NAME : MAJJIGA JASWANTH
REGNO : 20BCD7171

Experiment - 3

Aim: Determination of efficiency and I-V characteristics of Solar Cell.

Apperatus: (a) lamp (b) Solar cell (c) Measuring Scale. (d) Circuit board.

Objective: finding efficiency and I-V characteristics of Solar cell

formulae:

(i) Power:

$P = VI$

where
P = Power
V = voltage
I = current

(ii) fill factor:

$$ff = \frac{P_{max}}{P_{the}} = \frac{V_{mp} I_{mp}}{V_{oc} I_{sc}}$$

where,
P_{max} = Maximum Power
P_{the} = Theoritical Power
V_{mp} = Voltage of maximum Power
I_{mp} = current at maximum power
V_{oc} = open circuit voltage
I_{sc} = short-circuit Voltage

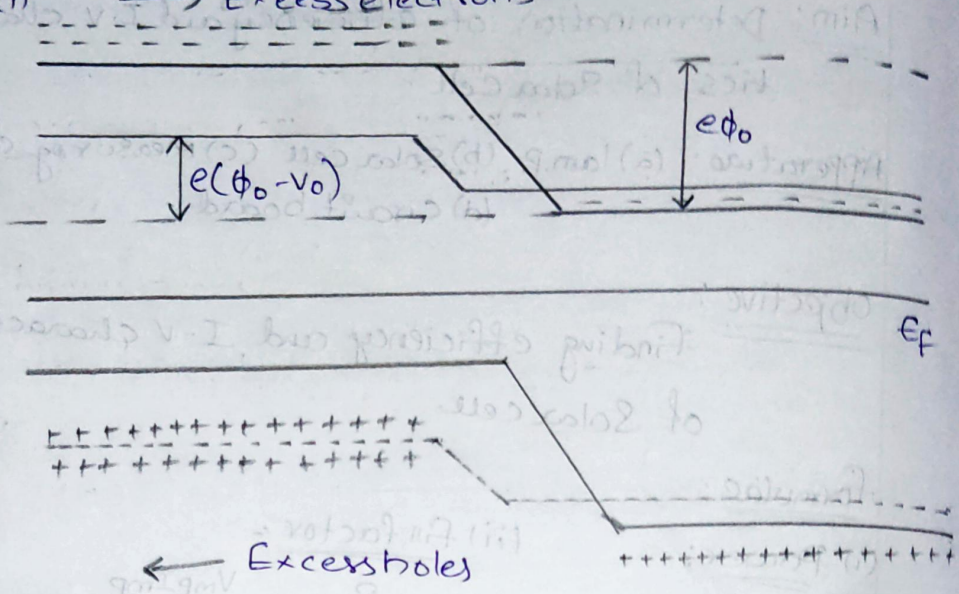
(iii) Efficiency:

$$\eta = \frac{P_{out}}{P_{in}} = \frac{I_{sc} V_{oc} ff}{P_{in}} = \frac{V_{mp} I_{mp}}{A_c I}$$

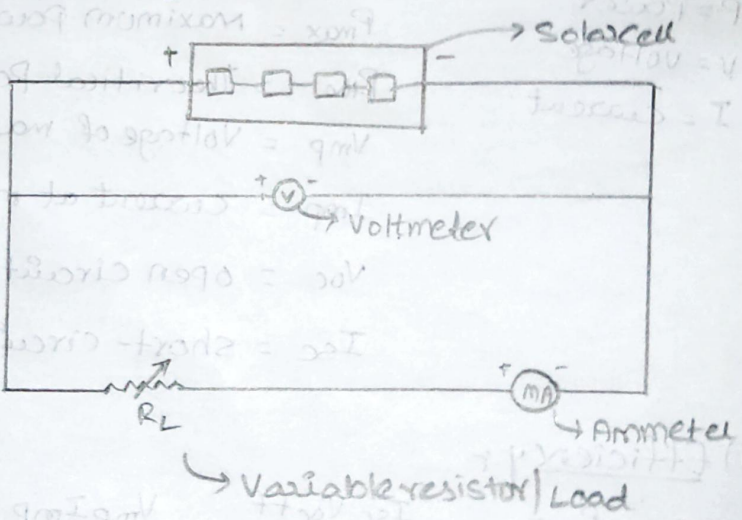
η = Efficiency
P_{out} = out Power
P_{in} = Input Power
I = Incident Intensity
A_c = Area of Solar Cell

Diagramatical Representation :-

(i) → Excess electrons



(ii) Circuit diagram :-



Observation Table :-

S/No	variable load Resistance (Ω)	12cm		15cm		18cm	
		$V_{oc}=2$	$I_{sc}=22$	$V_{oc}=1.95$	$I_{sc}=17$	$V_{oc}=1.85$	$I_{sc}=13$
		Voltage(V)	Current(I)	voltage(V)	Current(I)	Voltage(V)	Current(I)
1	10	0.5	22	0.25	17	0.2	13
2	22	0.6	22	0.5	17	0.4	13
3	33	0.8	21	0.6	17	0.6	13
4	47	1.0	21	0.75	16	0.65	12
5	68	1.3	20	1.0	16	0.8	12
6	82	1.55	20	1.2	16	0.95	12
7	100	1.7	18	1.5	15	1.15	12
8	150	1.8	12	1.7	11	1.6	10
9	220	1.9	8	1.8	8	1.7	8
10	470	1.95	3	1.9	3	1.8	3

Calculations :-

for $d=12cm$

$V_{mp}=1.55 \quad I_{mp}=20$

$V_{oc}=2 \quad I_{sc}=22$

fill factor $(ff)_1 = \frac{1.55\times20}{2\times22} = \frac{31}{44} = 0.70$

for $d=18cm$

$V_{mp}=1.15 \quad I_{mp}=12$

$V_{oc}=1.85 \quad I_{sc}=13$

fill factor $(ff)_2 = \frac{1.15\times12}{1.85\times13} = \frac{13.8}{24.05} = 0.57.$

For d = 15 cm.

