Jaypee University of Engineering and Technology, Guna

B.TECH., I YEAR,

I & II SEM

Lab Record

PHYSICS

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Enroll No. :201B172

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LAB EXPERIMENT NO. : (1) (Sem1-lab1) | 20IB172

Aim:

To plot a graph showing the variation of magnetic field with distance along the axis of a Helmholtz galvanometer and calculate the reduction factor 'K', horizontal component of earth's magnetic field 'H' and the radius of coil 'a' from graph.

Apparatus Required:

Helmholtz galvanometer, variable power supply, an ammeter, commutator an connecting wires.

Theory:

A helmholtz Galvanometer is an instrument which can be use to measure d.c current in the circuit. It is an improved form of the tangent galvanometer. It consist of two equal coils placed co-axially at a distance equal to the radius of the either coil.

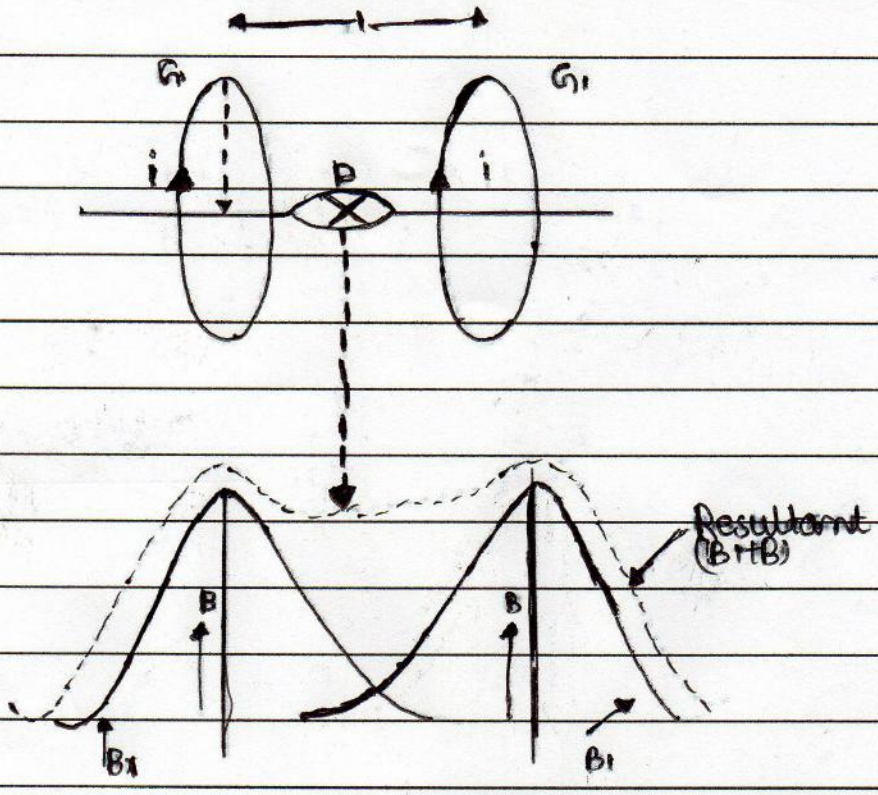
Commutator is used to change the direction of current in a circuit.

Formulae's : $K = I / \tan\theta$ Amperes.

(Calculation) $H = \frac{32\pi nK}{10a\sqrt{125}}$ (K/10 is expressed in emu)

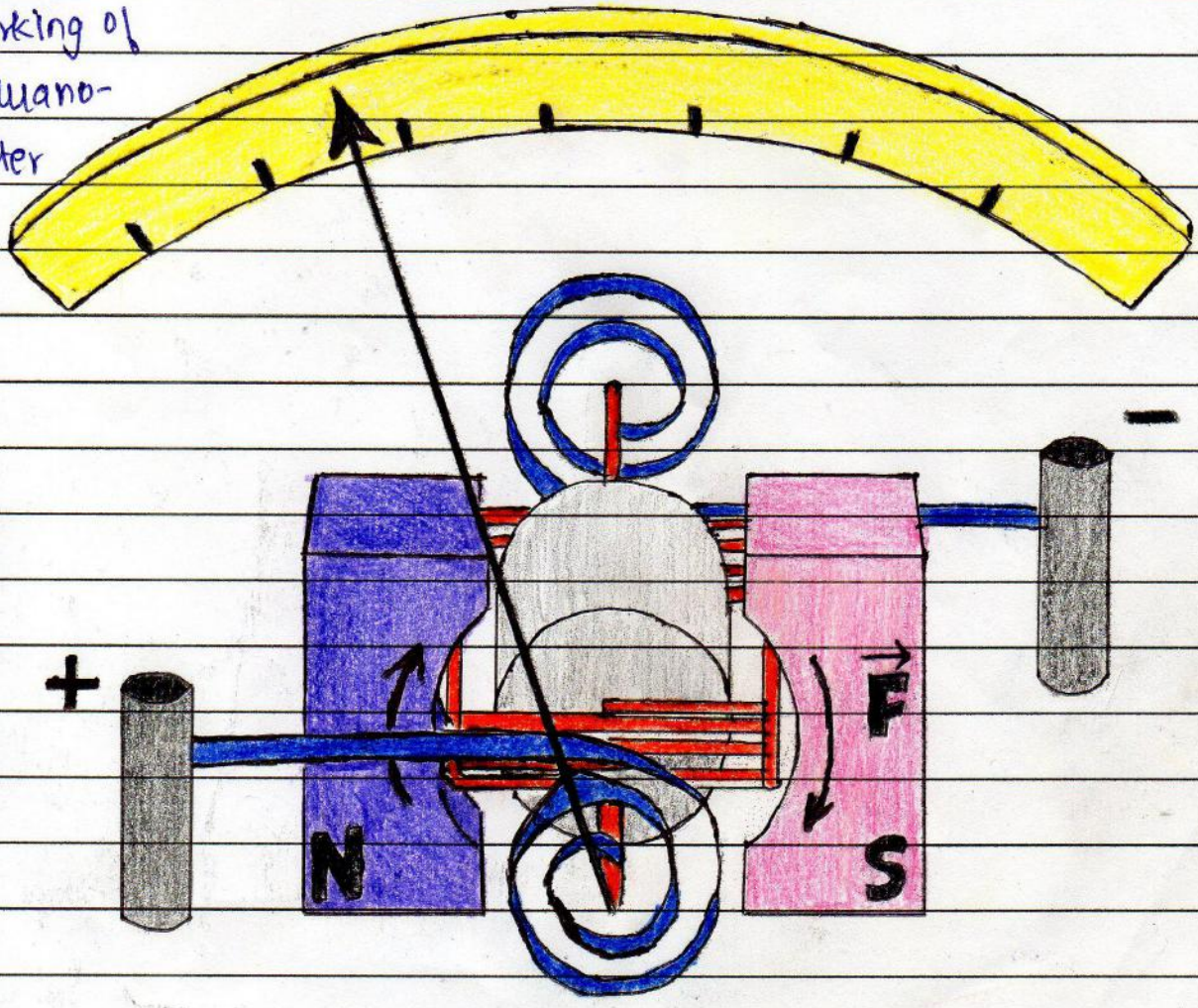
Magnetic Meridian : It is a line joining the magnetic north pole with the magnetic south pole inside earth. Therefore, a compass needle will be parallel to the magnetic meridian.

