EE236: Experiment No.1
I-V characteristic of different diodes and finding the ideality factor

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1 Overview of the experiment

1.1 Aim of the experiment

To plot the IV characterstic of normal diode, Zener and colour led's and observe their patterns and obtain the ideality factor using the slope of the ln curve.

1.2 Methods

Voltage across the diode is varied using a potentiometer, that voltage and current through the diode is measured for every interval of 0.1v or 0.2v, Then plot a graph for ln(i) vs V, slope can be obtained for the graph and using the formulae, we can obtain ideality factor.

$$ln(I_D/I_0) + E_g/KT = qV_d/nKT$$

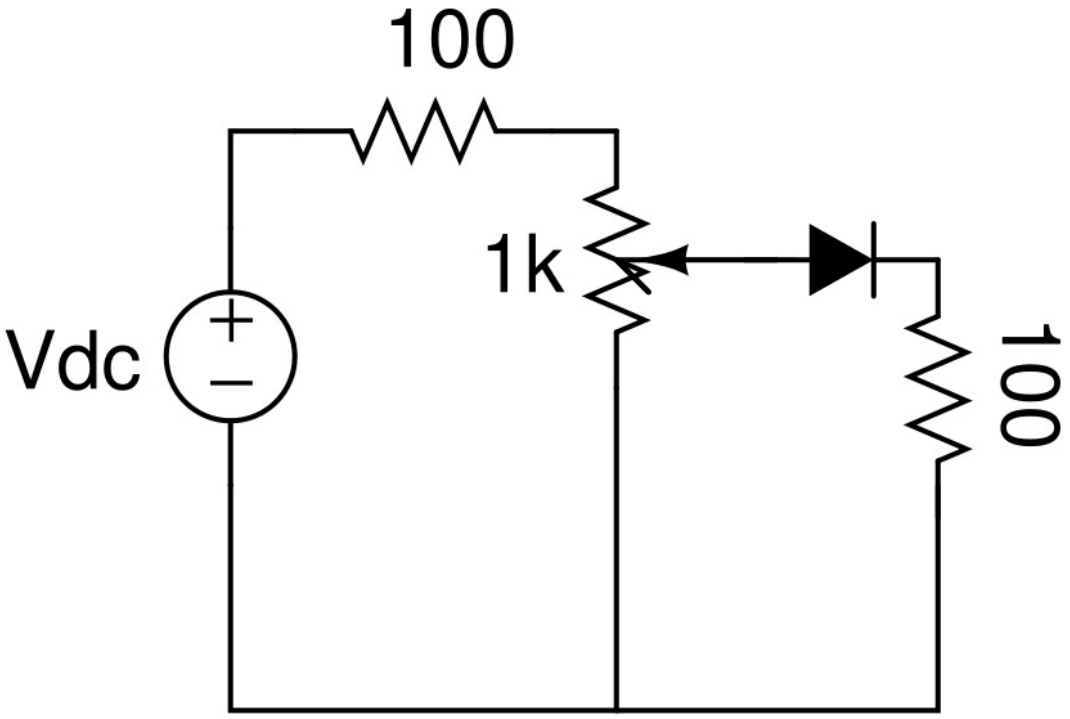
(1)

2 Design

1) A voltage of +5v is used connected to a 100ohm and 1Kohm in series.

2)Now our diode under observation and a 100ohm resister in series connected across the potentiometer.

3)Varying the potentiometer with small values voltage across the diode and current through the diode is measured and noted down



3 Simulation results

3.1 Code snippet

Diode Charecterstics
.include Diode$_{1N914}$.*txt*
.*includewhite*$_{5mm}$.*txt*
.*includeyellow*$_{5mm}$.*txt*
.*includegreen*$_{5mm}$.*txt*
.*includered*$_{5mm}$.*txt*
.*includeblue*$_{5mm}$.*txt*
$d1121n914$

