Protocol Laboratory: Electrical Engineering #4

Hochschule Rhein-Waal

Rhine-Waal University of Applied Sciences

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	Quang Minh, Dinh / 24211
	Edwin, Changiyoga / 22439
Course name:	Laboratory: Electrical Engineering
Group:	C
Faculty:	Communication and Environment
Deadline:	18.07.2019
Semester:	SS 2018/19
Supervisor:	Prof. Dr.-Ing. Christian Ressel
	Dipl.-Ing. (FH) Nicole Yazici

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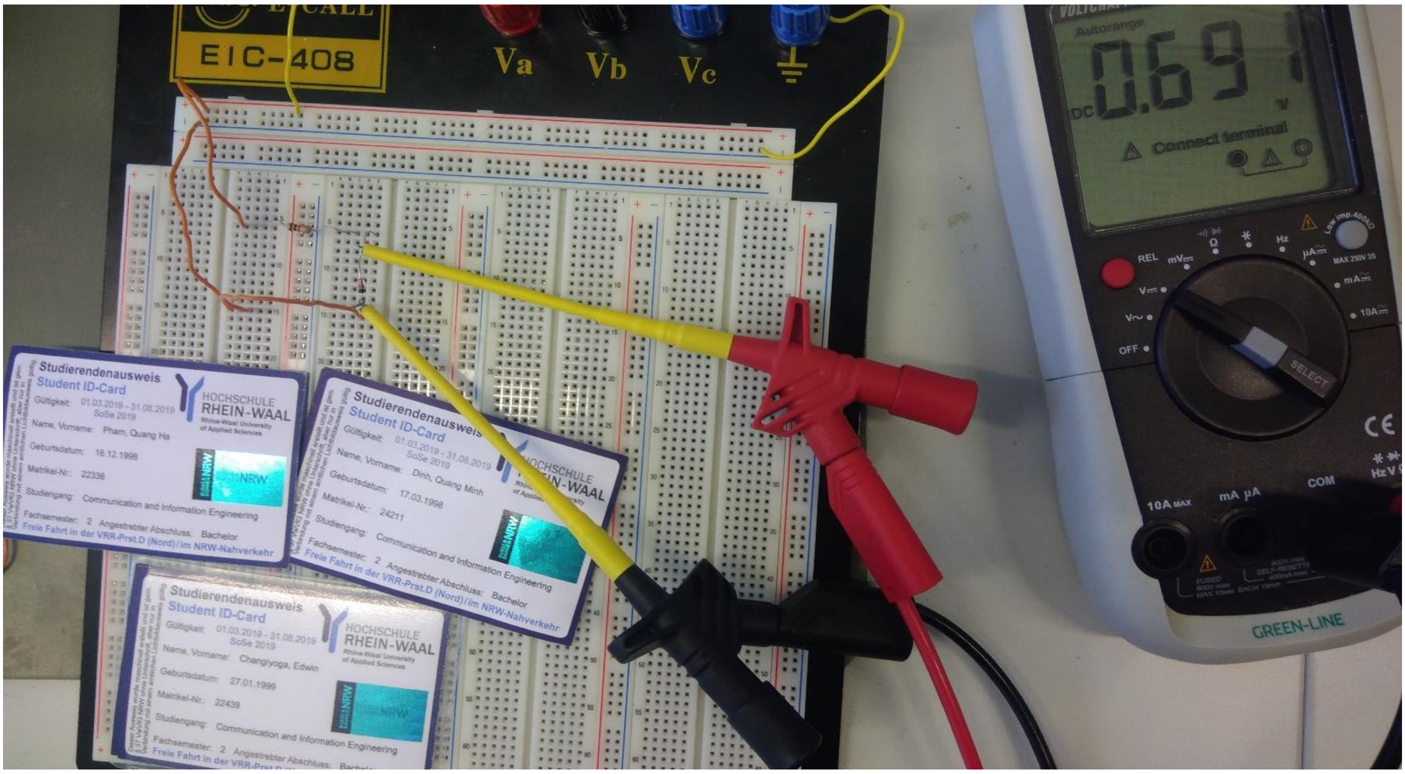
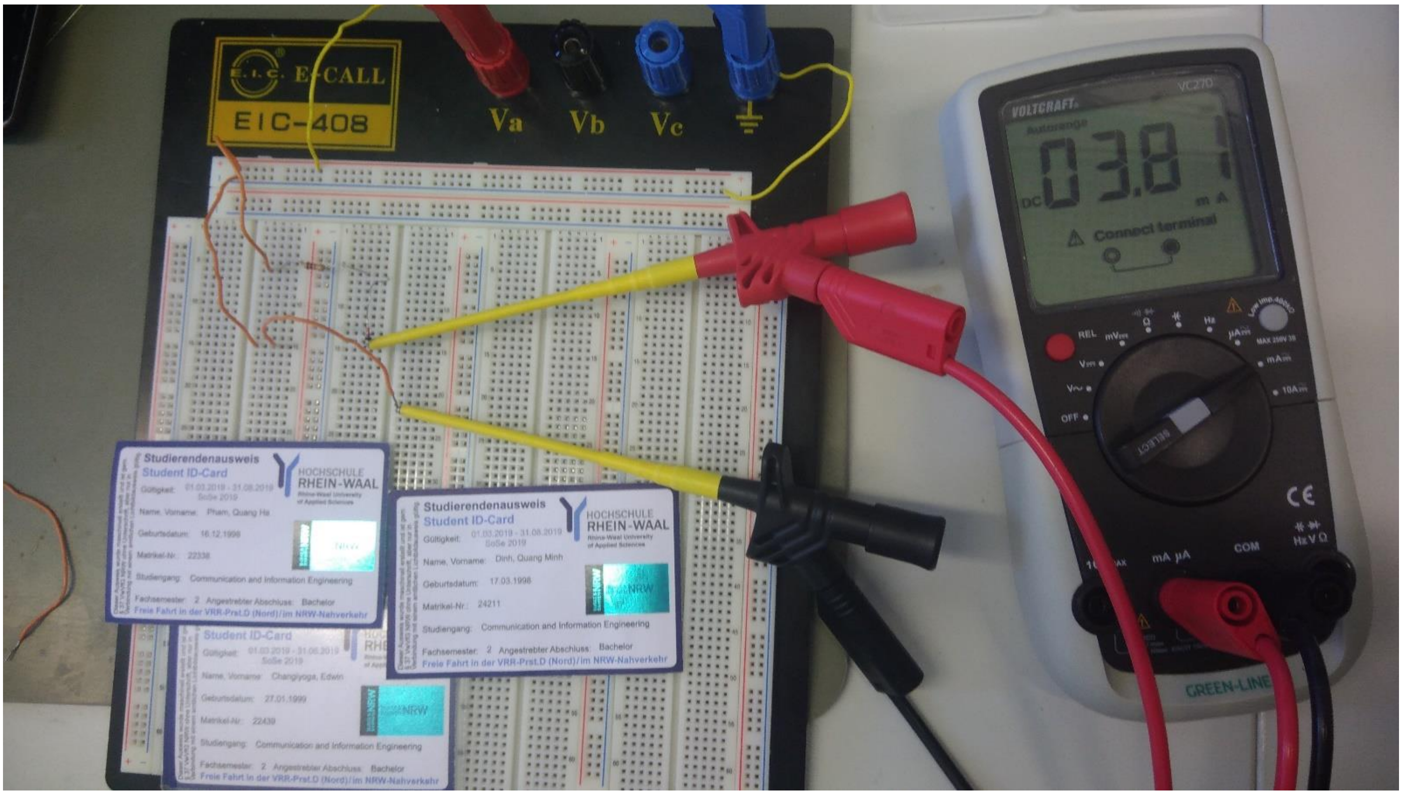
Challenge #1