Diagram:



* Distance V/s field variation

* Working of Galvano-meter



Objective :

To determine the Value of Planck's constant using photoelectric effect.

Apparatus Required :

Planck's constant experimental unit consisting of a vaccum photo tube, light source, color filters, regulated voltage power supply, volt meter, ammeter etc.

Theory :

Photoelectric effect : The emission of electrons when electromagnetic radiation such as light hits a material.

Photocell : The photo metal as cathode and another electrode as anode enclosed in a glass tube is known as photocell.

Einstein Equation : $h\nu = w_0 + \frac{1}{2}mv^2$

whereas h is planck's constant, ν is the frequency of incident radiation, m is mass of electron and v is velocity.

Stopping Potential : The negative potential of the anode of a photoelectric current stops or becomes zero is called stopping potential.

Formula used : The value of planck's constant is given by.

$$h = \frac{e(V_2 - V_1)\lambda_1\lambda_2}{c(\lambda_1 - \lambda_2)}$$

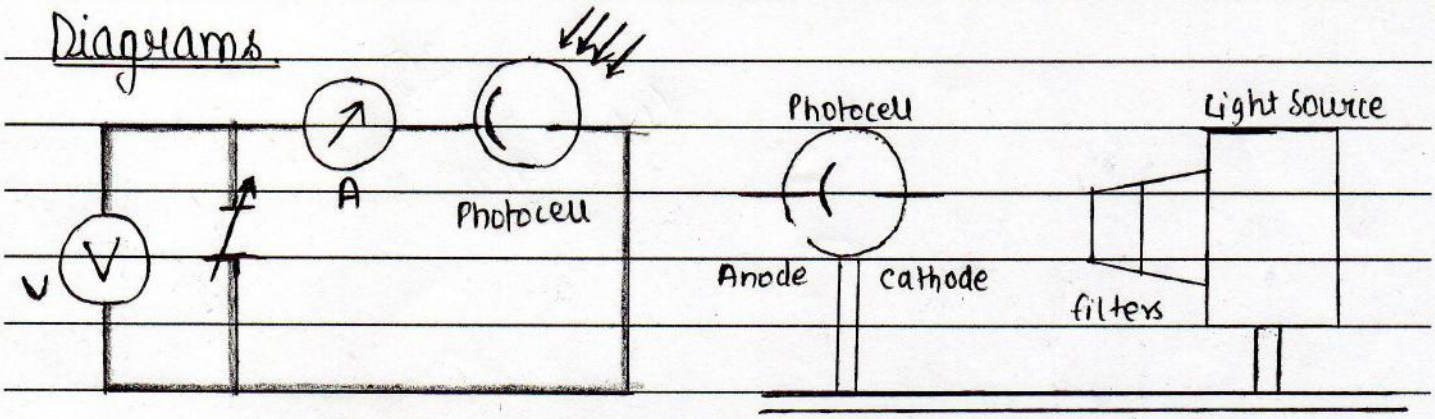
whereas, e = charge of electron

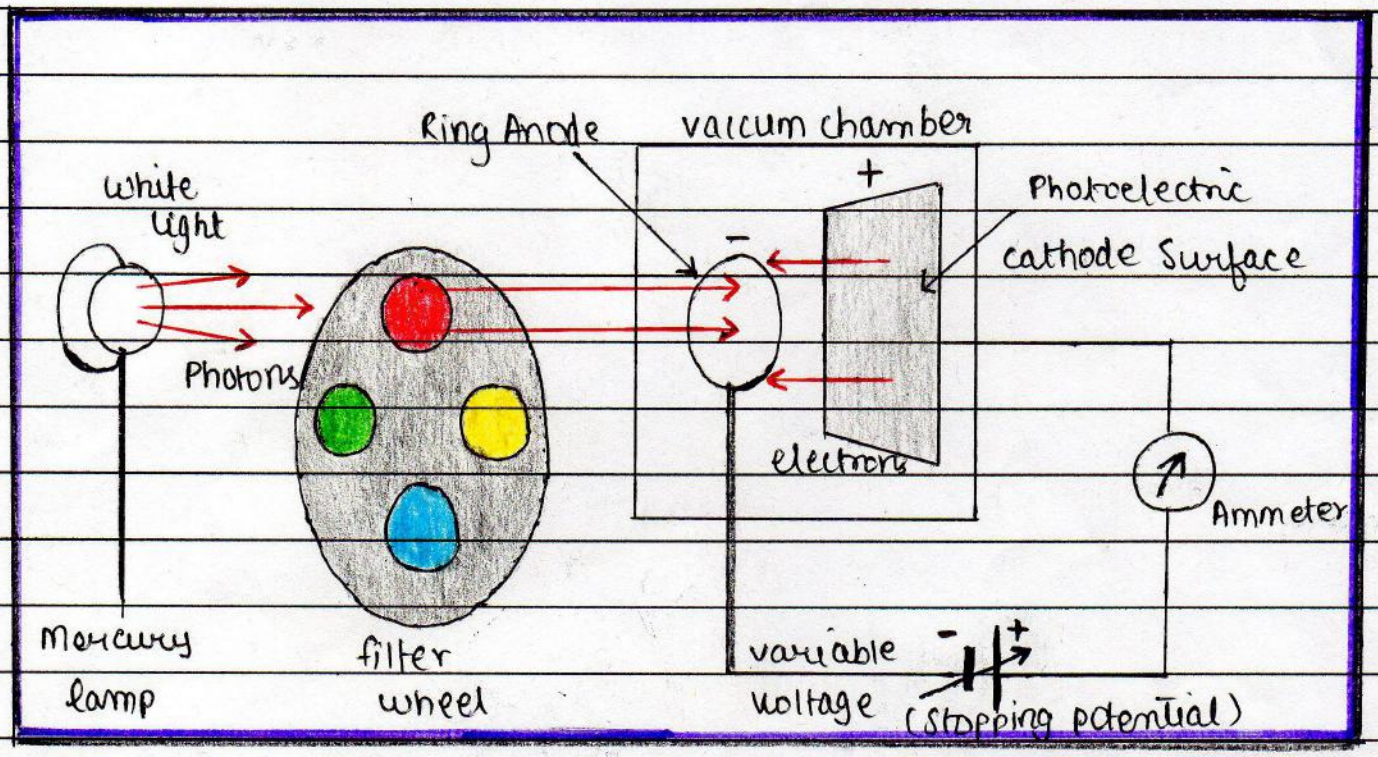
$\lambda_1\lambda_2$ = wavelength of light in meters.

h = planck's constant