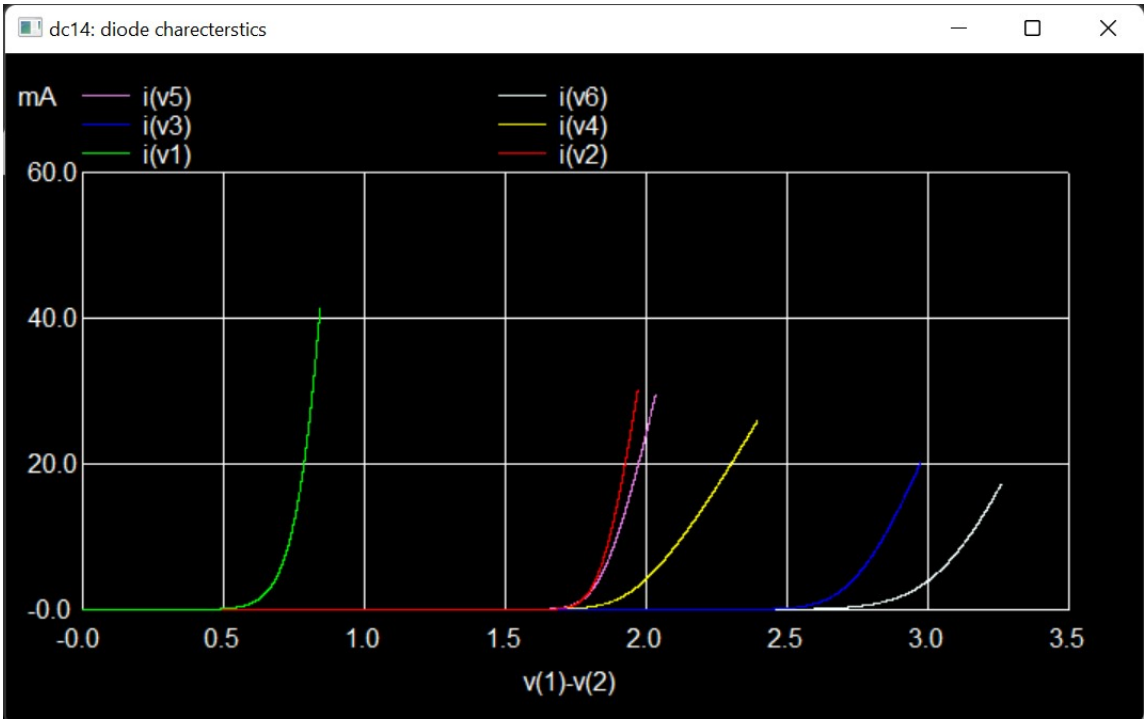
$d213red$
$d314blue$
$d415green$
$d516yellow$
$d617white$
$v12120$
$v23130$
$v34140$
$v45150$
$v56160$
$v67170$

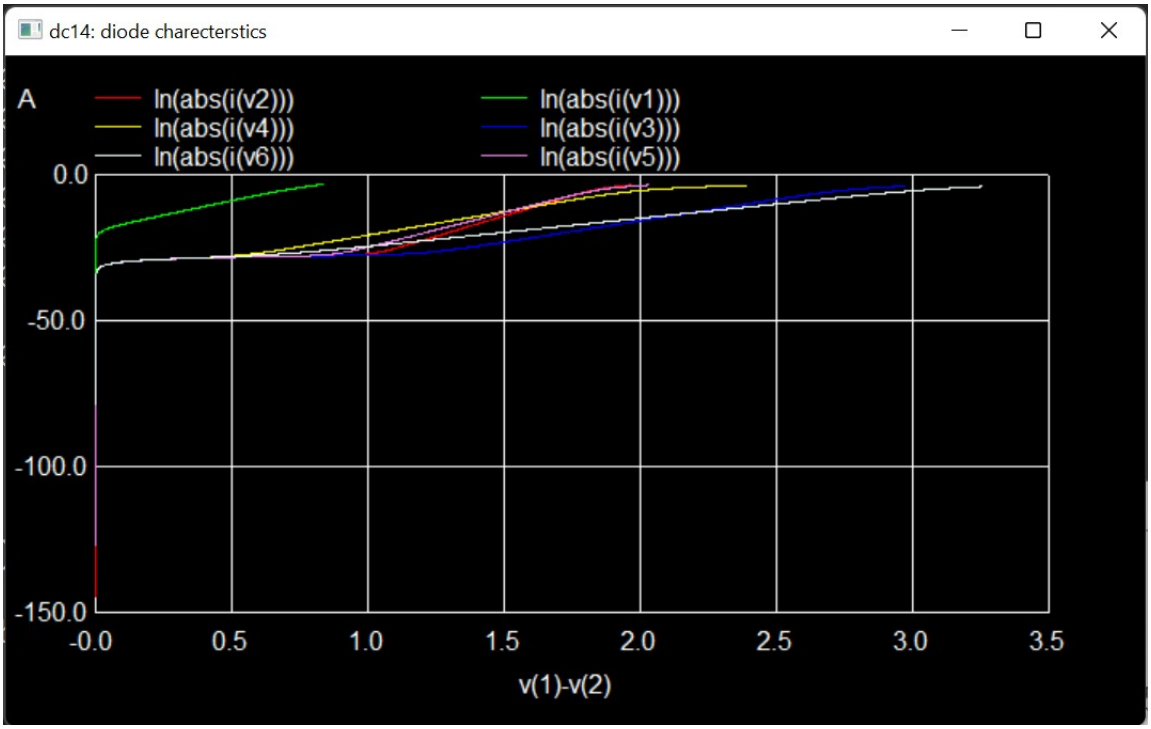
r1 12 0 100
r2 13 0 100
r3 14 0 100
r4 15 0 100
r5 16 0 100
r6 17 0 100

