EE 236: Electronic Divice Lab
Lab No. 4

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22B3952

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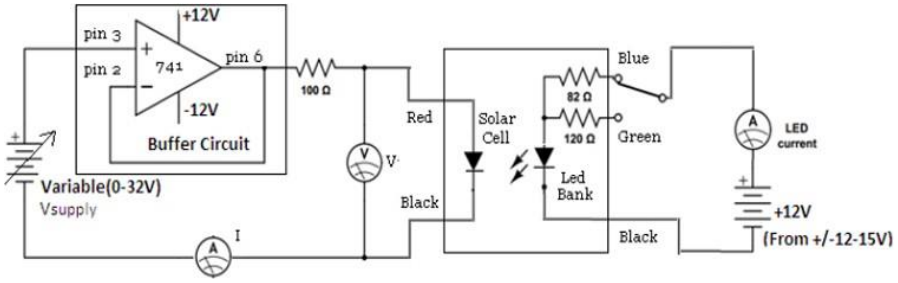
1 Measurement (I-V characteristics)

1.1 Circuit :-



1.2 V_d vs I_d

1.2.1 Dark I-V Characteristics

Vd (mV)	Id (mA)
-2325	-0.64
-1980	-0.47
-1520	-0.24
-1104	-0.11
-1000	-0.09
-625	-0.04
-330	-0.02
-169	-0.01
0	0
140	0.01
185	0.04
240	0.11
271	0.18
314	0.38
327	0.47
342	0.59
367	0.92
375	1.1
389	1.38
407	1.95
423	2.74
430	3.23
439	4.04
450	5.23
460	6.41
470	8.2
480	10.44
490	14.59
501	17.91

1.2.2 I-V characteristics (under light)

For I_{led}=46mA

Vd (mV)	Id (mA)	Power
-2003	-9.32	18667.96
-1799	-9.21	16568.79
-1660	-9.14	15172.4
-1470	-9.08	13347.6
-1320	-9.03	11919.6
-1180	-8.99	10608.2
-1040	-8.95	9308
-845	-8.92	7537.4
-703	-8.91	6263.73
-488	-8.88	4333.44
-112	-8.86	992.32
-62	-8.86	549.32
18	-8.85	-159.3
130	-8.83	-1147.9
220	-8.76	-1927.2
297	-8.55	-2539.35
340	-8.17	-2777.8
378	-7.45	-2816.1
398	-6.78	-2698.44
419	-5.28	-2212.32
438	-3.27	-1432.26
466	2.85	1328.1
478	6.01	2872.78
499	18.37	9166.63

From this table we got V_{oc}= 456mV I_{sc} = -8.855mA I_m = -7.115mA V_m = 388mV FF = 0.684

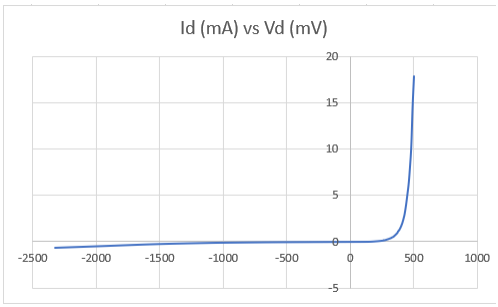
For I_{led}=62mA

Vd (mV)	Id (mA)	Power
-2000	-12.38	24760
-1881	-12.31	23155.11
-1799	-12.27	22073.73
-1700	-12.21	20757
-1627	-12.18	19816.86
-1420	-12.11	17196.2
-1277	-12.07	15413.39
-1173	-12.03	14111.19
-968	-12	11616
-784	-11.97	9384.48
-717	-11.95	8568.15
-457	-11.93	5452.01
418	-7.9	-3302.2
436	-6.21	-2707.56
439	-5.32	-2335.48
440	-4.59	-2019.6
444	-3.62	-1607.28
461	-0.18	-82.98
462	0	0
469	1.28	600.32
478	4.19	2002.82
490	12.08	5919.2

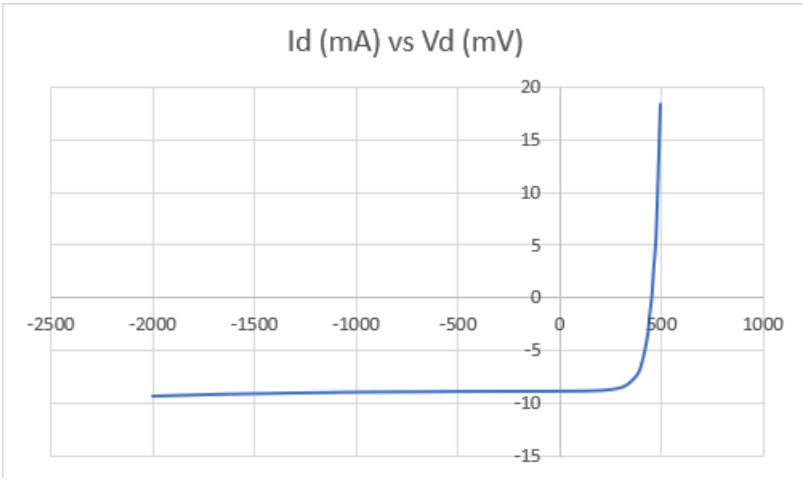
From this table we got V_{oc}= 398mV I_{sc} = -9.69mA I_m = -11/9mA V_m = 462mV FF = 0.7015