V_1, V_2 = Stopping potentials.

Diagrams





Procedure :

Starting with Switching on the setup along with adjustments required. Now switch ON the bulb, place one of the filter and note photo current at zero anode potential, Now apply a small negative potential and note the reading similarly increasing negative potential and note the readings and repeat the experiment for different filters. along with this make required graph and calculate the requirements ie stopping potential and value of plank's constant

LAB EXPERIMENT NO. : 03 (Semi - lab 1) | 2018172

Aim:

To study Frank-Hertz Experiment and verify the presence of discrete energy levels

Apparatus Required:

Frank hertz kit.

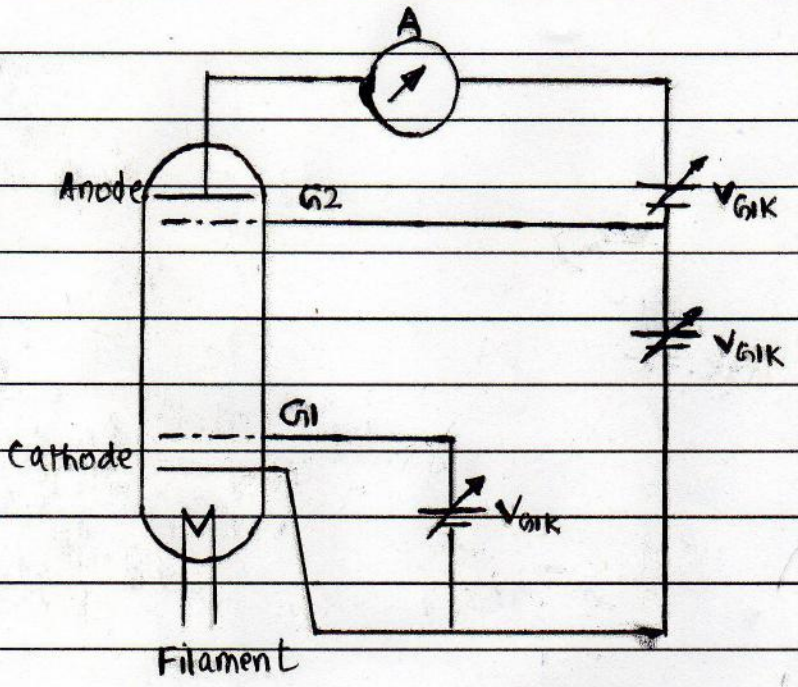
Theory:

The Original experiment used a heated vaccum tube of temperature 115°C with a drop of mercury of vapour pressure 100Pa. Three electrodes, an electron-emitting hot cathode, a metal mesh grid, and an anode are attached to the tube. To draw the emitted electrons, the grid voltage is made positive with respect to the cathode. Franck Hertz experiment was explained in terms of elastic and inelastic collisions between the electrons and the mercury atoms.