v 1 0 dc 0

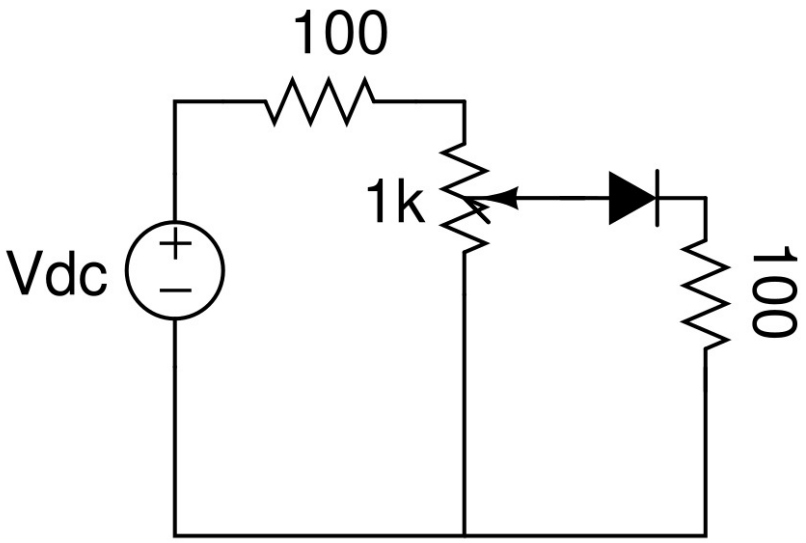
.dc v 0 5 0.001
.control
run
plot i(v1) vs v(1)-v(2) i(v2) vs v(1)-v(3) i(v3) vs v(1)-v(4) i(v4) vs v(1)-v(5) i(v5) vs v(1)-v(6) i(v6) vs v(1)-v(7)
plot ln(abs(i(v1))) vs v(1)-v(2) ln(abs(i(v2))) vs v(1)-v(3) ln(abs(i(v3))) vs v(1)-v(4) ln(abs(i(v4))) vs v(1)-v(5) ln(abs(i(v5))) vs v(1)-v(6) ln(abs(i(v6))) vs v(1)-v(7)
.endc
.end