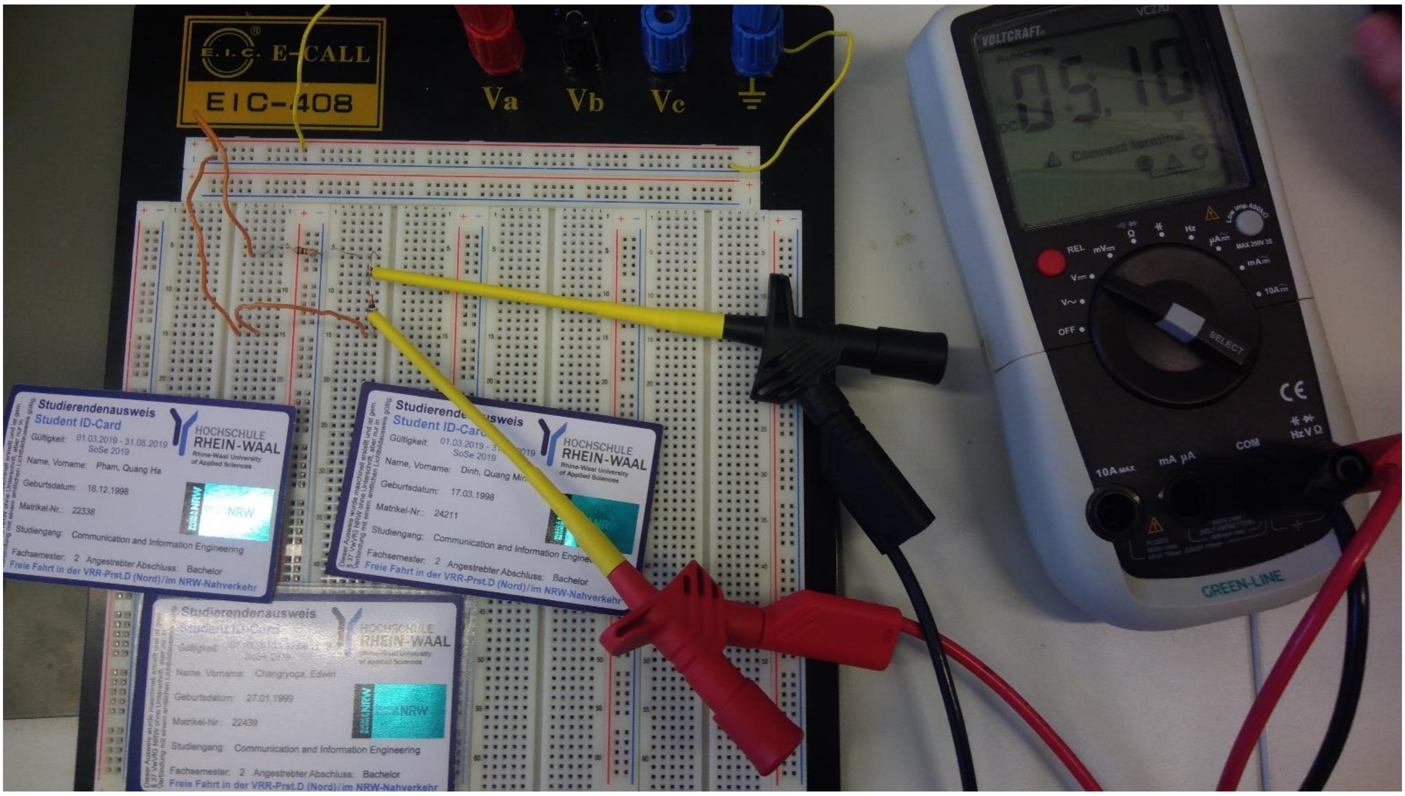
Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

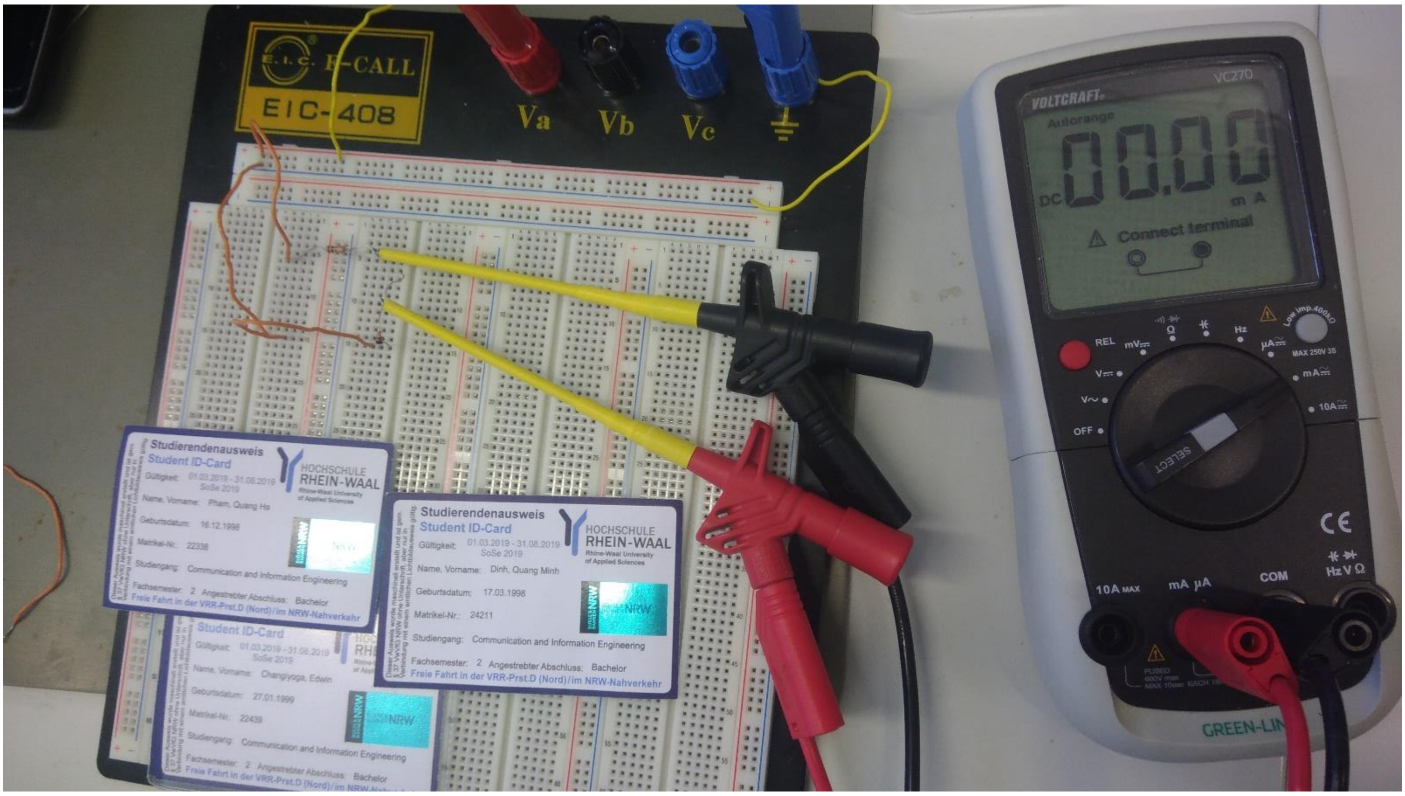
Pictures:







E.I.C. E-CALL
EIC-408
Va
Vb
Vc
VOLTCRAFT
05.10
Studierendenausweis
Student ID-Card
HOCHSCHULE RHEIN-WAAL
GREEN-LINE



E.I.C. E-CALL
EIC-408
Va
Vb
Vc
VOLTCRAFT
VC270
Autorange
00.00
mA
Connect terminal
Studierendenausweis
Student ID-Card
HOCHSCHULE RHEIN-WAAL

Results:

Describe the function of a diode.

A diode can let an electric current pass in one direction but block the current running in the opposite direction.

Or in other words, a diode only allows the current to pass through a circuit in one direction.

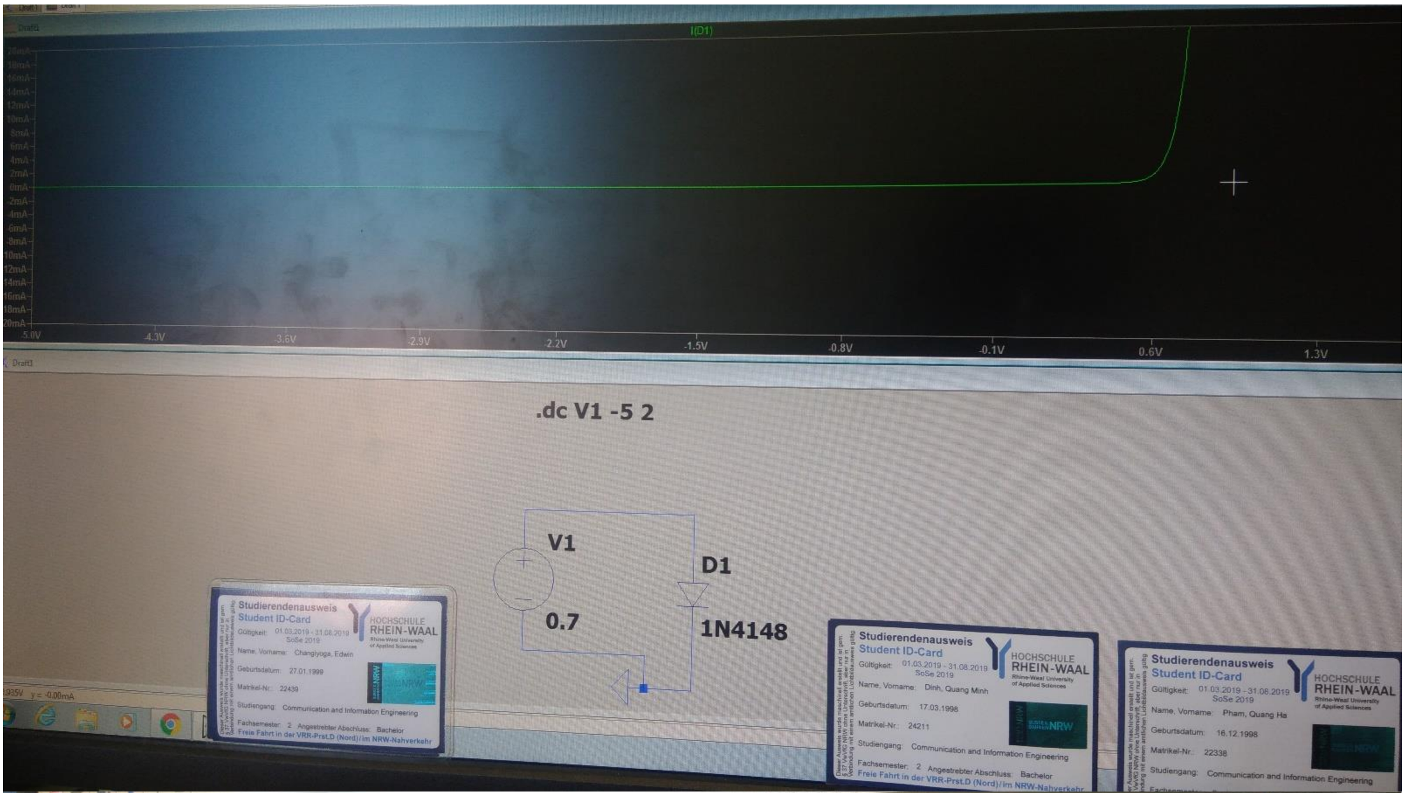
Voltage over D1 [V]	**Current through D1 [mA]**	**D1 is conductive [yes/no]**
0.691	3.81	yes
5.10	0	no

