

# DEVICES AND CIRCUITS LAB REPORT – 1

**EXPERIMENT NAME** : Light Emitting Diode And photodiode Characterization

**ROLL NUMBERS** : 200020010 , 200020051

**Ng Spice Code** :

\*IV char of RED GREEN BLUE colour led

v1 1 0 dc=5

d1 2 3 red

d2 4 5 green

d3 6 7 blue

r1 1 2 1k

r2 1 4 1k

r3 1 6 1k

vd1 3 0

vd2 5 0

vd3 7 0

.model red D(Vj=.75 Cjo=175p Rs=.25 Eg=3.2 M=.5516 Nbv=1.6989 N=2.4 Bv=1.7 Fc=.5 Ikf=0  
Ibv=20.245m Is=880.5E-18 Xti=3)

.model green D(Is=1e-19 Rs=1.5 N=1.5 Cjo=50p Iave=30m Vpk=5)

.model blue D(IS=93.1P RS=42M N=7.47 BV=5 IBV=30U CJO=2.97P VJ=.75 M=.333 TT=4.32U)

.save all @d1[id]

.save all @d2[id]

.save all @d3[id]

.dc v1 1 10 0.05

\* Control Statements

.control

run

\*white background

set color0=white

\* black grid and text (only needed with X11, automatic with MS Win)

set color1=black

\* wider grid and plot lines

set xbrushwidth=2

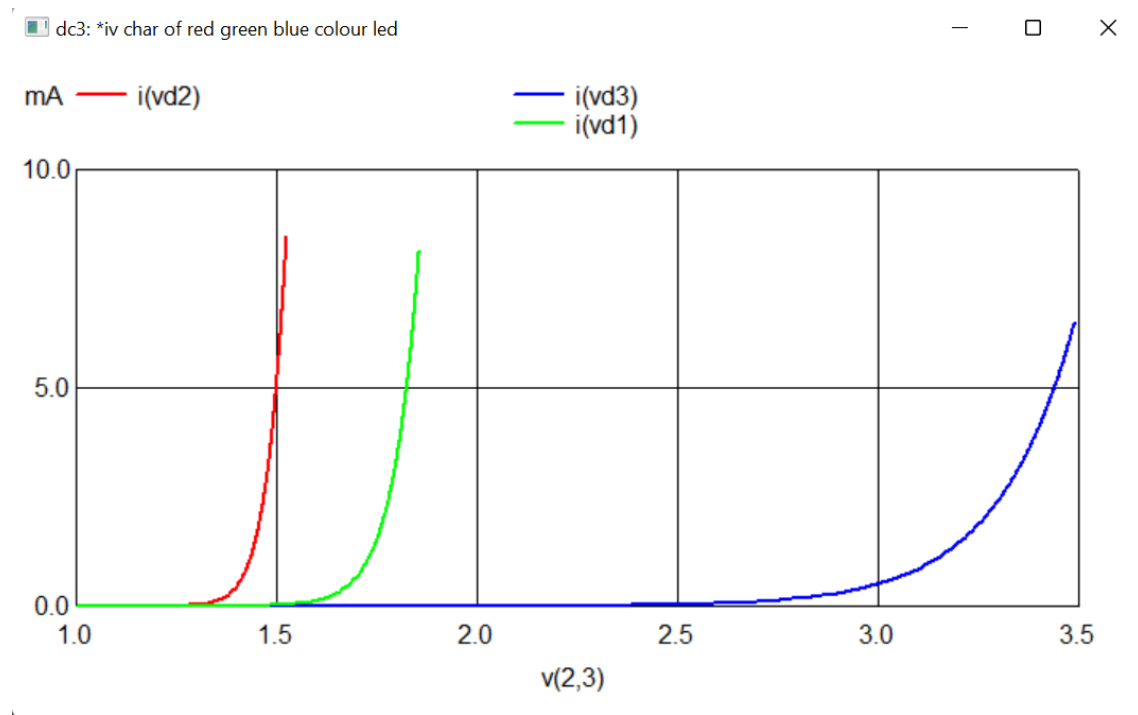
plot i(vd1) vs v(2,3) i(vd2) vs v(4,5) i(vd3) vs v(6,7)

plot ln(i(vd1)) vs v(2,3) ln(i(vd2)) vs v(4,5) ln(i(vd3)) vs v(6,7)