Procedure / Summary:

Starting by turning on the power and adjust all the control knobs at minimum position. Turn the voltage display selector V G1K to the reading 1.5 Volt Similary V G2K to the 7.5 Volt and after that observe the variation of plate current with the increase of V2K. The current reading would show set of minima and maxima Now note variation of plate current by changing V2K. Take 60 readings, keeping difference 1.5 Volt.

Diagram:



Precaution:

Handle the device carefully.

LAB EXPERIMENT NO. : 04 (Sem I - Lab I) | 20IB172

Aim:

To study the CRO & function generator by producing the following waveform:-

(i) 10 KHz, 8 V_{p-p} (Sine wave)

(ii) 4KHz, 6 V_{p-p} (Square wave)

(iii) 12 kHz, 2 V_{peak} (Triangular wave)

(iv) 7kHz, 3 V_{peak} (Sine Wave)

Apparatus Required:

CRO, Variable frequency generator and connecting chords.

Theory:

CRO and function generator are useful electronic devices by which we can measure the amplitude, time period and frequency of a signal. Function generator generates different types of signals and from visual screen of CRO, we can easily measure amplitude, time period and also the frequency of the signal generated by the function generator

Procedure:

Turn ON the devices, setting the intensity to the mid position and get a sharp and bright trace on screen, Now set the knob of function generator at sin position, with Range at 10KHz position, Set frequency. then a sin trace appears. Now adjust the trace according to our comfort the trace it using trace paper and take all the readings and repeat the exp. for different frequency and voltage.

Diagram:

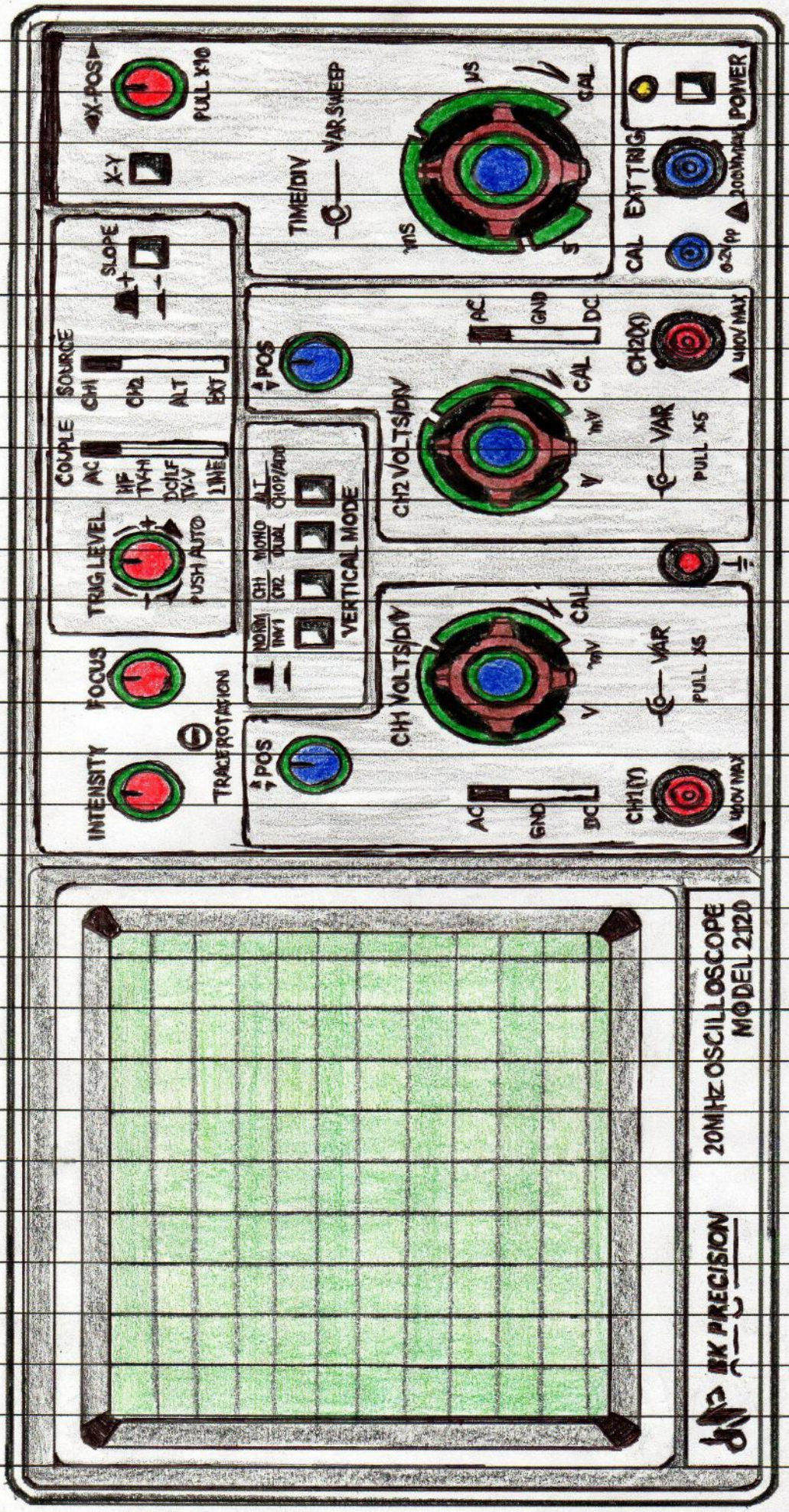
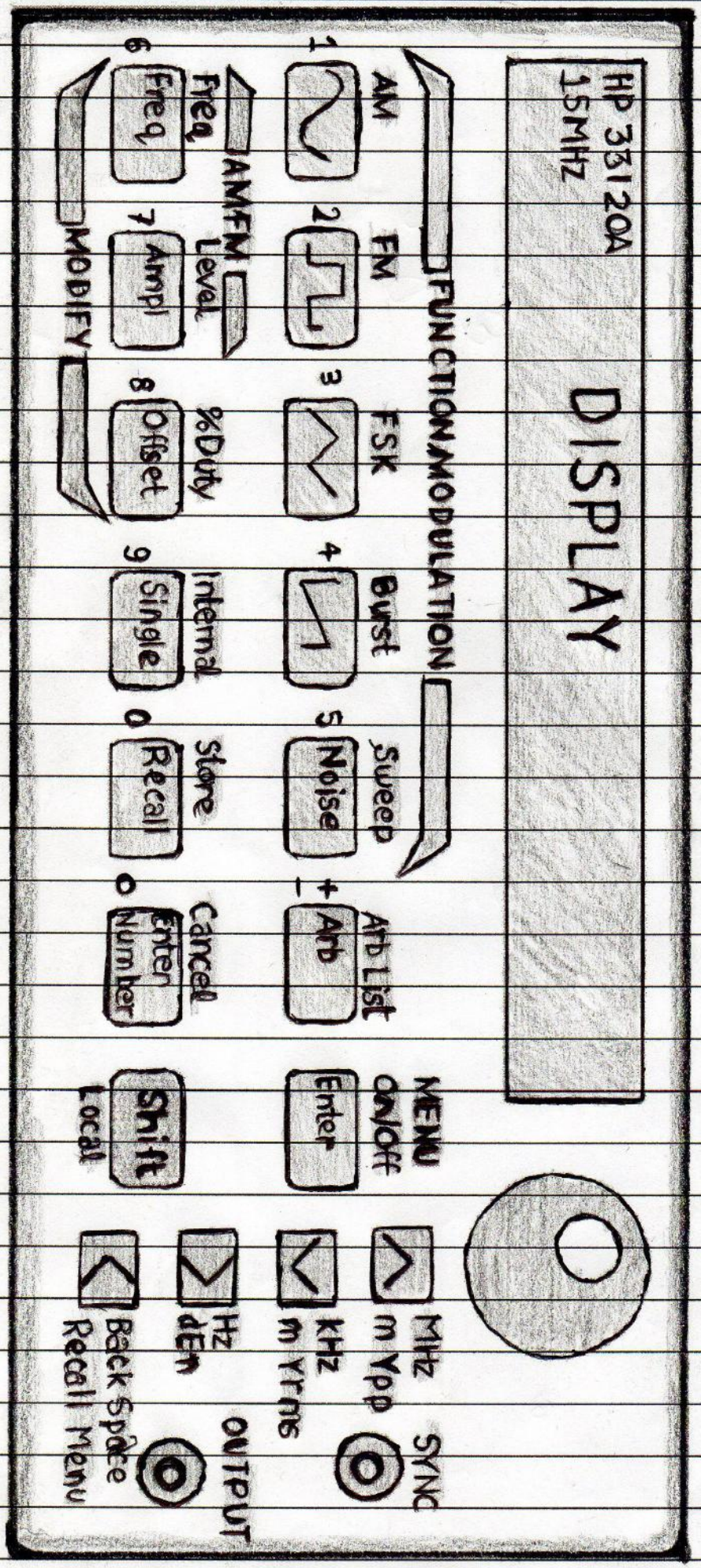

