SWAMI VIVEKANAND COLLEGE OF ENGINEERING INDORE

CLASS WORK
SESSIONAL WORK

ASSINGMENT / EXPERIMENT No.

SUBMITED ON .... MARKS OR GRADE OBTAINED ....

NAME: KRISH SONI   ROLL NO. 0822CS241109

CLASS: 2nd SEM {1st Year}   DEPARTMENT: CS-II

SUBJECT: Engineering Physics (IRB)   CODE No. BT-201

Signature of Student: Krish   Signature of Professor

Object:- To Plot the V-I characteristics of the Solar cell and hence determine the fill factor

Apparatus Required:- Solar cell kit, lamp.

Theory:- The Solar cell is a semiconductor device, which convert the Solar Energy into electrical energy. It is also called a Photovoltaic cell. A solar panel consists of numbers of Solar cells connected in Series or parallel. The number of Solar Cell Connected in a series generates the desired output voltage and Connected in parallel generates the desired output Current. The Conversion of Sunlight (Solar Energy) into electric energy takes place only when the light is falling on the cells of the Solar panel. Therefore in most practical applications, the Solar panels are used to charge the lead acid or Nickel-cadmium batteries. In the Sunlight, the Solar panel charges the battery and also supplies the power to the load directly. when there is no Sunlight, the charged battery Supplies the required power to the load.

A Solar cell operates in Somewhat the Same manner as other junction photo detectors. A built-in depletion region is generated in that without an applied reverse bias and photons of adequate energy create hole-electrons pairs. In the Solar cell, as shown in fig. 1a. the pair must diffuse a considerable distance to reach the narrow depletion region to be drawn out as useful current. Hence, there is higher Probability of recombination. The current generated by separated pairs increases the depletion region voltage (Photovoltaic effect). when a load is connected across the cell, the potential causes the photocurrent to flow through the load.

