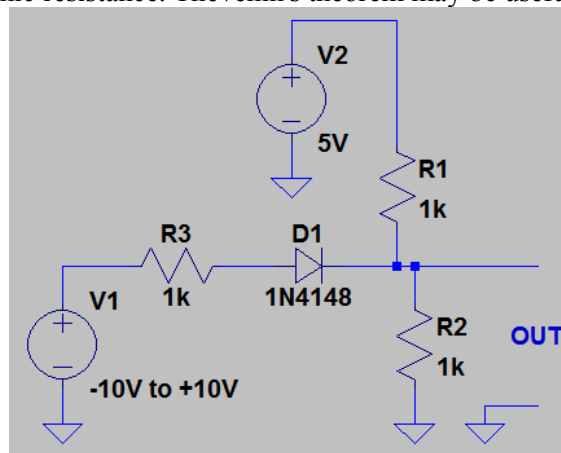
4. Build and measure the circuit from the previous point. Make measurements for the whole range of input voltages (from  $-10V$  to  $+10V$ ) with a step of  $1V$ . For measurements please use the multimeter on DC voltage range.

5. Please consider the following circuit with a diode and a resistor. What voltages will be present on the output of the circuit when the input voltage range is  $-10\text{V}$  to  $+10\text{V}$ ? Please assume the forward voltage of the diode to be equal to the one estimated in the point 1 and use a simple model of the diode with zero dynamic resistance.



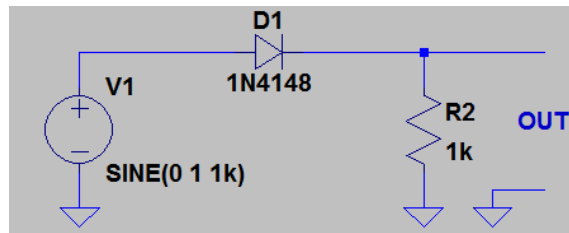
Please prepare the  $U_{\text{out}}(U_{\text{in}})$  function plot.

6. Build and measure the circuit from the previous point. Make measurements for the whole range of input voltages (from  $-10\text{V}$  to  $+10\text{V}$ ) with a step of  $1\text{V}$ . For measurements please use the multimeter on DC voltage range.
7. Please consider the following circuit with a diode and a resistor. What voltages will be present on the output of the circuit when the input voltage range is  $-10\text{V}$  to  $+10\text{V}$ ? Please assume the forward voltage of the diode to be equal to the one estimated in the point 1 and use a simple model of the diode with zero dynamic resistance. Thevenin's theorem may be useful in this task.

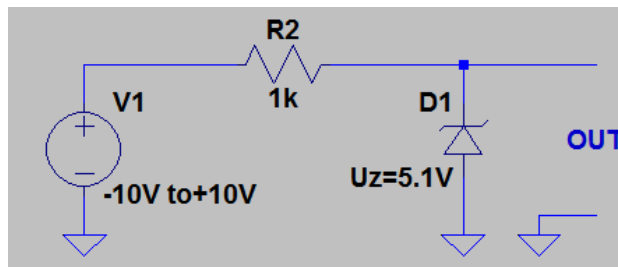


8. Build and measure the circuit from the previous point. Make measurements for the whole range of input voltages (from  $-10\text{V}$  to  $+10\text{V}$ ) with a step of  $1\text{V}$ . For measurements please use the multimeter on DC voltage range.

9. Please build the following circuit with a diode and a resistor. Using oscilloscope, measure the voltages present on the output of the circuit when the input voltage is a sinewave with 0V DC offset, 2V pk-pk voltage and 1kHz frequency. Please draw the input and output voltage shape. Adjust the -pk-pk voltage to be 5V. How does the output voltage change? What is the difference between the input and output voltage for positive voltages on the input? Please explain the value of this difference.



10. Please consider the following circuit with a Zener diode and a resistor. What voltages will be present on the output of the circuit when the input voltage range is -10V to +10V? Please assume the forward voltage of the diode to be equal to the one estimated in the point 1 and the Zener voltage to be equal to 5.1V. This time we assume that the dynamic resistance of the diode is not zero (but is yet unknown – the guess is that it is much smaller than  $1k\Omega$ ).



11. Build and measure the circuit from the previous point. Make measurements for the whole range of input voltages (from -10V to +10V) with a step of 0.2V. For measurements please use the multimeter on DC voltage range. Please prepare a graph showing the output voltage to input voltage dependency. Please calculate the value of the dynamic resistance of the diode (separately for forward and reverse conduction) based on the obtained results and the graph.