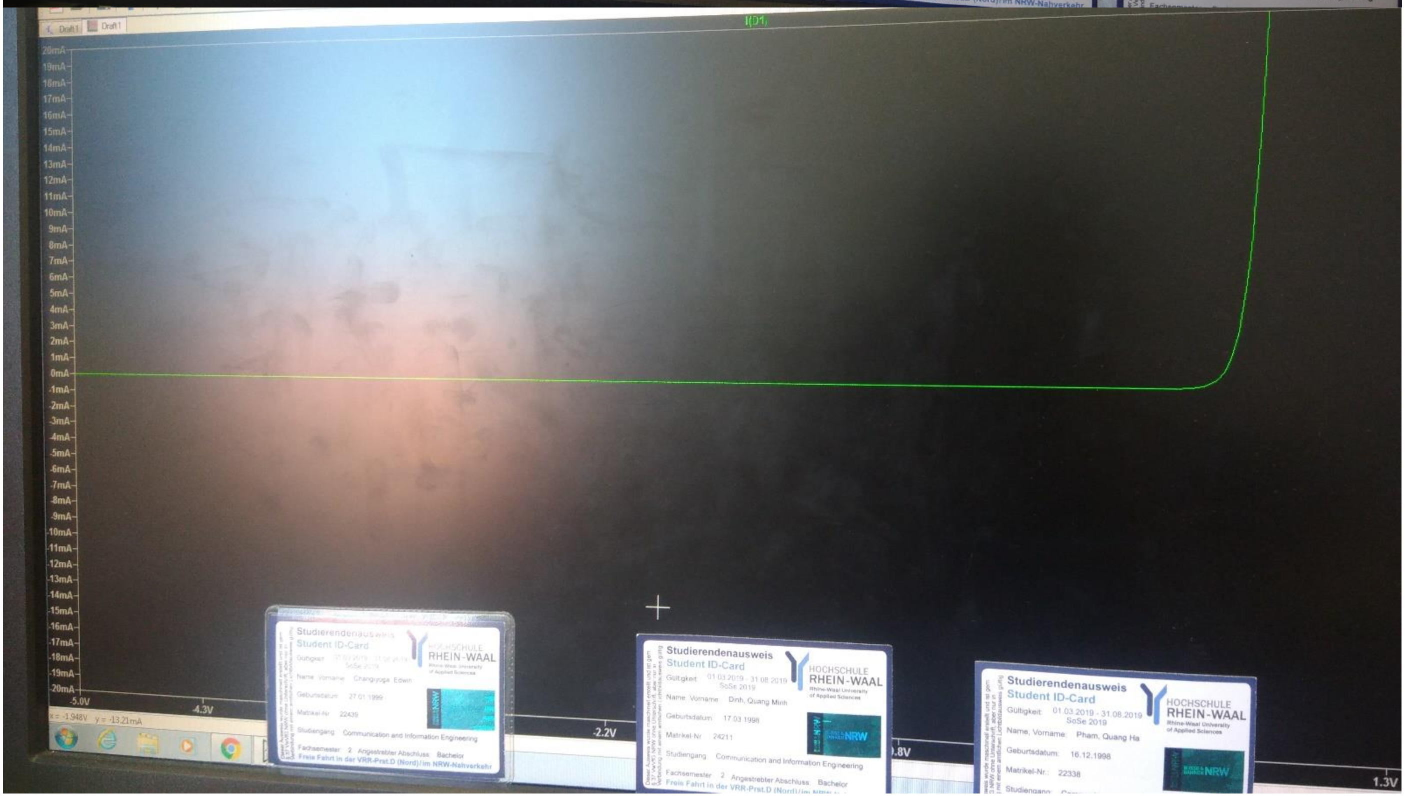
Challenge #2

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

Pictures:





Results:

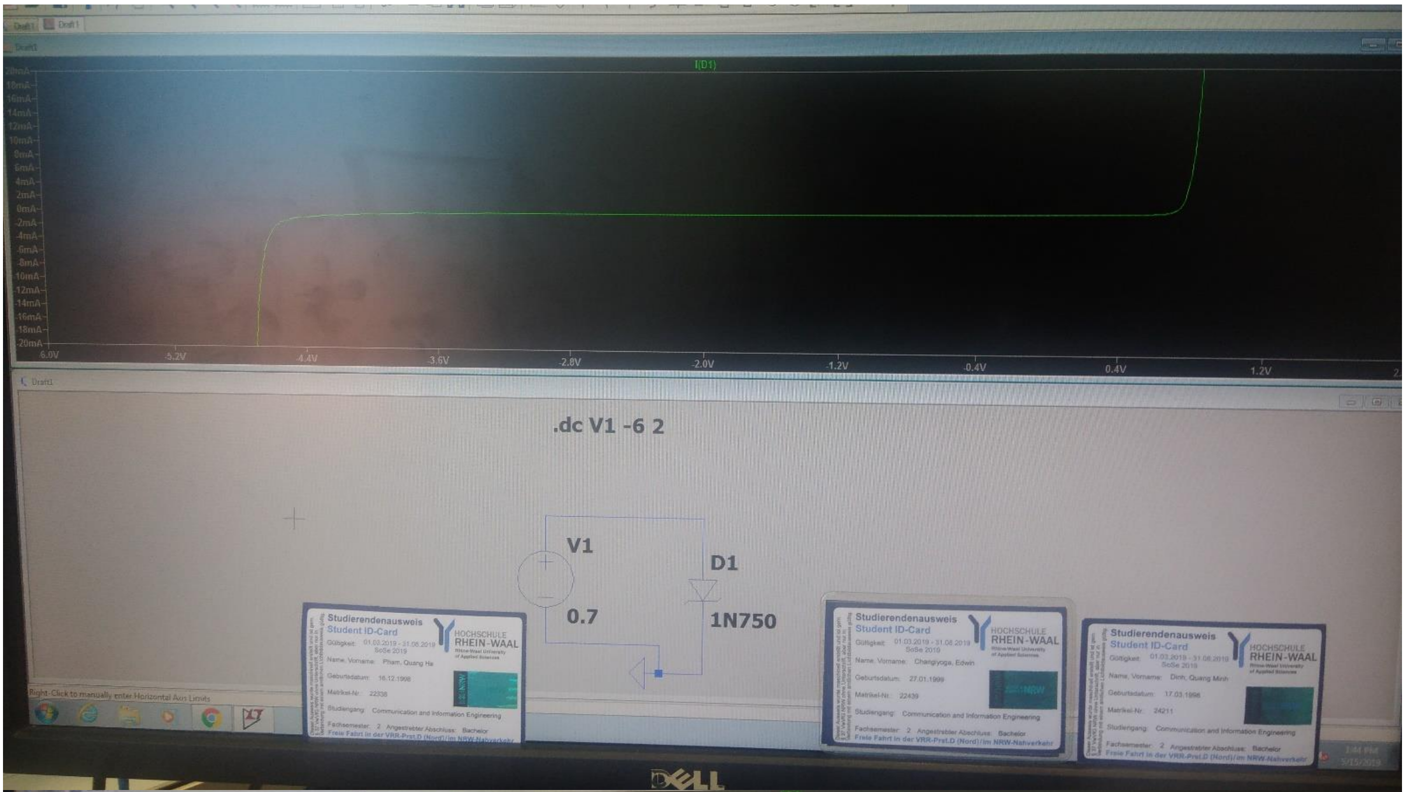
From what we can understand from the plot, the diode lets the current go through only if there is enough voltage to “activate” the diode (in the case of this plot, we need approximately 0.6V).