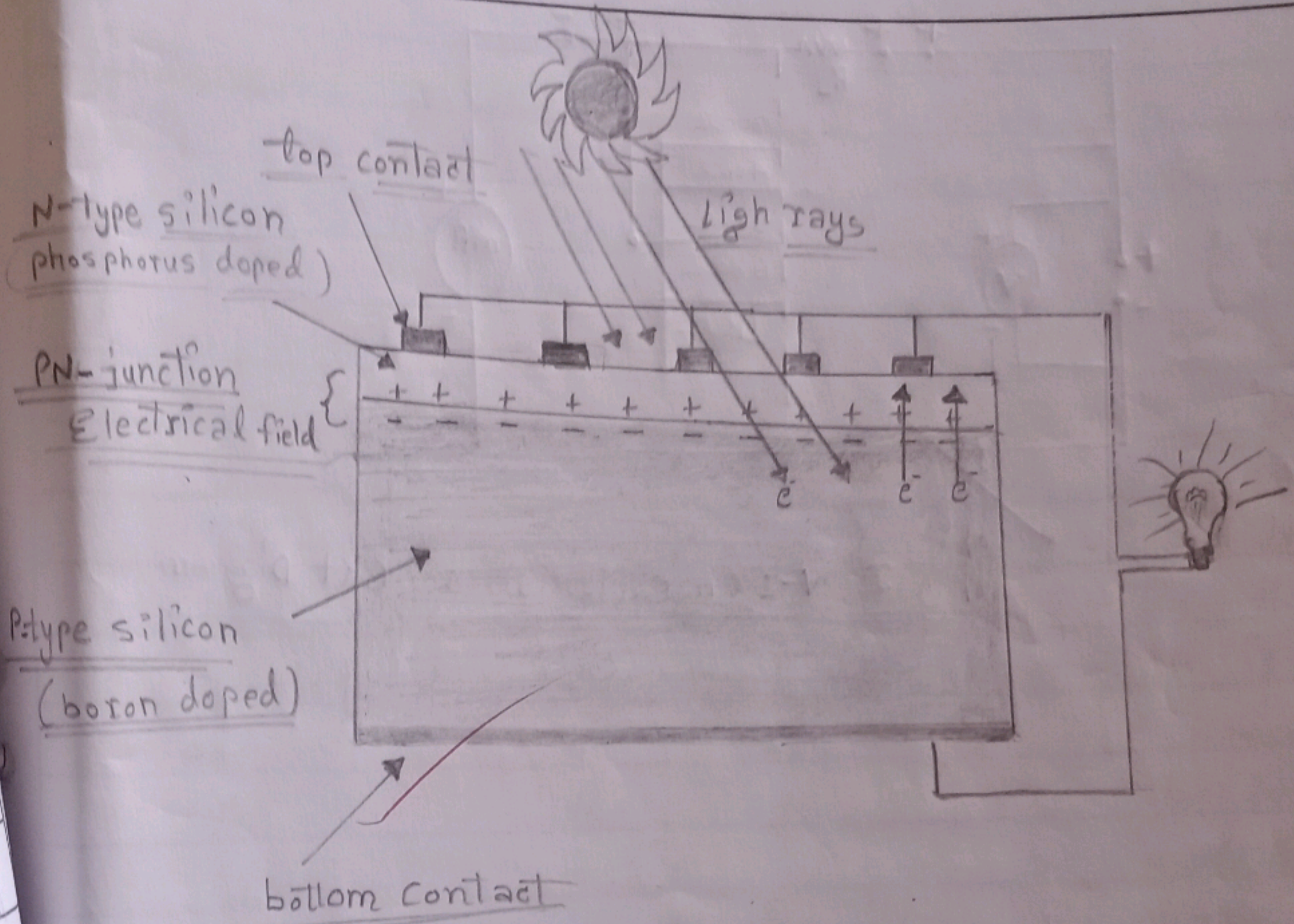

fig.1a Working principle of a solar

Circuit Diagram

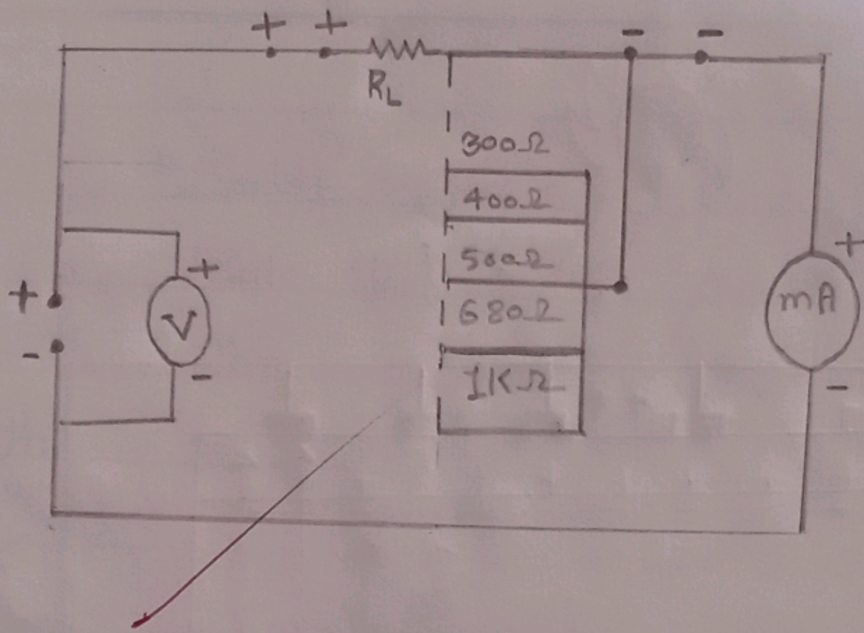

fig. 2 V-I Characteristicsc Ckt Diagram

The e.m.f. generated by the photo-voltaic cell in the open circuit, i.e, when no current is drawn front it is denoted by Voc (V-open circuit). This is the maximum value of e.m.f. when a high resistance is introduced in the external circuit a small current flows through it and the voltage decreases. The voltage goes on falling and the current goes on increasing as the resistance in the external circuit is reduced. when the resistance is reduced to zero the current rises to its maximum value known as saturation current and is denoted as value of e.m.f.. when a high resistance is introduced in the external circuit a small current flows through it and the voltage decreases The voltage goes on falling and the current goes on increasing as the resistance in the external circuit is reduced. When the resistance is reduced to zero the current rises to its maximum value known as saturation current and is denoted as Isc the voltage becomes zero A V-I characteristic of a photo. voltaic cell is shown in fig. 1b.

The Product or open circuit voltage Voc and Short circuit current ISC is Known a Ideal Power.

$\therefore$ Ideal Power $= V_{oc} \times I_{sc}$

The maximum useful is the area of the largest rectangle that can be formed under the V-I curve. If Vm and Im are the values of voltage and current under this condition, then

Maximum useful Power $= V_m \times I_m$

The ratio of the maximum useful power to ideal Power is called the fill factor

$$\therefore \text{fill factor} = \frac{V_m \times I_m}{V_{oc} \times I_{sc}}$$

Observations :-

voltmeter reading for open circuit, $V_{oc} =$ 2.97 volt

Milli-Ammeter reading with zero resistance, $I_{sc} =$ 8.0 mA.

