EE 236: Electronic Divice Lab
Lab No. 5

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Contents

1 Dark forward characteristics at different temperatures

1.1 Prelab

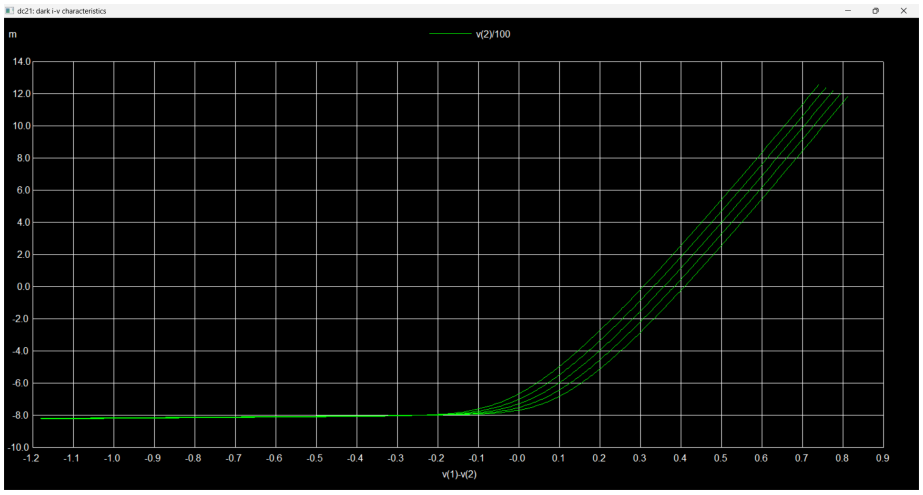

Figure 1: I-V Craracteristics for Dark

In the above diagram, the graph at the bottom represents a temperature of 35 °C, increasing up to 75 °C at the top.

1.2 InLab

1.2.1 Circuit Diagram

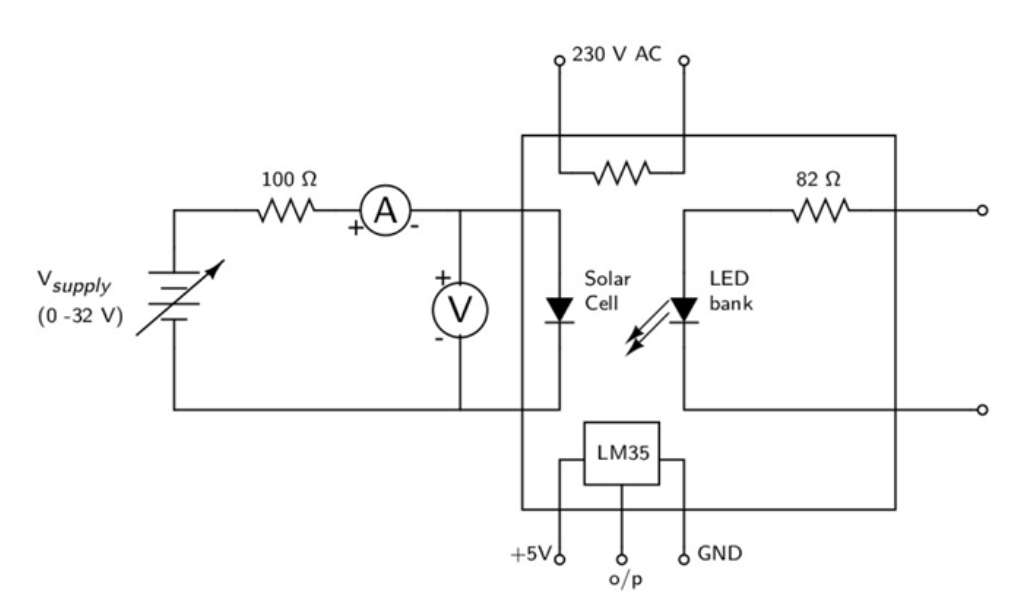

Figure 2: Circuit Diagram

1.2.2 Reading of V_d, I_d and $ln(I_d)$ for different temperatures

V_d (V)	I_d (mA) at 35°C	ln(I_d) at 35°C
0	0	
0.025	0.01	-4.605
0.05	0.01	-4.605
0.075	0.03	-3.507
0.1	0.05	-2.996
0.125	0.07	-2.659
0.15	0.12	-2.120
0.175	0.15	-1.897
0.2	0.21	-1.561
0.225	0.29	-1.238
0.25	0.4	-0.916
0.275	0.57	-0.562
0.3	0.77	-0.261
0.325	1.12	0.113
0.35	1.6	0.470
0.375	2.32	0.842
0.4	3.5	1.253
0.425	5.36	1.679
0.45	8.62	2.154
0.475	14.45	2.671