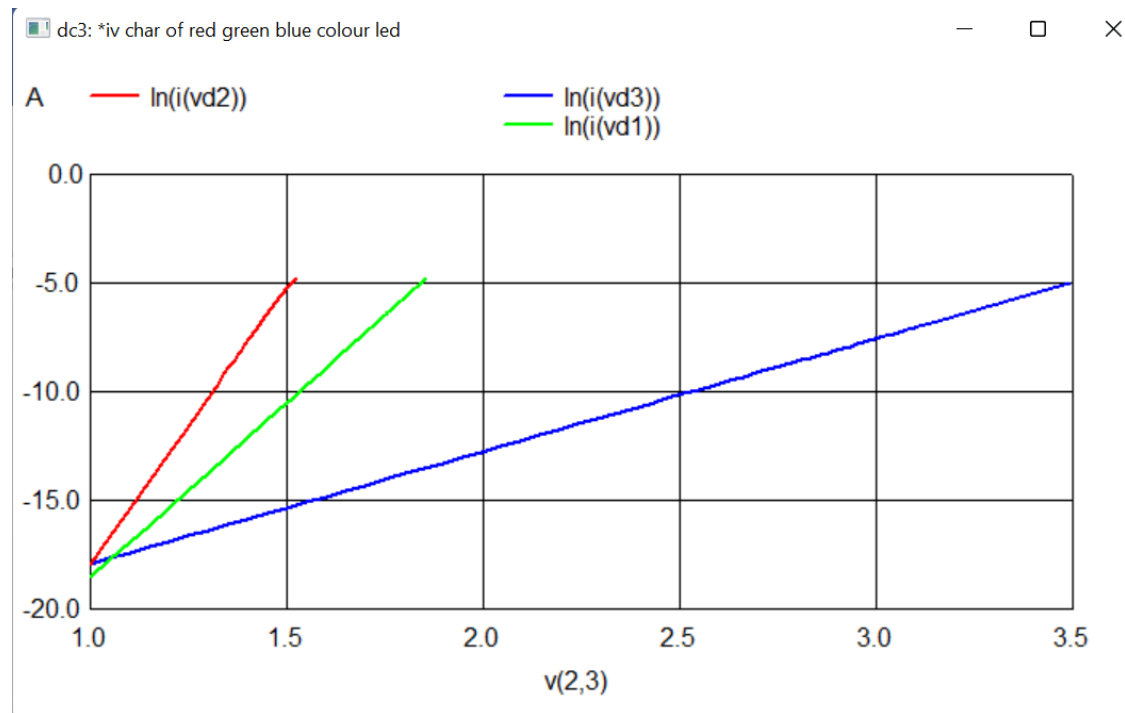
.endc

.end

### 1. I-V characteristics of red green blue colour led diodes



## 2. $\log(I_d)$ vs $V_d$ characteristics of red green blue colour led diodes



From above plot:

Slope of red colour led =  $16.27 = 1/\eta V_t$

Implies  $\eta = 2.38$

Slope of green colour led =  $25.32 = 1/\eta V_t$

Implies  $\eta = 1.52$

Slope of blue colour led =  $5.20 = 1/\eta V_t$

Implies  $\eta = 7.46$

## 3. from internet

Emission wavelength of red colour led = 633nm

Implies  $E_g = 1.958 \text{ eV}$

Emission wavelength of green colour led = 520nm

Implies  $E_g = 2.380 \text{ eV}$

Emission wavelength of blue colour led = 448nm

Implies  $E_g = 2.767 \text{ eV}$

4.from plot-1

Voltage across red colour led at 1mA current = 1.72V

Voltage across green colour led at 1mA current = 1.43V

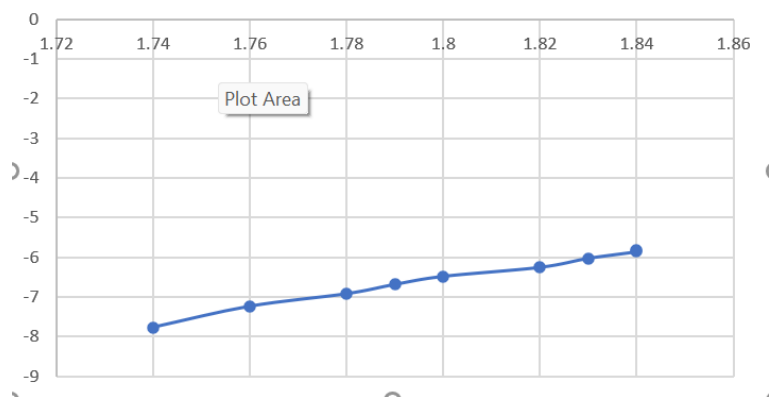
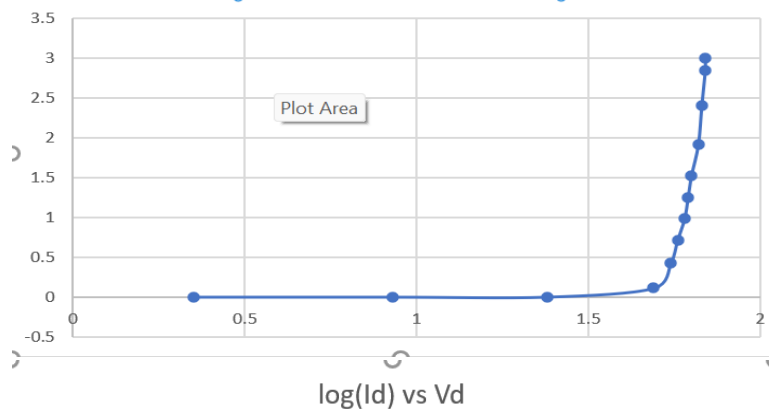
Voltage across blue colour led at 1mA current = 3.15V