$V_{mp} = 1.5$ $I_{mp} = 15$

$V_{oc} = 1.95$ $I_{sc} = 17$

fill factor $(ff)_2 = \frac{1.5 \times 15}{1.95 \times 17} = \frac{22.5}{33.15} = 0.68$

Result:=

The fill factor was found to be 0.65

lab-3

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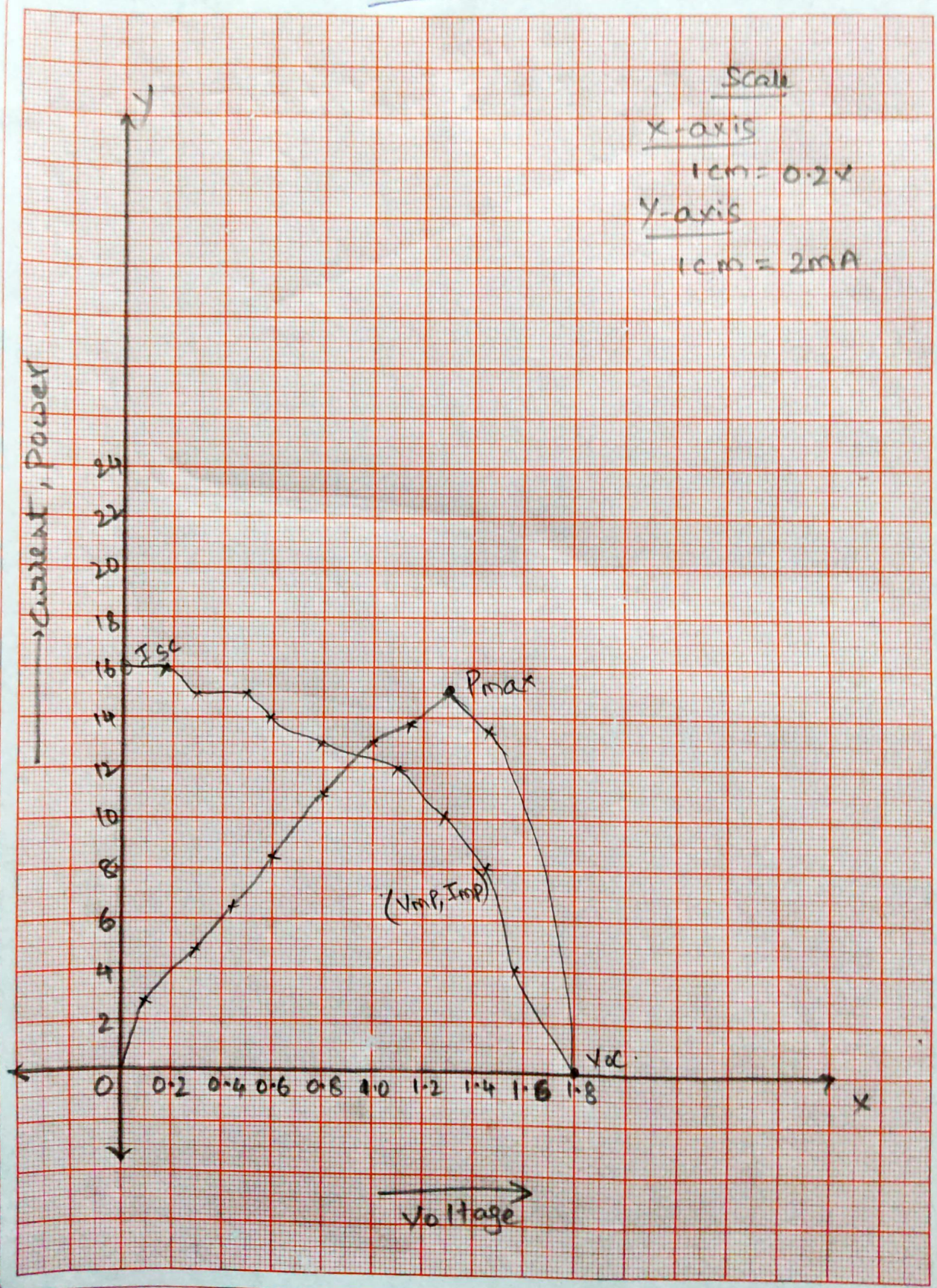
Scale
X-axis
1cm = 0.2V
Y-axis
1cm = 2mA
Y
Current, Power
24
22
20
18
16
14
12
10
8
6
4
2
0
Isc
Pmax
(Vmp, Imp)
Voc
0·2 0·4 0·6 0·8 1·0 1·2 1·4 1·6 1·8
X
Voltage