S.No.	Voltage	Current	load	Power V×I
1	2.06	6.2	300Ω	12.77
2	2.59	4.8	470Ω	12.43
3	2.70	3.2	680Ω	8.64
4	2.76	2.2	1KΩ	6.07

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NAME Krish Soni

CLASS 1st Year, 2nd Sem. ROLL NO 0822CS241109

SUBJECT Engineering Physics DEPARTMENT CS-II

Krish
Signature of Student CODE NO BT-201

Signature of Professor

Objective To determine the value of acceleration due to gravity and radius of gyration using bar pendulum.

Apparatus used :- Bar pendulum, stop watch and meter Scale.

Formula :-

(A) The general formula of the time period for bar pendulum is given by following equation :-

$$g = 8\pi^2 \frac{(L_1 + l_2)}{T_2} \quad \text{— (1)}$$

where I: distance between C. G. and suspension point.

L: distance between Suspension and

Gotte oscillation points, $L = L_1 + L_2 = \frac{K^2 + I}{I}$

(B) The time period is minimum when $I = \pm K$
in this situation the Equation (1)
becomes as:

$$T_{min} = 2\pi\sqrt{\frac{2K}{g}}$$

$$g = 8\pi^2 \frac{K}{T^2} \quad \text{— (2)}$$

where, K: radius of gyration
T_{min} minimum time period.
The value of 'g' can be calculated
using Equation (1) and (2)
The values of L, T, K and T_{min} are
obtained using graph between T and L
for bar pendulum which is shown in
following figure.

from figure (1) and (2)
(a) $L_1 = AC + CD$, $L_2 = EC + CB$ and $L = (L_1 + L_2)/2$, T = time at C
(b) $K = (PQ + QR)/2$ and T_{min} = time at Q
(C) Time radius of gyration can be obtained
with following formula.