## Observations :

Red colour led :

Variable supply(V) (in volts)	Voltage across diode (Vd) (in volts)	Current across diode (Id) (in milli amps)	ln(Id)
0.4	0.35	0	
1.0	0.93	0	
1.4	1.38	0	
1.8	1.69	0.11	
2.2	1.74	0.419	-7.77764
2.6	1.76	0.714	-7.24463
2.8	1.78	0.98	-6.92796
3.2	1.79	1.24	-6.69264
3.5	1.80	1.52	-6.48904
4.0	1.82	1.91	-6.26065
4.3	1.83	2.4	-6.03229
4.7	1.84	2.84	-5.86395
5.0	1.84	2.99	-5.81248

I-V char of Red colour led

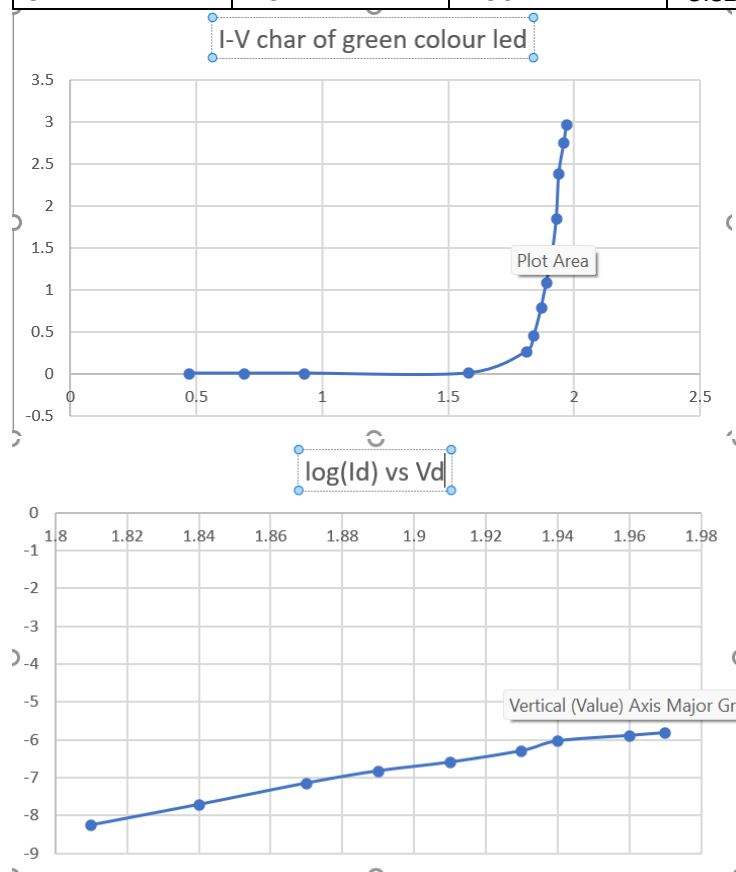


Slope = 19 (from graph)

By calculation ideality factor  $\eta = 2.03$

Green colour led :

Variable supply(V) (in volts)	Voltage across diode (Vd) (in volts)	Current across diode (Id) (in milli amps)	ln(Id)
0.5	0.47	0	
0.7	0.69	0	
1.0	0.93	0	
1.6	1.58	0.002	
2.1	1.81	0.259	-8.25868
2.4	1.84	0.445	-7.71744
2.8	1.87	0.783	-7.15238
3.1	1.89	1.081	-6.82987
3.5	1.91	1.36	-6.60027
4.0	1.93	1.844	-6.29582
4.4	1.94	2.38	-6.04065
4.8	1.96	2.75	-5.89615
5	1.97	2.96	-5.82257