INTENSITY
FOCUS
TRACE ROTATION
TRIG LEVEL
PUSH AUTO
COUPLE
AC
HF TV-H
DC/LF TV-V
LINE
SOURCE
CH1
CH2
ALT
EXT
SLOPE
X-POS
PULL X10
X-Y
TIME/DIV
VAR SWEEP
ms
s
CAL
CAL EXT TRIG
0.2Vpp
300VMAX
POWER
POS
NORM
INV
CH1
CH2
MONO
DUAL
ALT
CHOP/ADD
VERTICAL MODE
CH1 VOLTS/DIV
mV
V
CAL
VAR
PULL X5
AC
GND
DC
CH1(Y)
400V MAX
CH2 VOLTS/DIV
CH2(X)
20MHz OSCILLOSCOPE
MODEL 2120
B&K PRECISION

Fig 1


HP 33120A
15MHz
DISPLAY
FUNCTION/MODULATION
MODIFY
AM
FM
FSK
Burst
Sweep
Noise
Arb
Arb List
Freq
AM/FM Level
Ampl
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Offset
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Cancel
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Fig 2

LAB EXPERIMENT NO. : 01 (sem 2 - lab 2) | Enroll no.: 201B172

Objective :

To study the Magnetostriction in metallic rod with Michelson Interferometer

Apparatus Required :

Helium Neon Laser with adjustable stand, Constant Current source, Screen, Michelson Interferometer

Theory :

Magnetostriction : It is the deformation of a material, especially a ferromagnetic material, exposed to a magnetic field.

Principle : With the aid of two mirrors in a Michelson arrangement, light is brought to interference. Due to Magnetostrictive effect, one of the mirrors is shifted by variation in the magnetic field applied to a sample, and the change in the interference pattern is observed.