Table 1: Dark I-V Characteristics at 35°C

V_d (V)	I_d (mA) at 45°C	ln(I_d) at 45°C
0	0	
0.025	0.01	-4.605
0.05	0.02	-3.912
0.075	0.04	-3.219
0.1	0.06	-2.813
0.125	0.1	-2.303
0.15	0.13	-2.040
0.175	0.18	-1.715
0.2	0.25	-1.386
0.225	0.35	-1.050
0.25	0.52	-0.654
0.275	0.72	-0.329
0.3	1.02	0.020
0.325	1.46	0.378
0.35	2.19	0.784
0.375	3.28	1.188
0.4	5.2	1.649
0.425	8.31	2.117
0.45	13.95	2.635

Table 2: Dark I-V Characteristics at 45°C

V_d (V)	I_d (mA) at 55°C	$\ln(I_d)$ at 55°C
0	0	
0.025	0.02	-3.912
0.05	0.03	-3.507
0.075	0.04	-3.219
0.1	0.06	-2.813
0.125	0.1	-2.303
0.15	0.16	-1.833
0.175	0.23	-1.470
0.2	0.33	-1.109
0.225	0.45	-0.799
0.25	0.68	-0.386
0.275	0.98	-0.020
0.3	1.36	0.307
0.325	2.05	0.718
0.35	3.18	1.157
0.375	5.00	1.609
0.4	8.50	2.140
0.425	14.00	2.639
0.45	19.00	2.944

Table 3: Readings of V_d, I_d, and $\ln(I_d)$ at 55°C

V_d (V)	I_d (mA) at 65°C	$\ln(I_d)$ at 65°C
0	0	
0.025	0.01	-4.605
0.05	0.02	-3.912
0.075	0.07	-2.659
0.1	0.1	-2.303
0.125	0.15	-1.897
0.15	0.21	-1.561
0.175	0.34	-1.079
0.2	0.45	-0.799
0.225	0.65	-0.431
0.25	0.95	-0.051
0.275	1.38	0.322
0.3	2.08	0.732
0.325	3.15	1.147
0.35	4.84	1.577
0.375	7.75	2.048
0.4	13.22	2.582
0.425	19.00	2.944

Table 4: Readings of V_d, I_d, and $\ln(I_d)$ at 65°C

V_d (V)	I_d (mA) at 75°C	$\ln(I_d)$ at 75°C
0	0	
0.025	0.02	-3.912
0.05	0.04	-3.219
0.075	0.08	-2.526
0.1	0.14	-1.966
0.125	0.21	-1.561
0.15	0.3	-1.204
0.175	0.41	-0.892
0.2	0.64	-0.446
0.225	0.9	-0.105
0.25	1.34	0.293
0.275	2.00	0.693
0.3	3.00	1.099
0.325	4.69	1.545
0.35	7.59	2.027
0.375	12.37	2.515
0.4	19.90	2.991