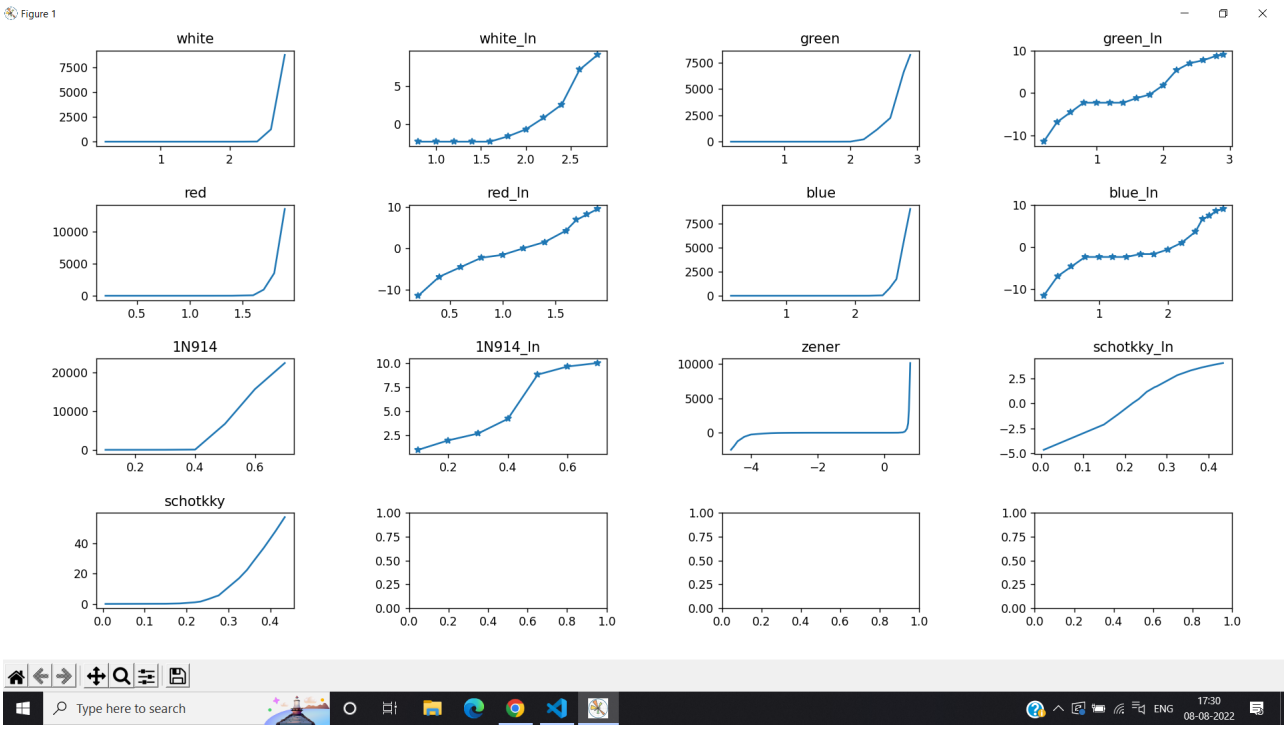
3.2 Simulation results





4 Experimental results





the values obtained are

```
4
5   x_w = [.2, .4, .6, .8, 1, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8]
6   y_w = [.00001, .001, .01, .1, .1, .1, .1, .1, .2, .5, 2.3, 12.8, 1245, 876
7   y_l_w = np.log([.1, .1, .1, .1, .1, .2, .5, 2.3, 12.8, 1245, 8760])
8
9
10  x_g = [.2, .4, .6, .8, 1, 1.2, 1.4, 1.6, 1.8, 2, 2.2, 2.4, 2.6, 2.8, 2.9]
11  y_g = [.00001, .001, .01, .1, .1, .1, .1, .3, .7, 6.4, 220, 1150, 2250, 65
12  y_l_g = np.log(y_g)
13
14
15  x_r = [.2, .4, .6, .8, 1, 1.2, 1.4, 1.6, 1.7, 1.8, 1.9]     #Voltage in V
16  y_r = [.00001, .001, .01, .1, .2, 1, 4.5, 70, 950, 3510, 13510]     # I in
17  y_l_r = np.log(y_r)
18
19
20  x_b = [.2, .4, .6, .8, 1, 1.2, 1.4, 1.6, 1.8, 2, 2.2, 2.4, 2.5, 2.6, 2.7,
21  y_b = [.00001, .001, .01, .1, .1, .1, .1, .2, .2, .6, 2.9, 40, 777, 1726,
22  y_l_b = np.log(y_b)
23
24  x_1N = [.1, .2, .3, .4, .5, .6, .7]     #Voltage in V
25  y_1N = [2.7, 7.2, 14.7, 67.7, 6750, 15720, 22500]    # I in microAmp
26  y_l_1N = np.log(y_1N)
27
28  x_z = [-4.6, -4.5, -4.4, -4.2, -4, -3.8, -3.6, -3.4, -3.2, -3, -2.8, -2.4,
29  y_z = [-2490, -1907, -1241, -586, -260, -180, -113, -64, -34.9, -22, -12.4
30
31  x_bat = [.0063, .150, .184, .219, .233, .252, .271, .276, .325, .344, .357
32  y_bat = [9.5, 120, 337, 1038, 1548, 3190, 5100, 5520, 16900, 22400, 27200,
33  y_bat = np.array(y_bat)/1000
34  y_l_bat = np.log(y_bat)
```

5 Experiment completion status

cutin voltages of simulation
d1 0.6v
red 1.2v
blue 2.5v

green 1.85v
yellow 1.75
white 2.9v

cutin voltages of experment
d1 0.5v
red 1.5v
blue 2.2v
green 1.3v
yellow 1.75
white 2.2v

Ideality factor:
White - 1.63
Green - 1.45
Blue - 1.49
Red - 1.47