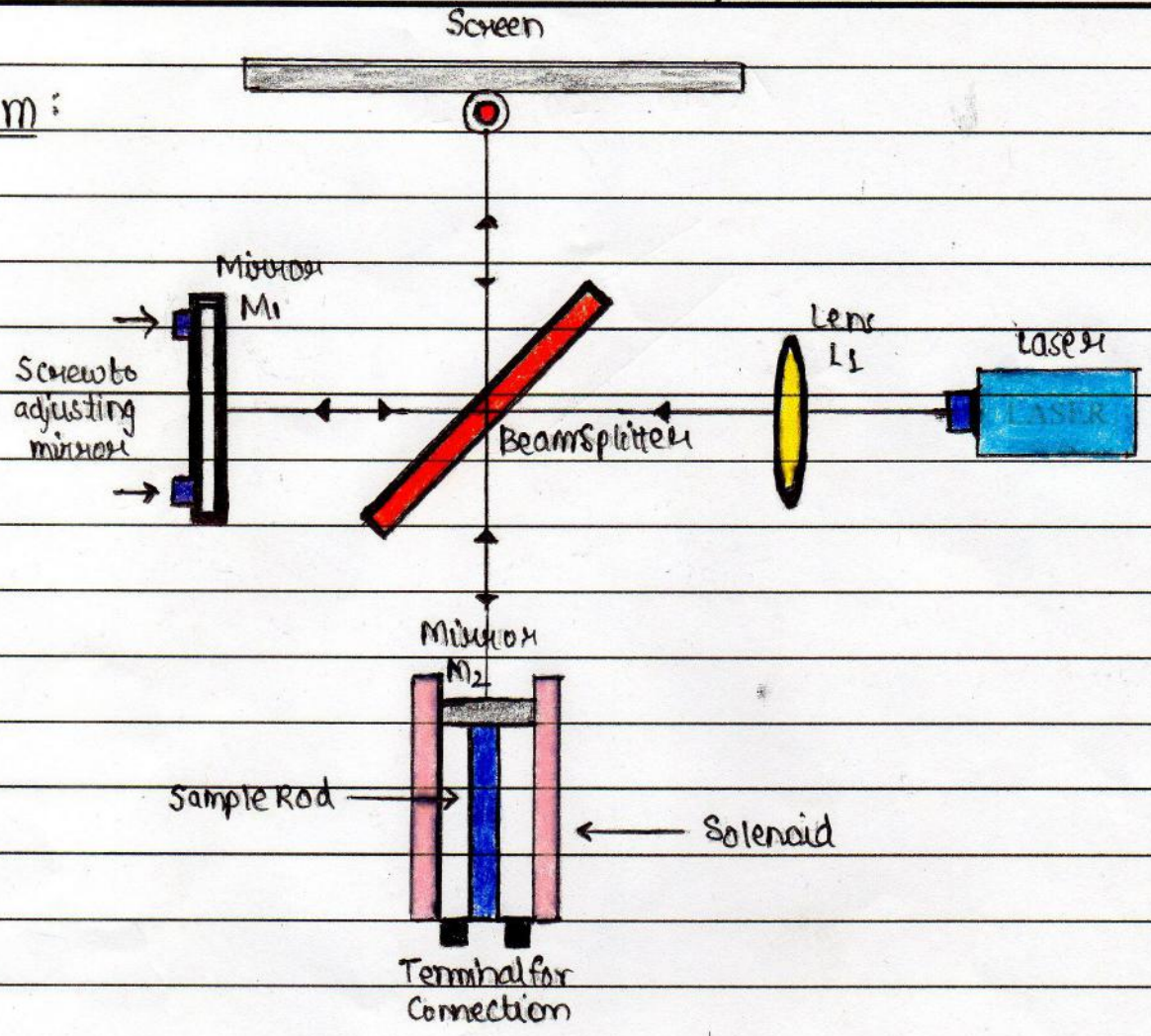
Formula : $\Delta l = \frac{n\lambda}{2}$

whereas, Δl is change in length.
n is the mean no.s of rings.
λ is the wavelength of laser light

Procedure

Starting with the adjustment of Michelson Interferometer, which is already for interference pattern. So turn on the laser and connect magnetostriction coil with constant current source after the appearance of rings note down the no. of rings. now turn off source than take the reading of rings disappear and can repeat experiment for different values.

Diagram:



Precaution:

lens and mirror should be properly cleaned.

LAB EXPERIMENT NO. : 02 (sem2-lab2) | 2018172

Aim:

Using the Hall effect measurement technique, studies the following properties of p-type semiconductor:

(a) Hall voltage and coefficient
(b) The no. of charge carriers per unit volume and
(c) Hall angle and mobility.

Apparatus Required :

Hall effect board, A semiconductor crystal, electromagnet, constant current power supply, digital gauss meter with gauss probe

Theory:

formulaes used:

Hall coefficient: $R_H = \tan\theta \left(\frac{b}{H_z}\right) 10^4$ meter^3/columb.