1.3 Plots

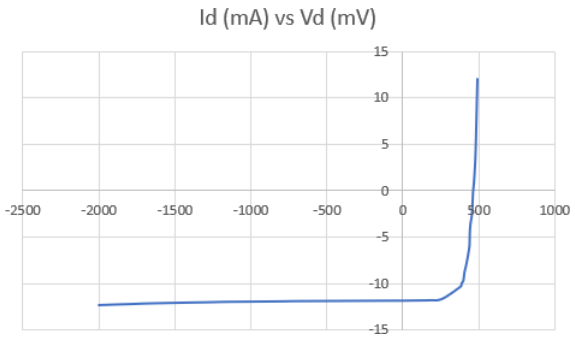
1.3.1 I_d vs V_d (Dark condition)



1.3.2 I_d vs V_d (Light-I1)



1.3.3 I_d vs $V_d(Light_{I2})$

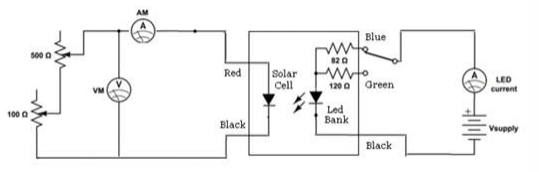


1.4 Completion Status

Completed.

2 Solar cell as power source

2.1 Circuit Diagram



2.2 I_l vs V_l

2.2.1 I_{led}=46mA

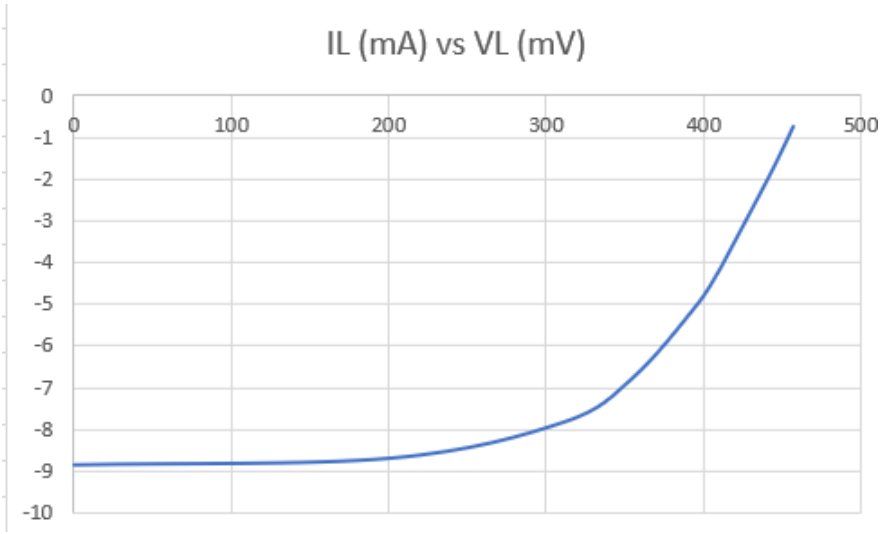
VL (mV)	IL (mA)
0	-8.83
201	-8.67
311	-7.81
355	-6.75
395	-5.04
409	-4.24
415	-3.83
441	-1.98
451	-1.22
457	-0.74

2.2.2 I_{led}=62mA

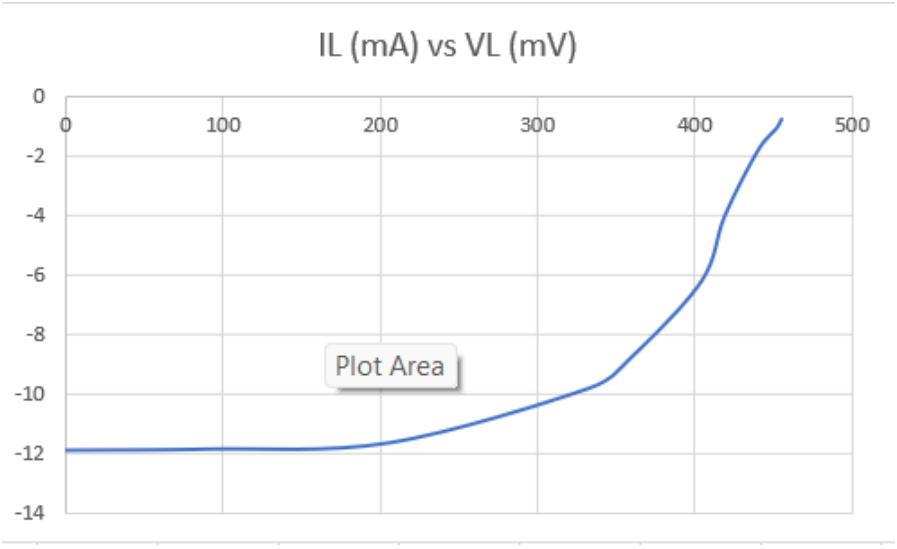
VL (mV)	IL (mA)
0	-8.83
201	-8.67
311	-7.81
355	-6.75
395	-5.04
409	-4.24
415	-3.83
441	-1.98
451	-1.22
457	-0.74