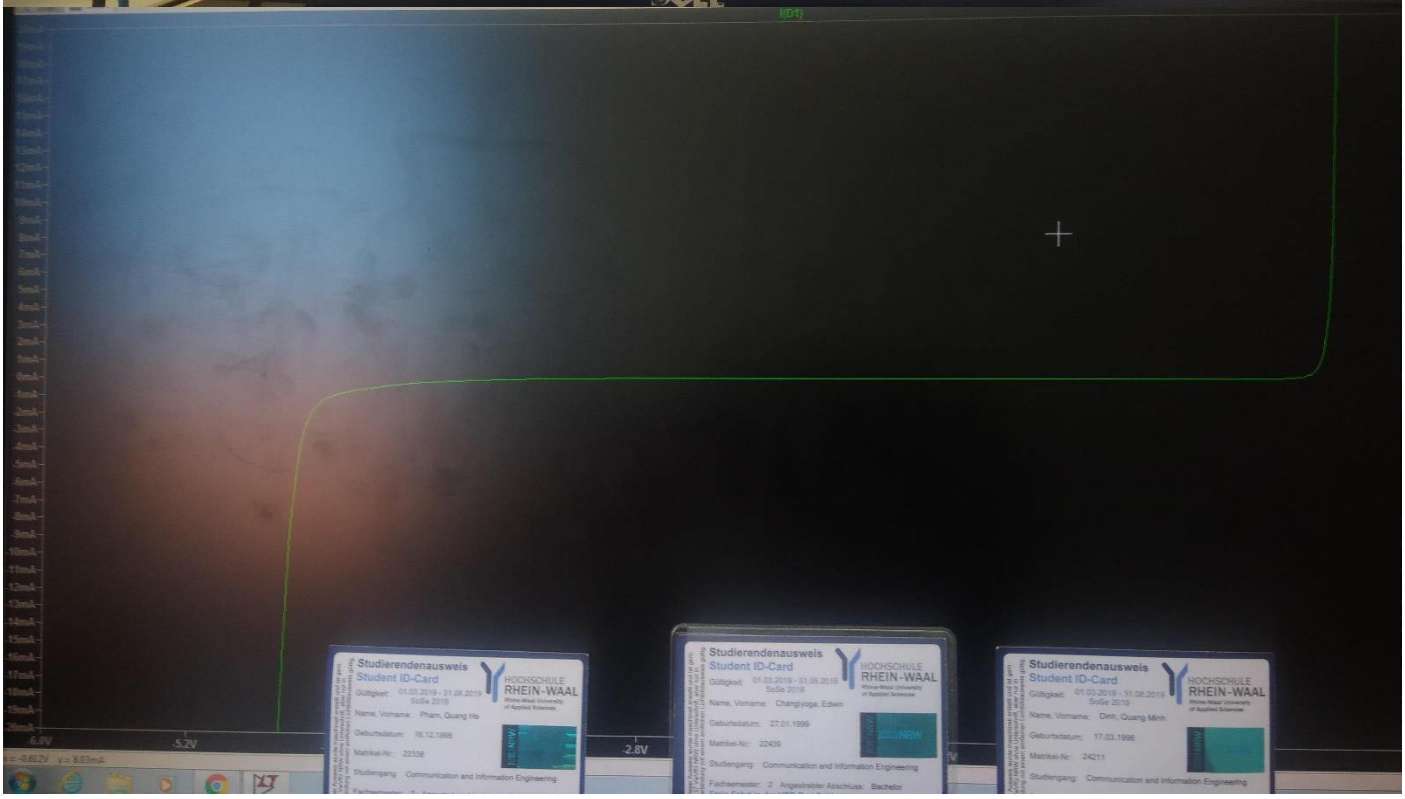
Challenge #3

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

Pictures:





Results:

From what we can understand from the plot, the Zener diode is similar to a normal diode which means it only lets the current go through if there is enough voltage to “activate” the diode.

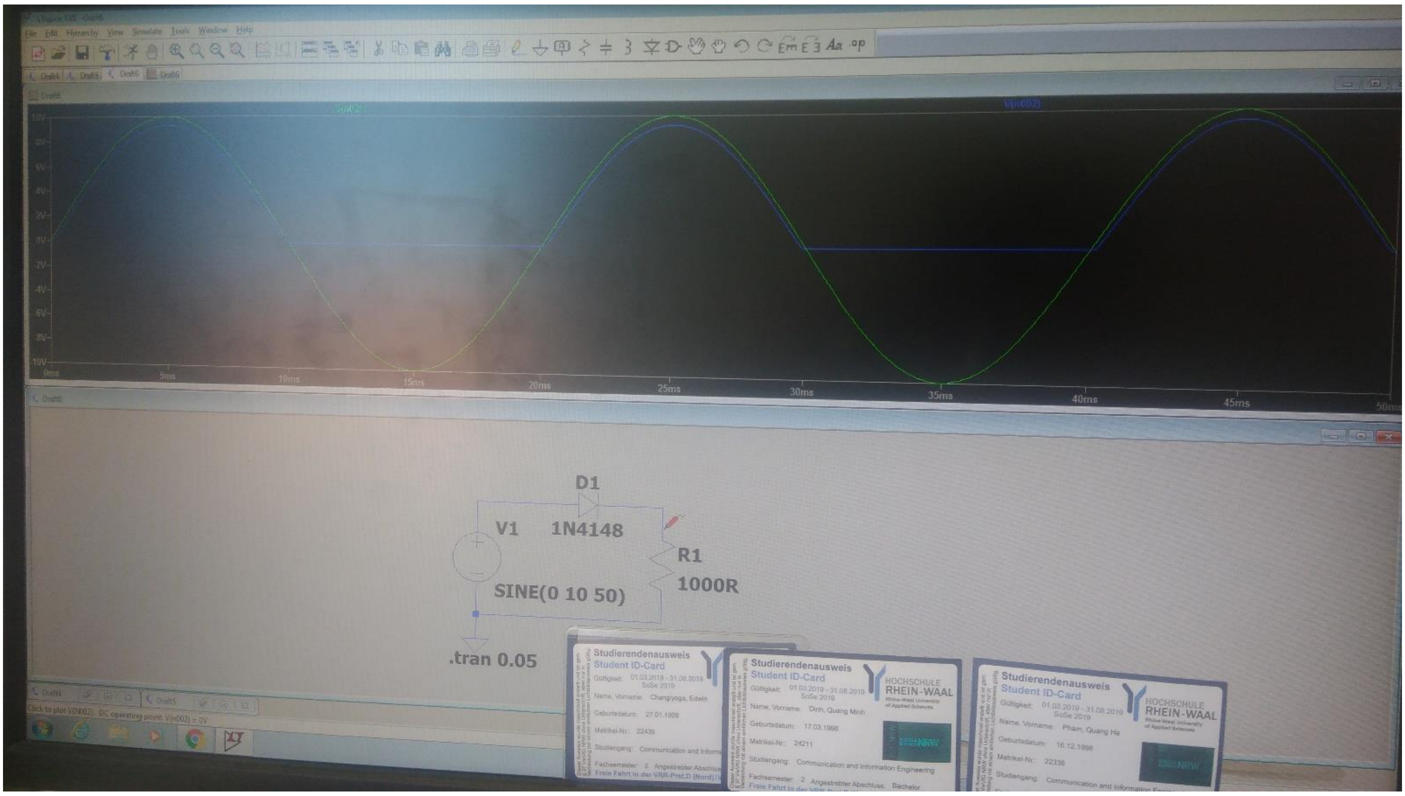
The difference between the Zener diode and normal diode is the Zener diode also allows current to go in the opposite direction of the Zener diode if there is enough voltage in the opposite direction to “activate” it.

Challenge #4

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

Pictures:



Results:

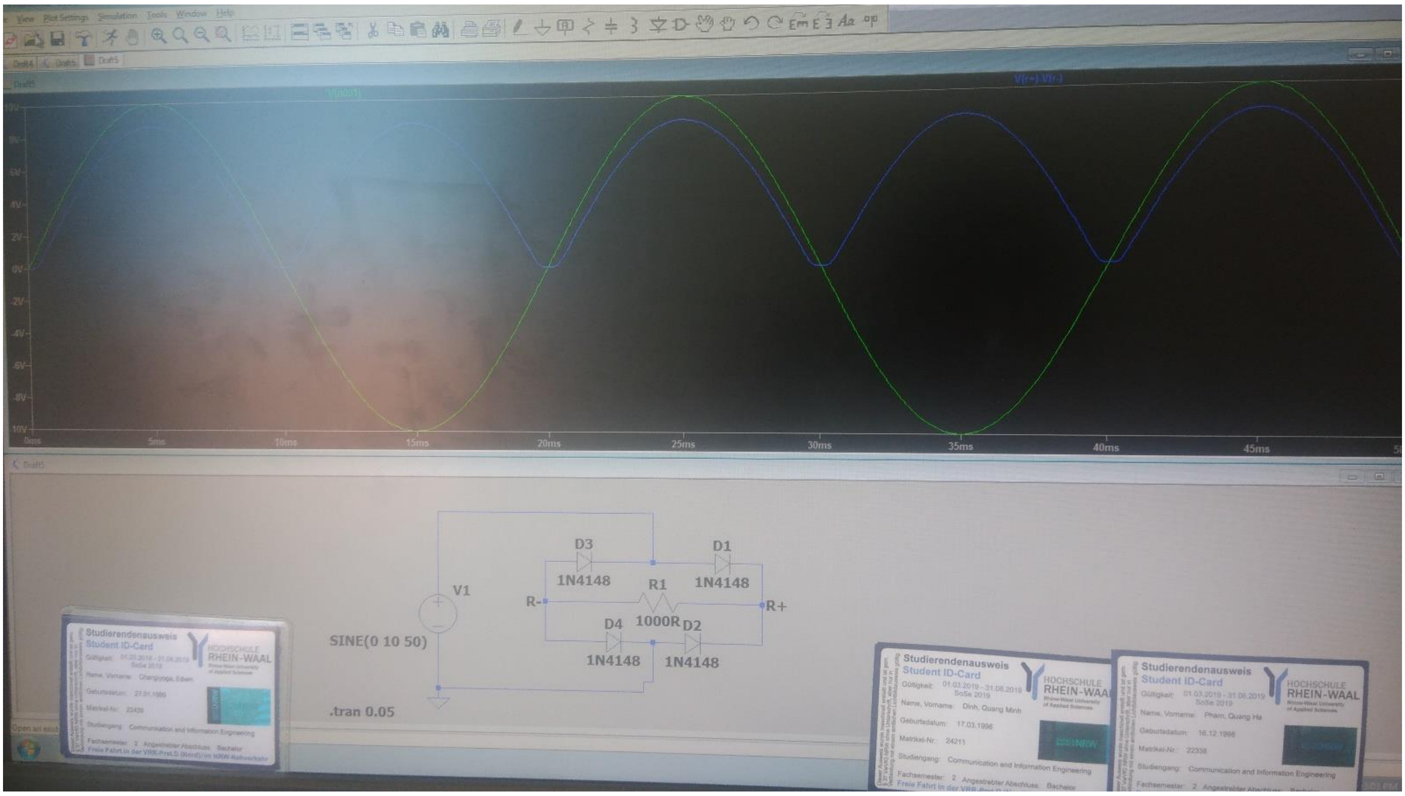
When V1 is negative (V1 is changing direction from positive to negative), the diode does its job and prevent the current from going in the opposite direction, this lets the voltage through resistor R1 stops at 0 instead of going to negative.

Challenge #5

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

Pictures:



Results:

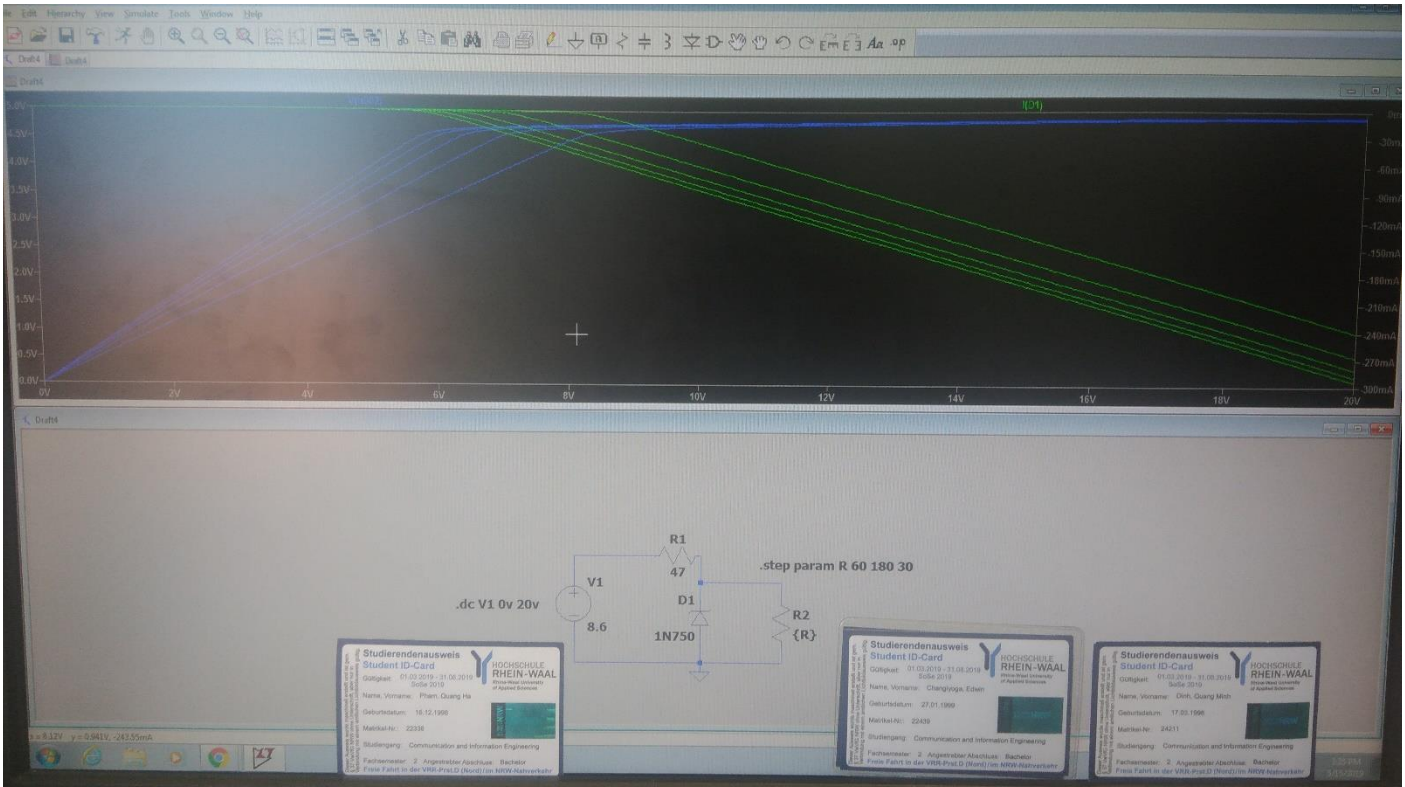
The difference to the result of challenge #4 is instead of the voltage through resistor R1 stops at 0 it bounces back up to positive in proportion to the magnitude of voltage V1 even though voltage V1 is in the opposite direction.