Number of charge carriers per unit volume : $n = \frac{1}{R_H e}$

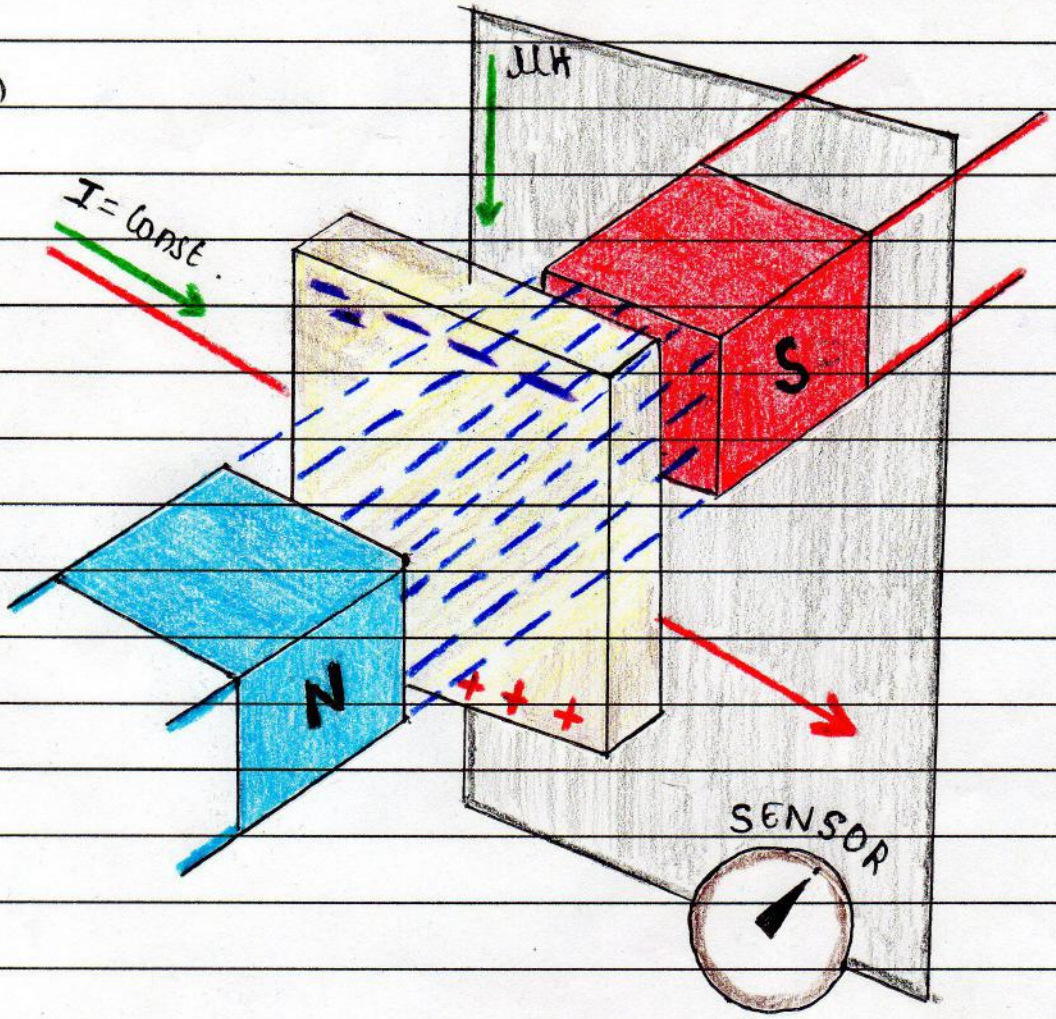
Hall angle: $\Phi = \left(\frac{V_H}{V_x}\right) \cdot \left(\frac{I_x}{b}\right)$ Radians.

Mobility = $m_H = \frac{\Phi}{H_z}$

Procedure:

For Magnetic field use gauss meter, Put the hauss probe b/w poles of electro-magnet connect the constant power supply, Switch on power supply vary the current and take the readings and for hall voltage make contacts (color wise) properly then set current 20mA and voltage 200mV, reduce the errors. place hall probe in constant magnetic field and take the readings $(V_x - V_H) - V_x$ will give you V_H.

Diagram



Precaution :

Hall voltage developed is very small and should be measured accurately with the help of a milli voltmeter.

Aim:

To determine the value specific charge e/m for an electron by thomson method

Apparatus Required:

Cathode Ray tube, High voltage Power Supply for CRT, Voltmeter, Three wooden stands, Magnetometer, Bar Magnets and Centimeter Scales.

Theory:

Yshift: It is located at the lower right hand side of the voltmeter. This control is used for shifting the spot on the screen along Y axis. A voltmeter of 50V-0-50V is provided to read the Y deflecting voltage.

X shift Control: It is located above side of y-shift deflection control. It is used for shifting the spot on the screen along X-axis.