Table 5: Readings of V_d, I_d, and $\ln(I_d)$ at 75°C

1.2.3 Plots

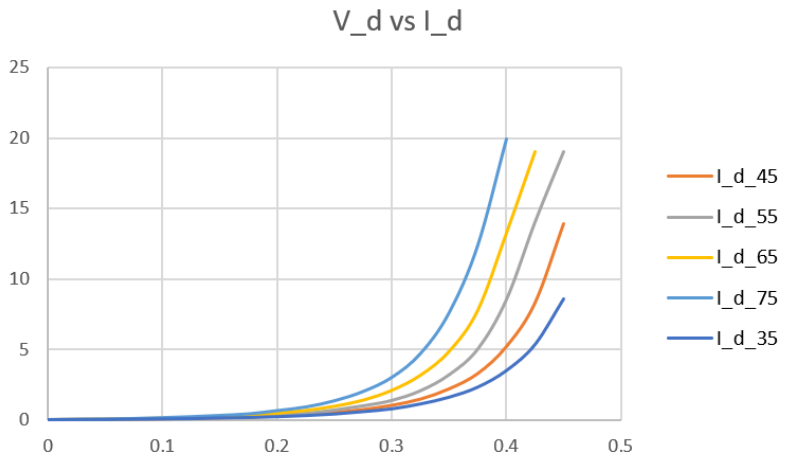

Figure 3: I_d vs V_d

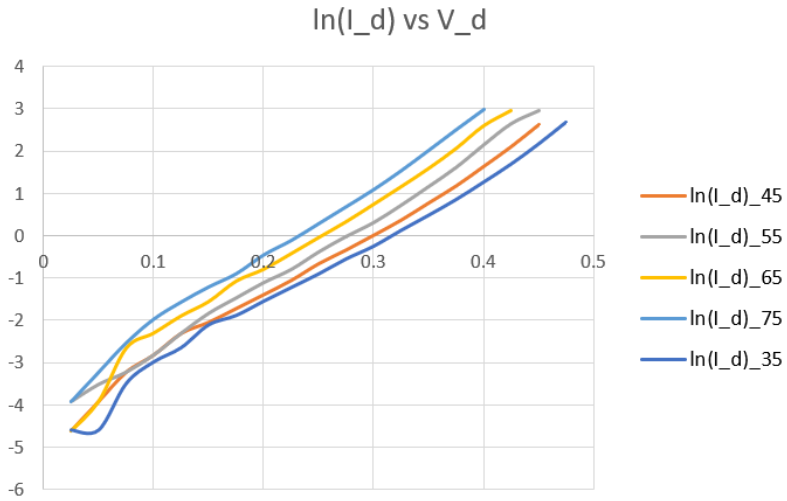

Figure 4: $ln(I_d)$ vs V_d

1.2.4 Observations

Temperature	V_d for $I_d = 1mA$	V_d for $I_d = 2mA$	V_d for $I_d = 5mA$	η for low forward bias	η for high forward bias
35°C	0.316	0.364	0.420	2.25567657	2.394703098
45°C	0.296	0.344	0.397	2.322294623	2.278348585
55°C	0.276	0.323	0.375	2.413137831	2.17533318
65°C	0.253	0.297	0.352	2.184456668	2.159706264
75°C	0.23	0.275	0.328	2.155205116	2.074932653

Table 6: Observation Table

2 Lighted I/V at different temperatures

2.1 Prelab

2.1.1 Plot

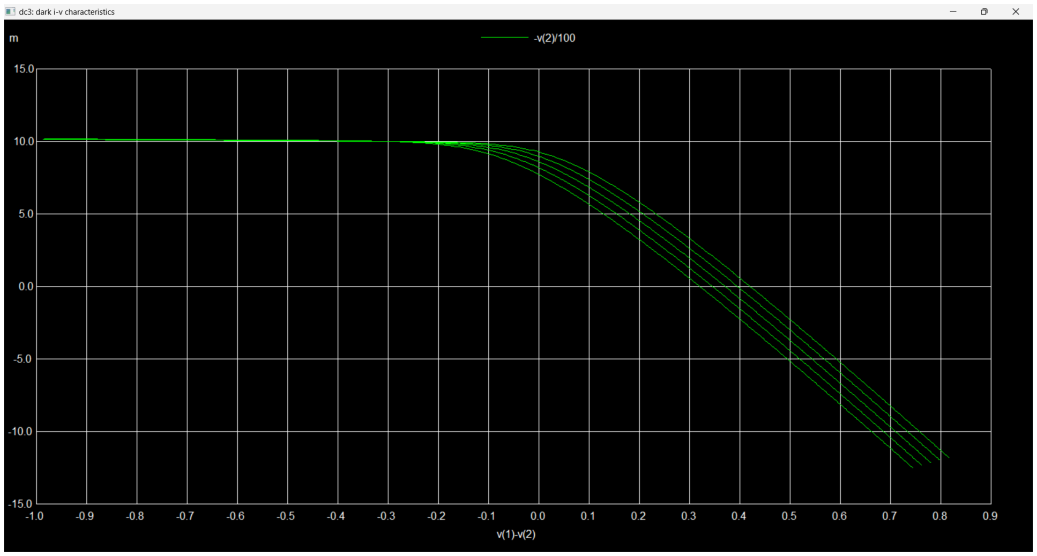

Figure 5: Lighted I-V characteristics

2.1.2 Calculated Values

Temperature (°C)	Vm (V)	Im (mA)	Isc (mA)	Voc (V)	FF
35	0.2612	-0.0076	-0.0099	0.4159	0.4831
45	0.2410	-0.0074	-0.0099	0.3944	0.4582
55	0.2209	-0.0072	-0.0099	0.3728	0.4330
65	0.2005	-0.0072	-0.0098	0.3513	0.4182
75	0.2019	-0.0061	-0.0098	0.2790	0.4526