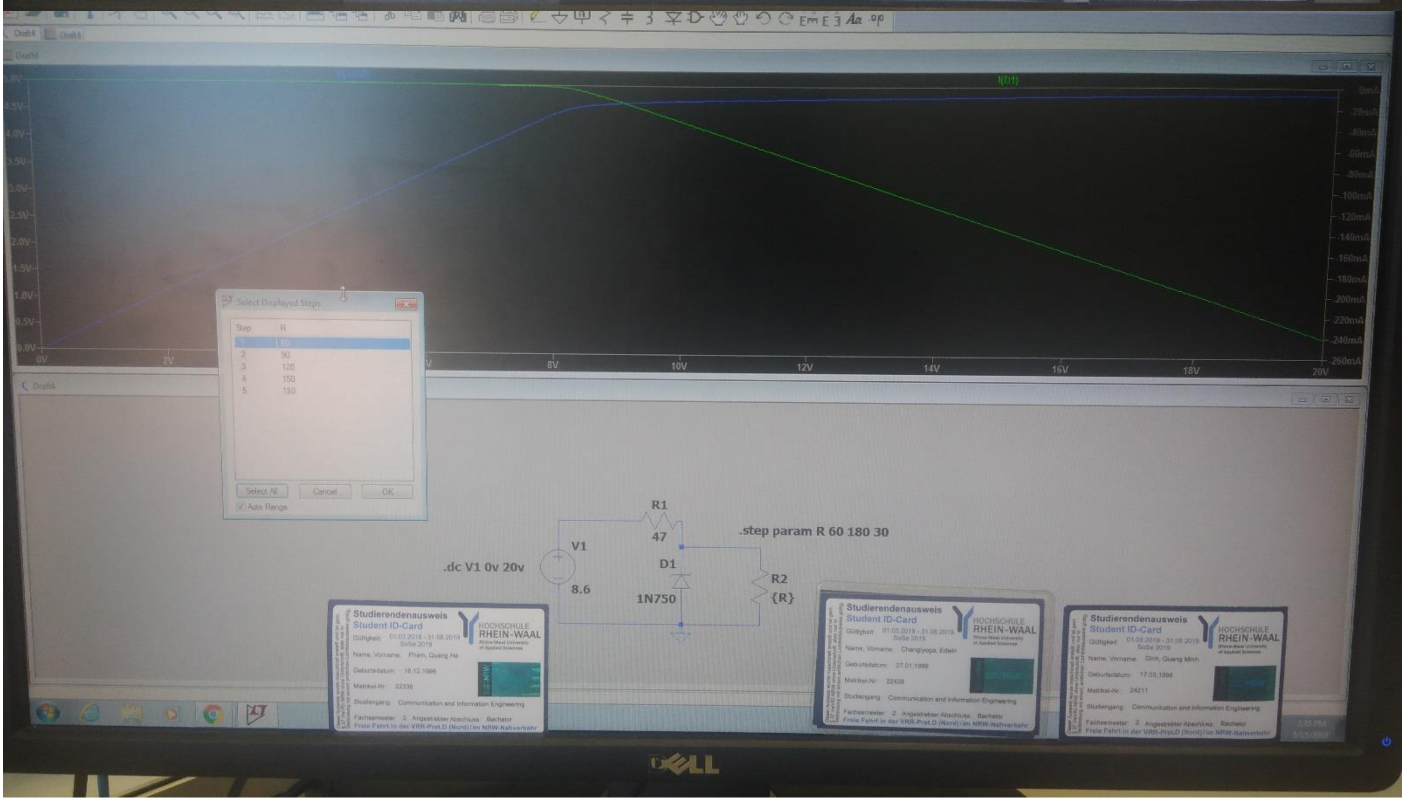
Challenge #6

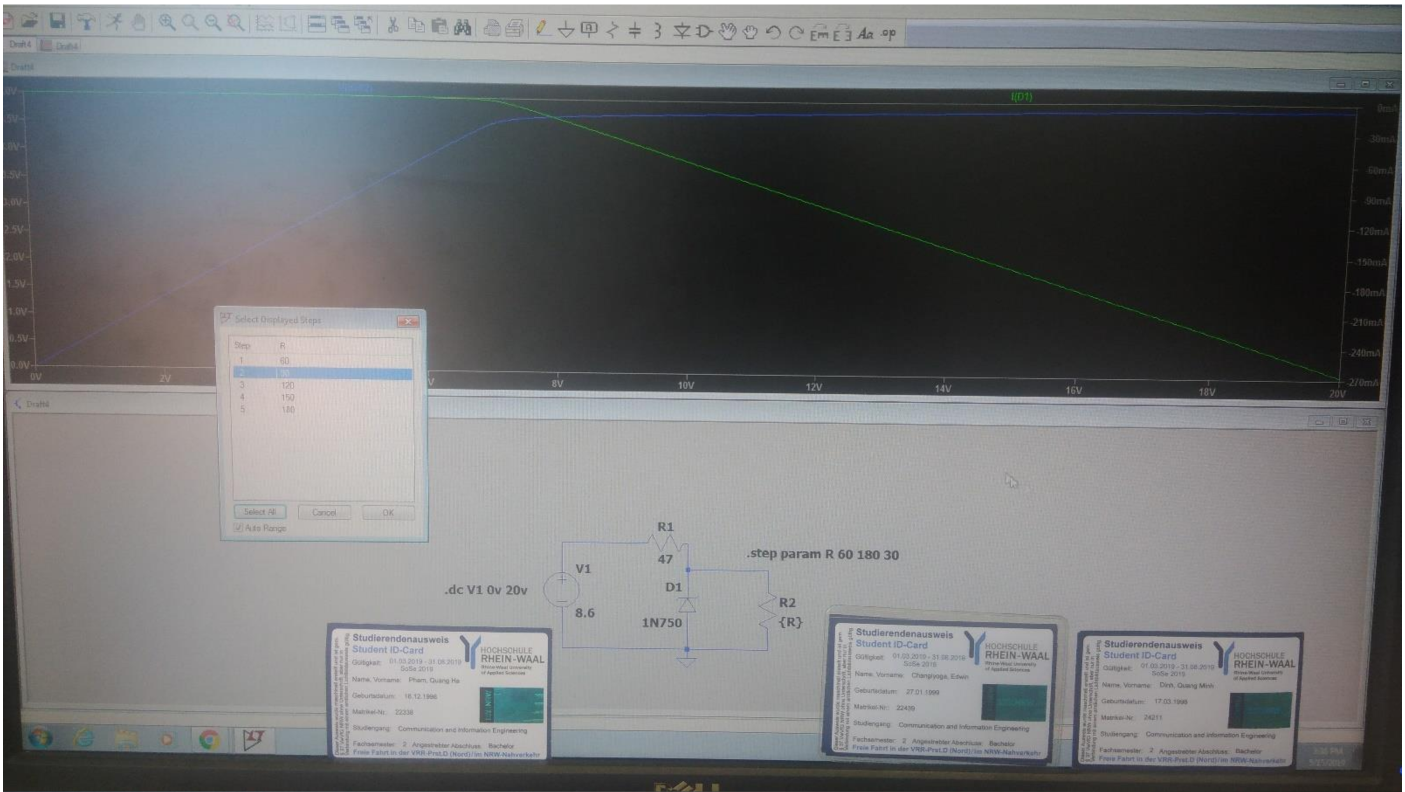
Abstract:

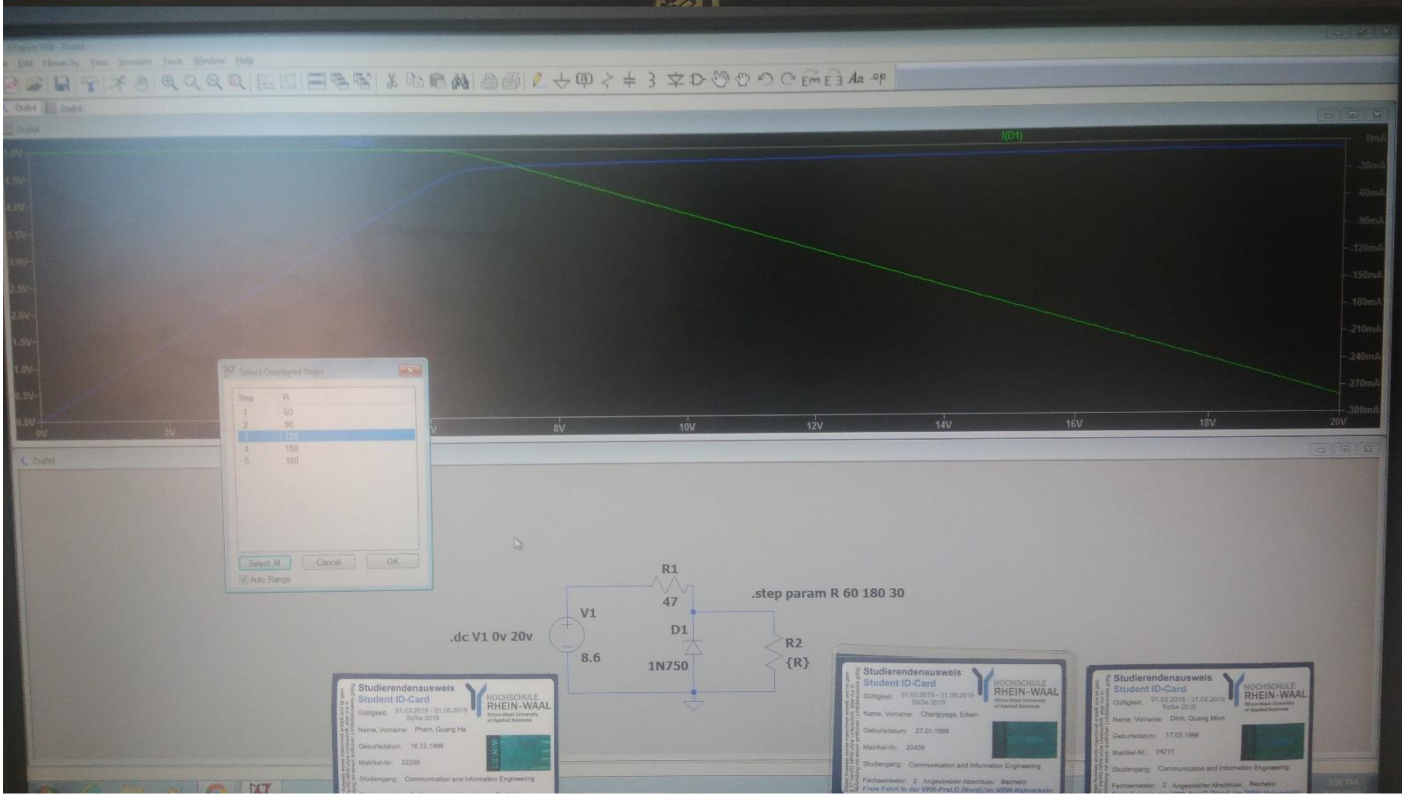
Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