2.3 Plot of I_l vs V_l

I_{led}=46mA



I_{led}=62mA

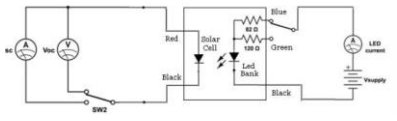


2.4 Completion Status

Completed

3 Measurement of VOC and ISC at different illumination levels

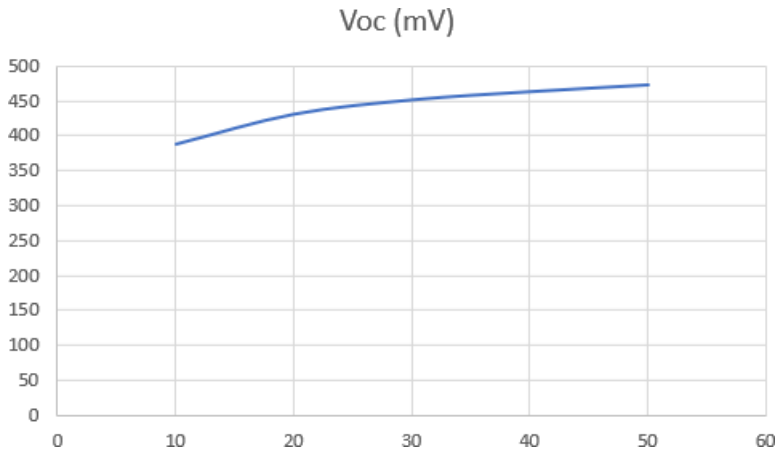
3.1 Curcuit Design

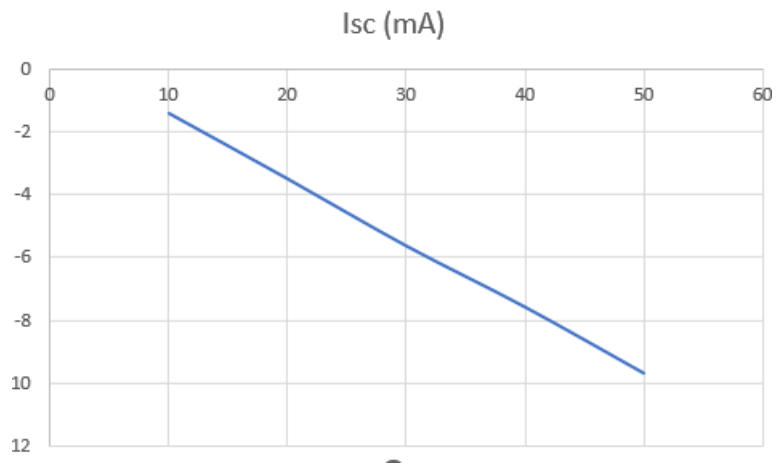


3.2 Data of the variations

Iled (mA)	Voc (mV)	Isc (mA)
10	387	-1.42
20	431	-3.5
30	452	-5.63
40	464	-7.57
50	474	-9.67

3.3 Plots


Voc (mV)
500
450
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60


Isc (mA)
0
-2
-4
-6
-8
10
12
0
10
20
30
40
50
60

Conclusion

In this experiment, we successfully characterized the current-voltage (I-V) behavior of a solar cell under dark conditions and at two different light intensities, I1 and I2. The resulting I-V plots under these varying conditions provided a clear visualization of key solar cell performance metrics, including short-circuit current (Isc) and open-circuit voltage (Voc) for both light intensities.

Using the data from part 2, we determined the maximum power point (MPP) by plotting power (P) as a function of voltage (V). The voltage (VMP) and current (IMP) at the MPP were then used to calculate the fill factor (FF), a crucial parameter indicating the solar cell's efficiency. The fill factor was calculated using the formula:

$$FF=ISC\times VOC/IMP\times VMP$$

Additionally, the experiment revealed that the short-circuit current (Isc) increases linearly with light intensity, while the open-circuit voltage (Voc) exhibits a linear relationship with the logarithm of the light intensity. These relationships were confirmed by plotting Isc against light intensity (I_LED) and Voc against log(I_LED).

Comparing the I-V curves from parts 1 and 2 in the fourth quadrant showed good agreement, further validating the consistency of the measurements taken under different conditions.

Overall, the experiment highlighted the dependence of solar cell parameters on light intensity and provided insights into the behavior of solar cells under varying illumination conditions. The calculated fill factor, along with the observed linear relationships between Isc, Voc, and light intensity, underscores the importance of these parameters in evaluating solar cell performance.

3.4 Completion status

Completed everything successfully and also checked by my TA