$$K = \left(\frac{L_1 + L_2}{2}\right) \quad \text{— (3)}$$

where $L_1 = (AC + CE)/2$, $L_2 = (BC + CD)/2$

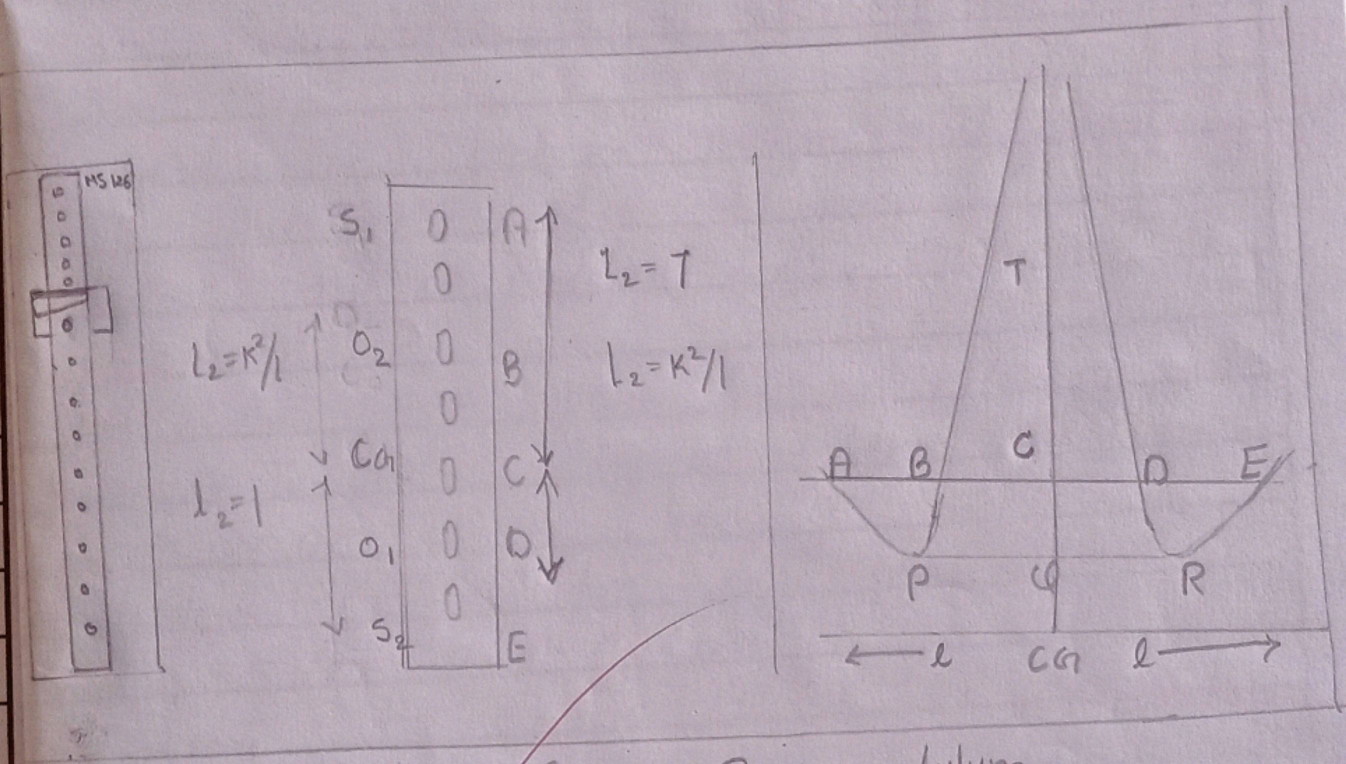

figure:- Bar pendulum

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Procedure:-

(1) Place the Knife-edges at the first hole of the bar

(2) Suspend the pendulum through rigid support with the Knife-edge

(3) Oscillate the pendulum for small amplitude ($\theta = 3 \sim 4^0$).

(4) Note the time taken for 20 oscillations and measure the distance of the hole from the C.G of the bar. (5) Repeat the observations (2)-(4) for Knife-edges at first half side holes of bar.

(6) Repeat the process (1)-(5) for the second half side of the bare.

(7) Plot the graph between T and L

Observations:-

1. Least Count of the stop watch = sec
2. Least Count of the meter Scale = cm
3. Table for L and T

S. NO.	L (cm)	t (time taken for 20 oscillations)	T = t/20
for first half side of the bar			
1	38.8	14.61	1.461
2	31.4	13.90	1.390
3.	$\boxed{23.9}$ L_1	$\boxed{13.53}$ T_1	$\boxed{1.353}$
4.	16.5	13.83	1.383

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For second half side of the bar

1.	37.0	14.62	1.462
2	29.9	13.98	1.398
3.	$\boxed{22.1}$ L_2	13.46	$\boxed{1.346}$ T_2
4.	14.5	14.24	1.424

Calculation:-

$$g = \frac{8\pi^2 K}{T^2}$$

$$K = \frac{l_1 + L_2}{2} = \frac{23.9 + 22.1}{2} = \frac{46.1}{2} = 23.05$$

$$T = \frac{T_1 + T_2}{2} = \frac{14.876}{2} = 7.438$$

$$g = \frac{8\pi^2 k}{T^2}$$

$$g = \frac{78.8768 \times 23.05}{(7.438)^2}$$

$$g = \frac{1818.11029}{55.323844}$$

$$g = 32.8630498$$

Results:- The acceleration due to gravity $(g) = 32.8630\ m/s^2$

Radius of gyration $(K) = 23.05\ cm$

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CLASS ... 1st Year {SEM 2nd} ... DEPARTMENT ... CS - II

SUBJECT .... CODE No. ... BT-201

Krish
Signature of Student

Signature of Professor

Object :- Determination of wavelength of laser using a plane transmission grating.

Apparatus required :- Transmission Grating, stand, Scale, laser.

Theory :- If monochromatic light from semiconductor laser source is allowed to fall on grating. we obtain image of laser along the same direction as well as diffraction spots incident rays in first and second order on both sides. These positions of the central image and the diffraction equation is

$$(e+d)\sin\theta = n\lambda$$

$$\sin\theta = \frac{n\lambda}{(e+d)}$$

$$\lambda = \frac{(e+d)\sin\theta}{n}$$

where, $\sin\theta$ = angle of inclination

n = order of Spectrum

λ = wavelength of source

$(e+d)$ = Grating element = $\frac{2.54}{15000}$

Procedure:- 1) Set the laser, diffraction grating and scale in one line so that the beam of laser falls on the scale directly.

(2) The centre spot of is the zero order image of the laser, the first image of both the sides from the centre is the first order image of the laser and further more

(3) Move left to the first order spectrum and then to right side and note down the distance.

(4) Experiment can be repeated for the second order image of the laser

$e+d = \frac{2.54}{15000}$

1 inch - 15000 slit

1 width - 2.54

distance from Screen grating	L.H.S	R.S.H	main	θ	λ
20cm	7.0	7.3	7.15	0.336	5.6×10^{-5}
25cm	8.7	8.6	17.3	0.569	9.6×10^{-6}

$\sin\theta = \frac{P}{H}$

$H^2 = d^2 + p^2$

$H^2 = (7.15)^2 + (20)^2$

$H^2 = 51.12 + 400$

$H = \sqrt{451.12}$

$H = 21.23$

$\sin\theta = \frac{7.15}{21.23}$

$\sin\theta = 0.336$

formula $\lambda = (e+d)\sin\theta$

$\lambda = \frac{2.54}{15000} \times 0.336$

$\lambda = 5.6 \times 10^{-5}$

RAY Diagram:-