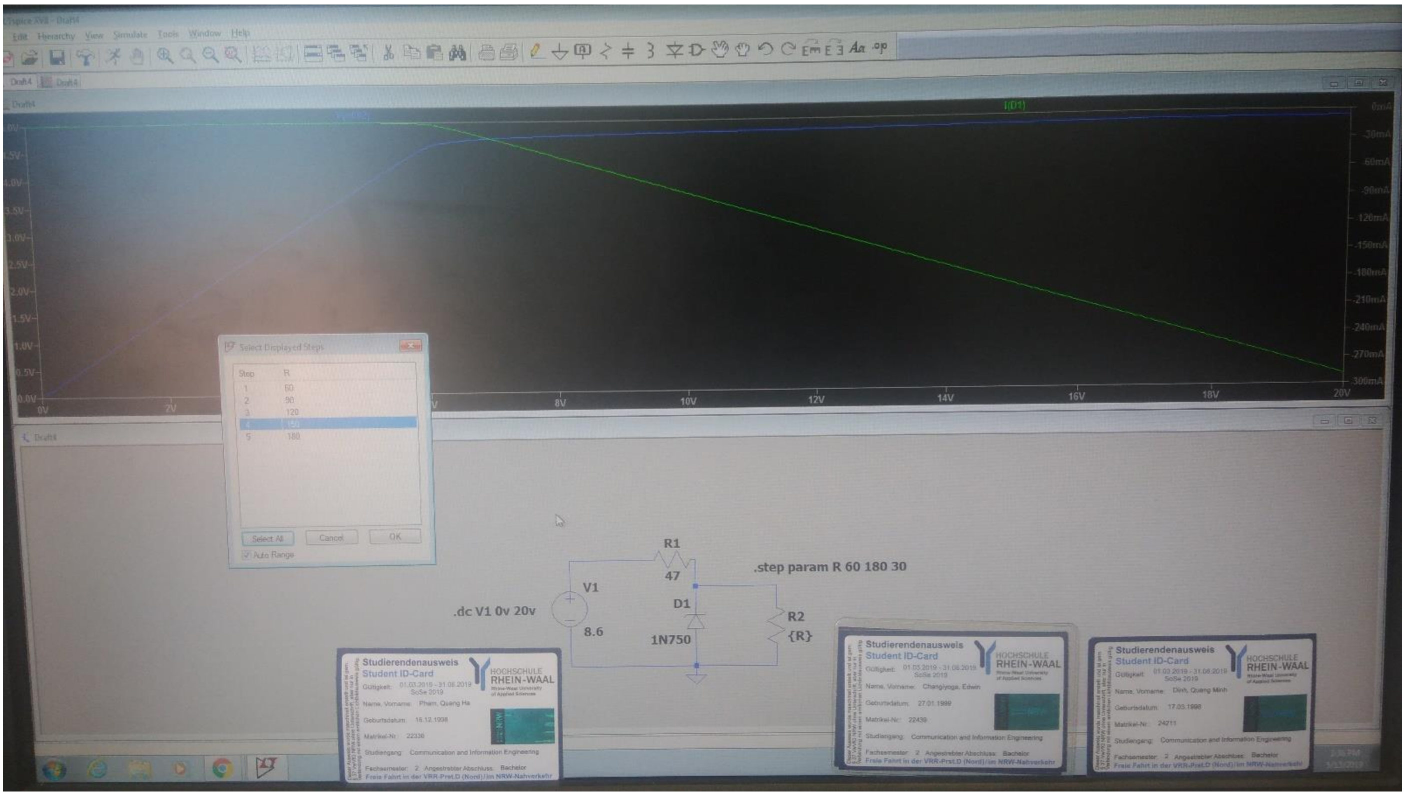
Pictures:

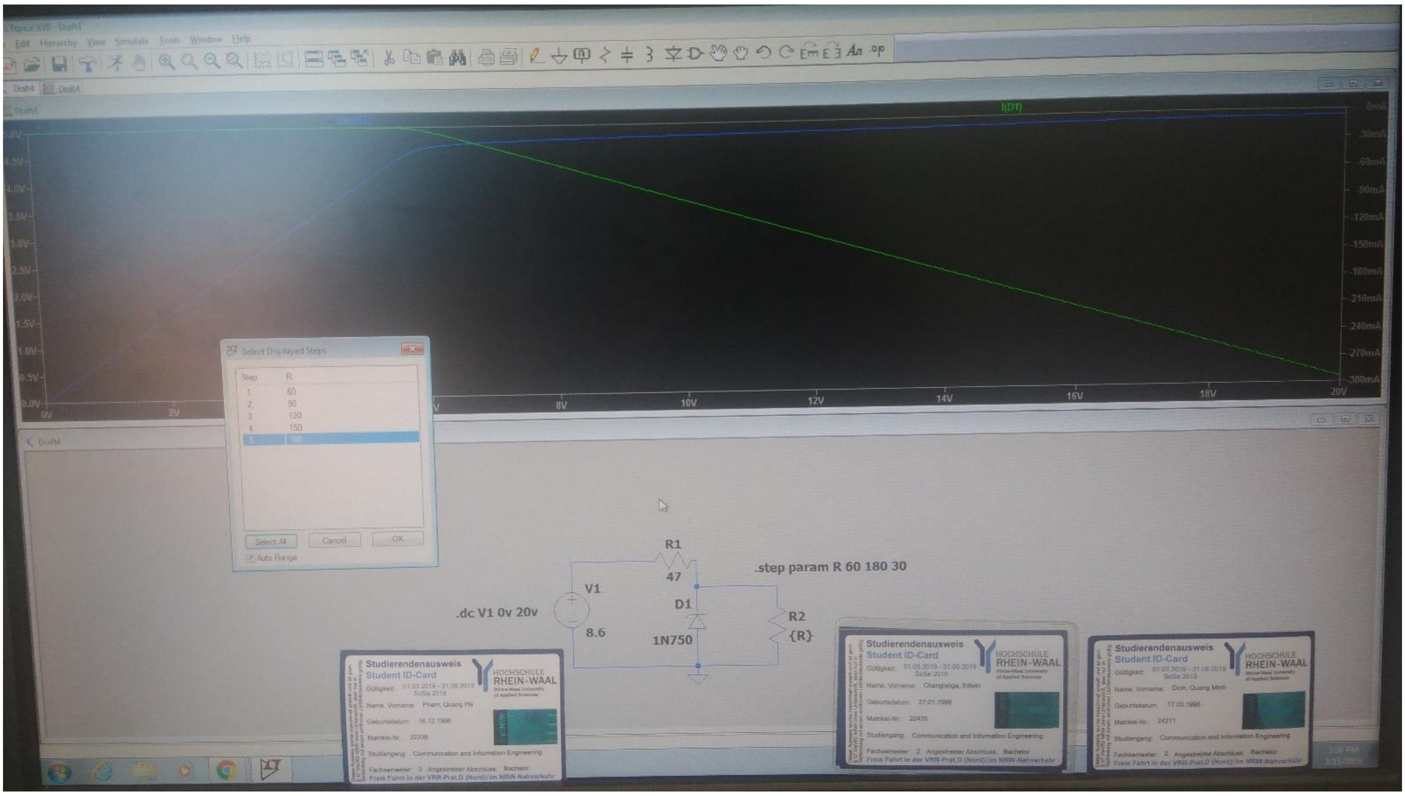




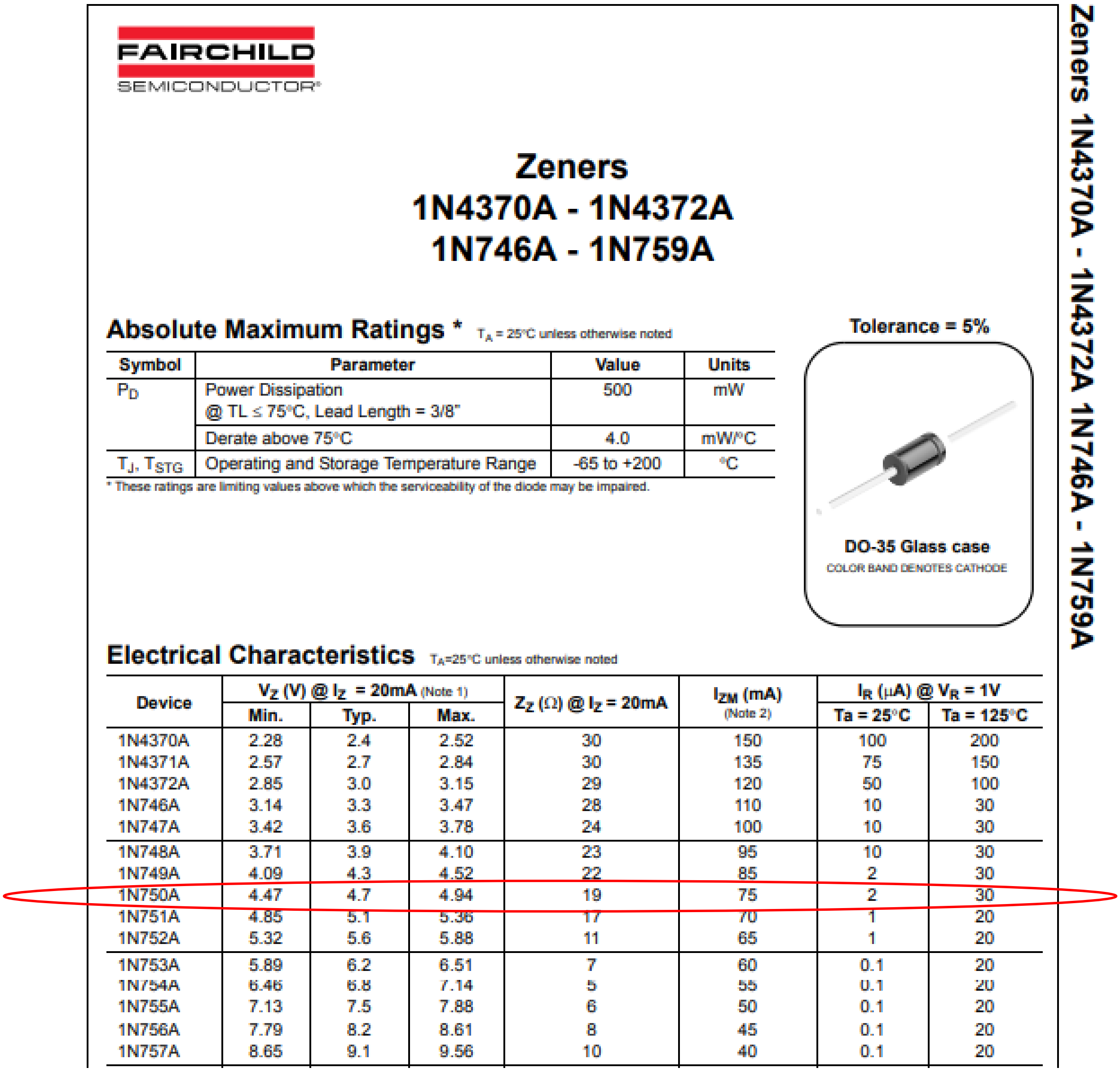

I(D1)
Select Displayed Steps
Select All
Cancel
OK
R1
47
.step param R 60 180 30
V1
.dc V1 0v 20v
D1
8.6
1N750
R2
{R}
Studierendenausweis
Student ID-Card
HOCHSCHULE RHEIN-WAAL


I(D1)
Select Displayed Steps
Select All
Cancel
OK
R1
47
.step param R 60 180 30
V1
.dc V1 0v 20v
D1
8.6
1N750
R2
{R}
Studierendenausweis
Student ID-Card
HOCHSCHULE RHEIN-WAAL


I(D1)
R1
47
.step param R 60 180 30
V1
.dc V1 0v 20v
D1
8.6
1N750
R2
{R}


I(D1)
R1
47
.step param R 60 180 30
V1
.dc V1 0v 20v
D1
8.6
1N750
R2
{R}

Results:



FAIRCHILD SEMICONDUCTOR®

Zeners
1N4370A - 1N4372A
1N746A - 1N759A

Zeners 1N4370A - 1N4372A 1N746A - 1N759A

Absolute Maximum Ratings * T_A = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
P_D	Power Dissipation @ TL ≤ 75°C, Lead Length = 3/8"	500	mW
	Derate above 75°C	4.0	mW/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to +200	°C

* These ratings are limiting values above which the serviceability of the diode may be impaired.

Tolerance = 5%

DO-35 Glass case
COLOR BAND DENOTES CATHODE

Electrical Characteristics T_A=25°C unless otherwise noted

Device	V_Z (V) @ I_Z = 20mA (Note 1)			Z_Z (Ω) @ I_Z = 20mA	I_{ZM} (mA) (Note 2)	I_R (μA) @ V_R = 1V	
	Min.	Typ.	Max.			Ta = 25°C	Ta = 125°C
1N4370A	2.28	2.4	2.52	30	150	100	200
1N4371A	2.57	2.7	2.84	30	135	75	150
1N4372A	2.85	3.0	3.15	29	120	50	100
1N746A	3.14	3.3	3.47	28	110	10	30
1N747A	3.42	3.6	3.78	24	100	10	30
1N748A	3.71	3.9	4.10	23	95	10	30
1N749A	4.09	4.3	4.52	22	85	2	30
1N750A	4.47	4.7	4.94	19	75	2	30
1N751A	4.85	5.1	5.36	17	70	1	20
1N752A	5.32	5.6	5.88	11	65	1	20
1N753A	5.89	6.2	6.51	7	60	0.1	20
1N754A	6.46	6.8	7.14	5	55	0.1	20
1N755A	7.13	7.5	7.88	6	50	0.1	20
1N756A	7.79	8.2	8.61	8	45	0.1	20
1N757A	8.65	9.1	9.56	10	40	0.1	20

According to this datasheet of Fairchild Semiconductor, the Maximum Zener Current (I_{ZM}) is 75mA for Zener diode 1N750 (the one we are using).

The optimal supply voltage for our circuit to get the best voltage regulation for loads between 60Ω to 180Ω should be the intersection point between the two lines I_{D1} and V_{R2} in the plot.

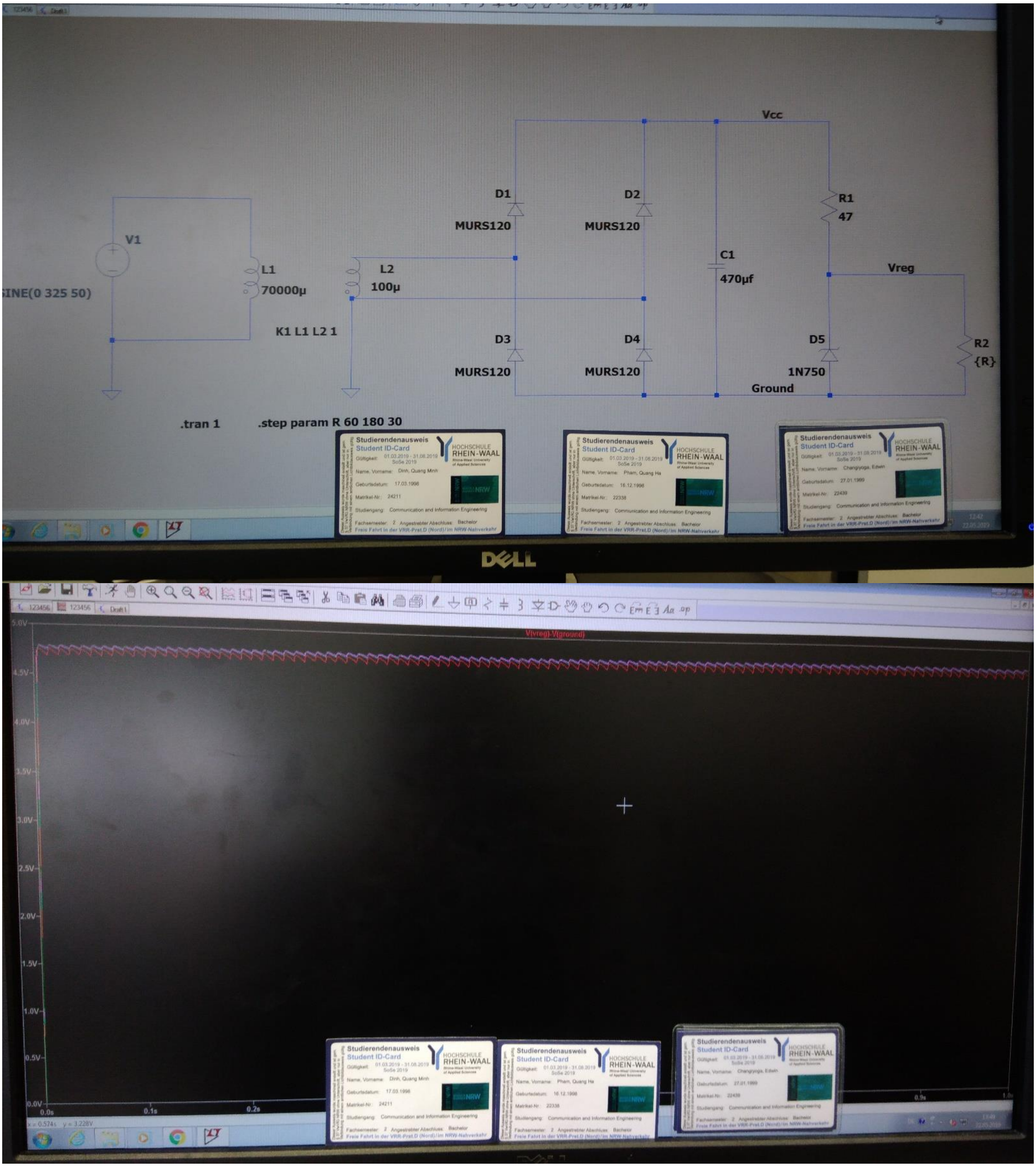
Load R_2 [Ω]	Optimal supply voltage [V]
60	~9.2
90	~8.0
120	~7.4
150	~7.0
180	~6.8

Challenge #7

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet.

Pictures:



Results:

The function of this circuit is to turn an AC power source into DC.

First the coil L1 and L2 acts as transformers to reduce the large AC voltage of the power supply. Then the reduced voltage pass through a series of diode D1 to D4 which acts as rectifiers to produce the voltage similar to the one we seen in challenge #5, this is when the AC has been converted to DC. The rectified voltage however still has points where it's voltage hits 0 before it increases again (as seen in challenge #5), so finally it passes through C1.

The function of C1 from what we understand is to bring up the points where the rectified voltage hits 0 to create this ripple voltage as seen in the picture above. This is so that we can have a constantly running DC power supply without parts where the rectified voltage hits 0.

The bigger the value of C1, the less ripple the voltage has (smoother lines).