Table 7: Temperature dependence of solar cell parameters

2.2 Inlab

2.2.1 Circuit Diagram

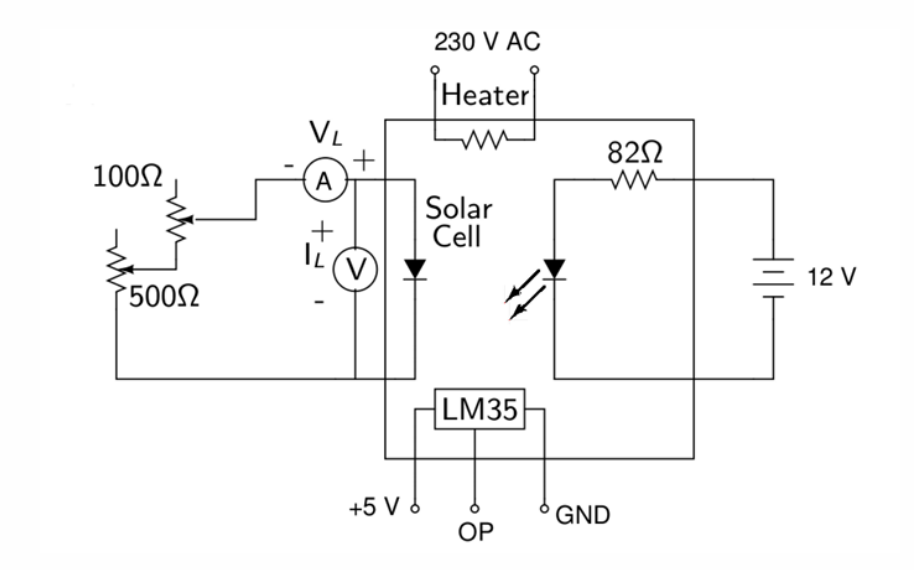

Figure 6: Circuit diagram for lighted I/V characteristics

2.2.2 Reading of V_d and I_d for different temperatures

V_l (V)	I_l (mA) at 35°C	P_l at 35°C
0	10.52	0.000
0.025	10.49	0.262
0.05	10.46	0.523
0.075	10.42	0.782
0.1	10.38	1.038
0.125	10.31	1.289
0.15	10.23	1.535
0.175	10.12	1.771
0.2	10.00	2.000
0.225	9.80	2.205
0.25	9.56	2.390
0.275	9.18	2.525
0.3	8.73	2.619
0.325	8.01	2.603
0.35	7.11	2.489
0.375	5.96	2.235
0.4	4.49	1.796
0.425	2.71	1.152

Table 8: Readings of V_l, I_l, and P_l at 35°C

V_l (V)	I_l (mA) at 45°C	P_l at 45°C
0	10.46	0.000
0.025	10.44	0.261
0.05	10.41	0.521
0.075	10.35	0.776
0.1	10.30	1.030
0.125	10.21	1.276
0.15	10.09	1.514
0.175	9.96	1.743
0.2	9.71	1.942
0.225	9.50	2.138
0.25	9.20	2.300
0.275	8.55	2.351
0.3	7.95	2.385
0.325	7.08	2.301
0.35	5.92	2.072
0.375	4.52	1.695
0.4	2.80	1.120
0.425	0.82	0.349

Table 9: Readings of V_l, I_l, and P_l at 45°C

V_l (V)	I_l (mA) at 55°C	P_l
0	10.40	0
0.025	10.39	0.25975
0.05	10.33	0.5165
0.075	10.27	0.77025
0.1	10.20	1.02
0.125	10.10	1.2625
0.15	10.00	1.50
0.175	9.76	1.708
0.2	9.54	1.908
0.225	9.10	2.0475
0.25	8.60	2.15
0.275	8.08	2.222
0.3	7.13	2.139
0.325	6.01	1.95325
0.35	4.55	1.5925
0.375	2.93	1.09875
0.4	0.88	0.352

Table 10: Readings of V_l, I_l, and P_l at 55°C

V_l (V)	I_l (mA) at 65°C	P_l
0	10.32	0
0.025	10.31	0.25775
0.05	10.25	0.5125
0.075	10.16	0.762
0.1	10.05	1.005
0.125	9.91	1.23875
0.15	9.72	1.458
0.175	9.50	1.6625
0.2	9.17	1.834
0.225	8.70	1.9575
0.25	8.05	2.0125
0.275	7.20	1.98
0.3	6.11	1.833
0.325	4.64	1.508
0.35	2.92	1.022
0.375	0.92	0.345