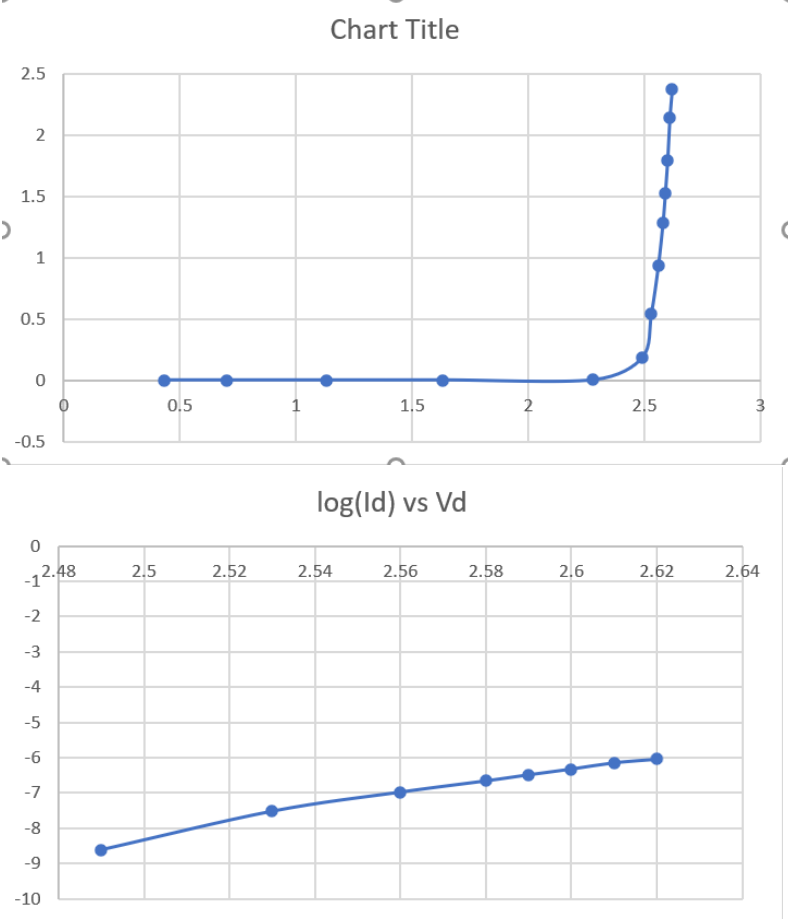


Slope = 16.5 (from graph)

By calculation ideality factor  $\eta = 2.3$

Blue colour led :

Variable supply(V) (in volts)	Voltage across diode (Vd) (in volts)	Current across diode (Id) (in milli amps)	ln(Id)
0.5	0.43	0	
0.8	0.7	0	
1.2	1.13	0	
1.7	1.63	0	
2.3	2.28	0.001	
2.7	2.49	0.18	-8.62255
3.2	2.53	0.54	-7.52394
3.6	2.56	0.93	-6.98033
4.0	2.58	1.28	-6.6609
4.3	2.59	1.52	-6.48904
4.6	2.6	1.79	-6.32554
4.8	2.61	2.14	-6.14695
5.0	2.62	2.37	-6.04487



Slope = 21.4 (from graph)

By calculation ideality factor  $\eta = 1.80$

No,the hardware observations are not same as simulation results,but they are similar to the simulation results .

We have observed that the LED was blinking with a rate of 1 sec in “on” mode and 1 sec in “off” mode with the square wave input of frequency with 1Hz

### **Discussion :**

#### **200020051:**

Today in lab1 we have done simulation in ngspice and hardware exercise. This session helped me to learn how to use many components like multimeter , led , variable power supply, resistor ,bread board.We got to know how to use very minute components and how to handle them. we understood characteristics of diode in a better manner .We also observed that simulation and observations are so similar. We got to know how to handle devices and how sensitive and specific they are.

As this is our first lab we didn't got much time to do all experiments and a suggestion is it would be better if we have done the characteristics of only 2 LED's ,that will give us more time to do all activities that have assigned

#### **200020010:**

Today in lab1 we have done simulation in ngspice and hardware exercise. Today we learnt how to build circuits using many devices like multimeter , led , variable power supply, resistor ,bread board.We got to know how to use these devices how to handle them. By these experiment we understood characteristics of diode in a better manner .We also observed that simulation and observations are similar . By todays experiment we got more idea about simulation and its importance. We got to know how to handle devices and how sensitive and specific they are. We need to improve our speed of simulation (i.e: writing code) and we need to improve in hardware as we are not aware of devices we need to practice more and try different circuit models.