Table 11: Readings of V_l, I_l, and P_l at 65°C

V_l (V)	I_l (mA) at 75°C	P_l
0	10.27	0
0.025	10.23	0.25575
0.05	10.14	0.507
0.075	10.04	0.753
0.1	9.90	0.99
0.125	9.71	1.21375
0.15	9.48	1.422
0.175	9.13	1.59775
0.2	8.67	1.734
0.225	8.03	1.80675
0.25	7.18	1.795
0.275	6.07	1.66925
0.3	4.72	1.416
0.325	3.13	1.01725
0.35	1.12	0.392

Table 12: Readings of V_l, I_l, and P_l at 75°C

2.2.3 Plots

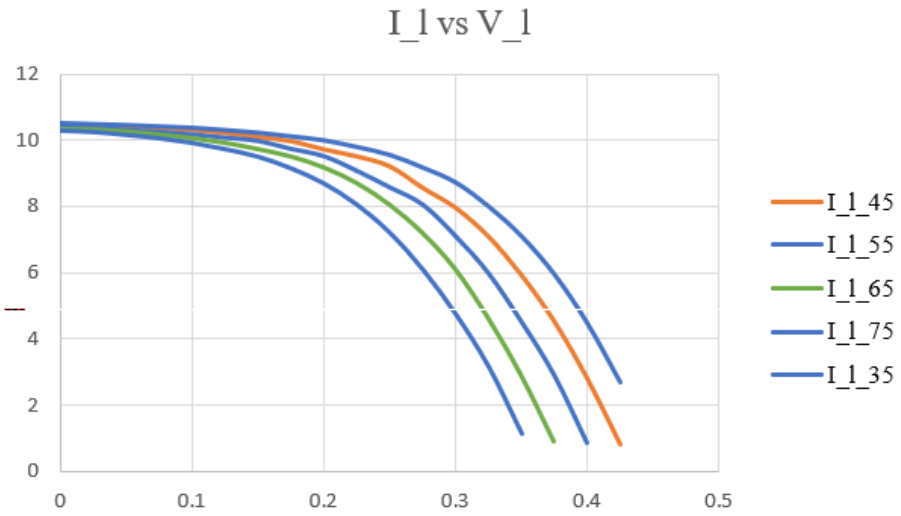

Figure 7: Caption

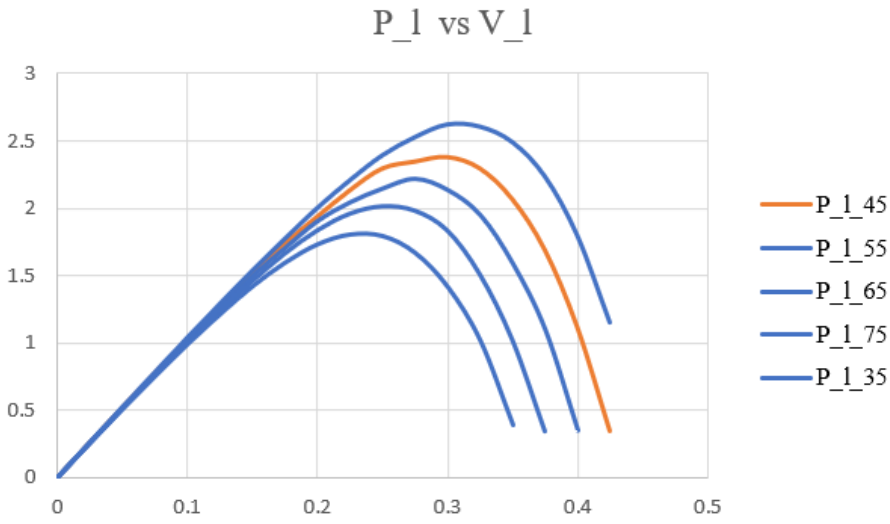

Figure 8: Caption

2.2.4 Observations

Temp	35°C	45°C	55°C	65°C	75°C
I_{sc}	11.9378	12.2615	12.1759	12.0530	11.9037
V_{oc}	0.8096	0.6475	0.6024	0.5570	0.5145
$I_m \times V_m$	2.6190	2.3850	2.2220	2.0125	1.8068
FF	0.2710	0.3004	0.3029	0.2998	0.2950

Table 13: Performance Metrics at Different Temperatures