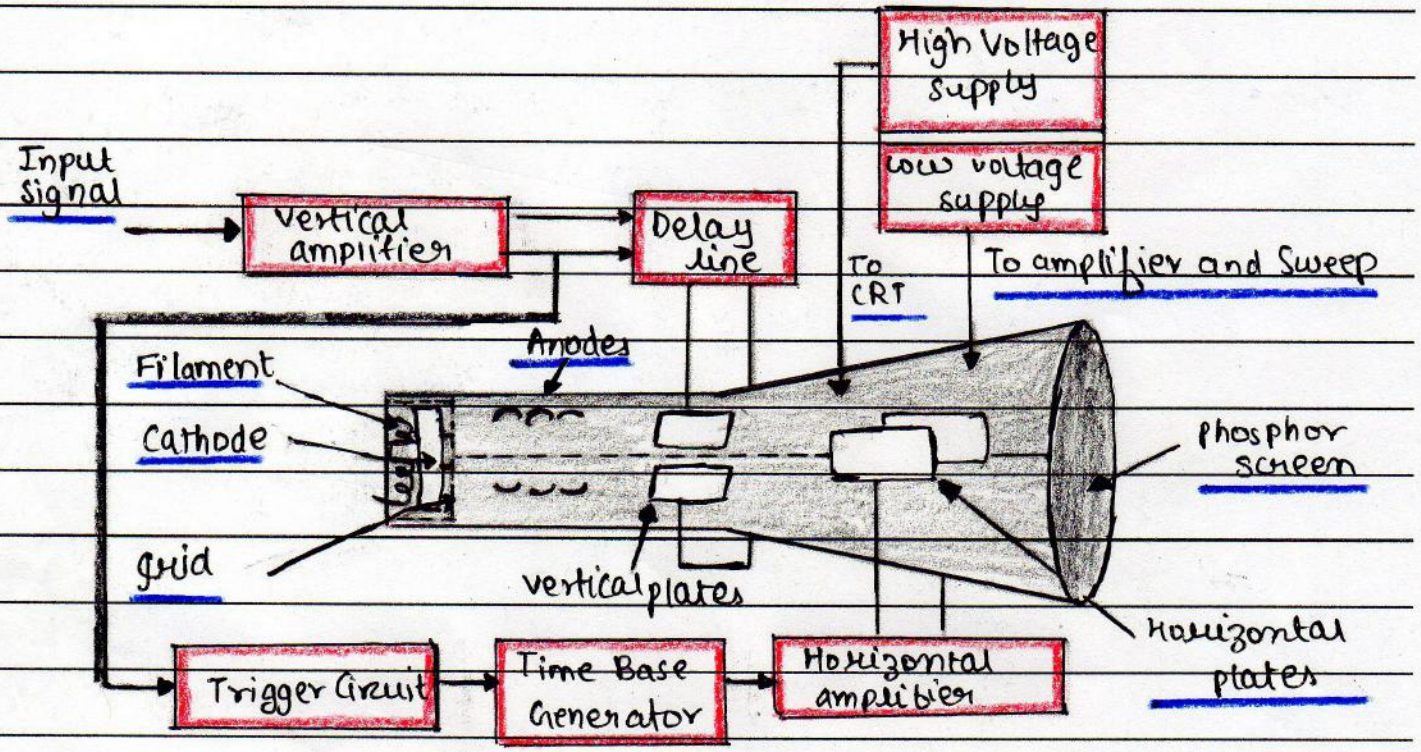
Brilliance Control: It is located at left Hand side of x shift control. It is used for charging the Brightness of spot on CRT screen.

Focus Control: It is located at left Hand side of Brilliance control. It is used for focus the spot.

Formula Used: $\frac{e}{m} = \frac{VD}{LdlB^2}$ Coulomb/kg

Whereas, d = separation between the deflecting plates
V = applied voltage
l = length of plates
B = applied magnetic plates
L = distance of the screen from edges
D = total deflection of the spot on the screen

Diagram:



Precaution:

Connection has to be made properly.

Aim:

To study the

(i) Voltage and current of a solar cell.

(ii) Voltage and current in series and parallel combination

(iii) Draw power curve to find Max. Power point.

(iv) To obtain the efficiency of a solar cell with the help of solar cell trainer.

Apparatus Required:

Solar Panel, Solar cell trainer kit, Digital multimeter, Table. lamp, Patch cord

Theory

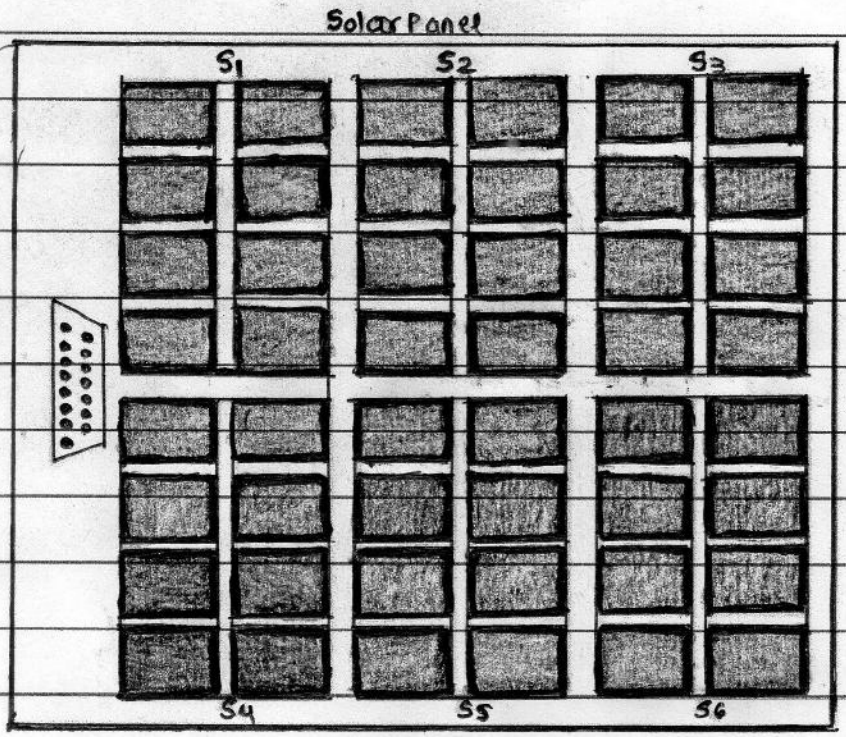
- Solar cell in series boost voltage but the current remains same, whereas when it is in parallel it boosts current rating but the voltage remains the same.

- V_{Total} (series) $= V_1 + V_2 + V_3 + V_4 + V_5 + V_6$, and
  I_{Total} (series) $= I_1 = I_2 = I_3 = I_4 = I_5 = I_6$.
- V_{Total} (Parallel) $= V_1 = V_2 = V_3 = V_4 = V_5 = V_6$ and
  I_{total} (Parallel) $= I_1 + I_2 + I_3 + I_4 + I_5 + I_6$

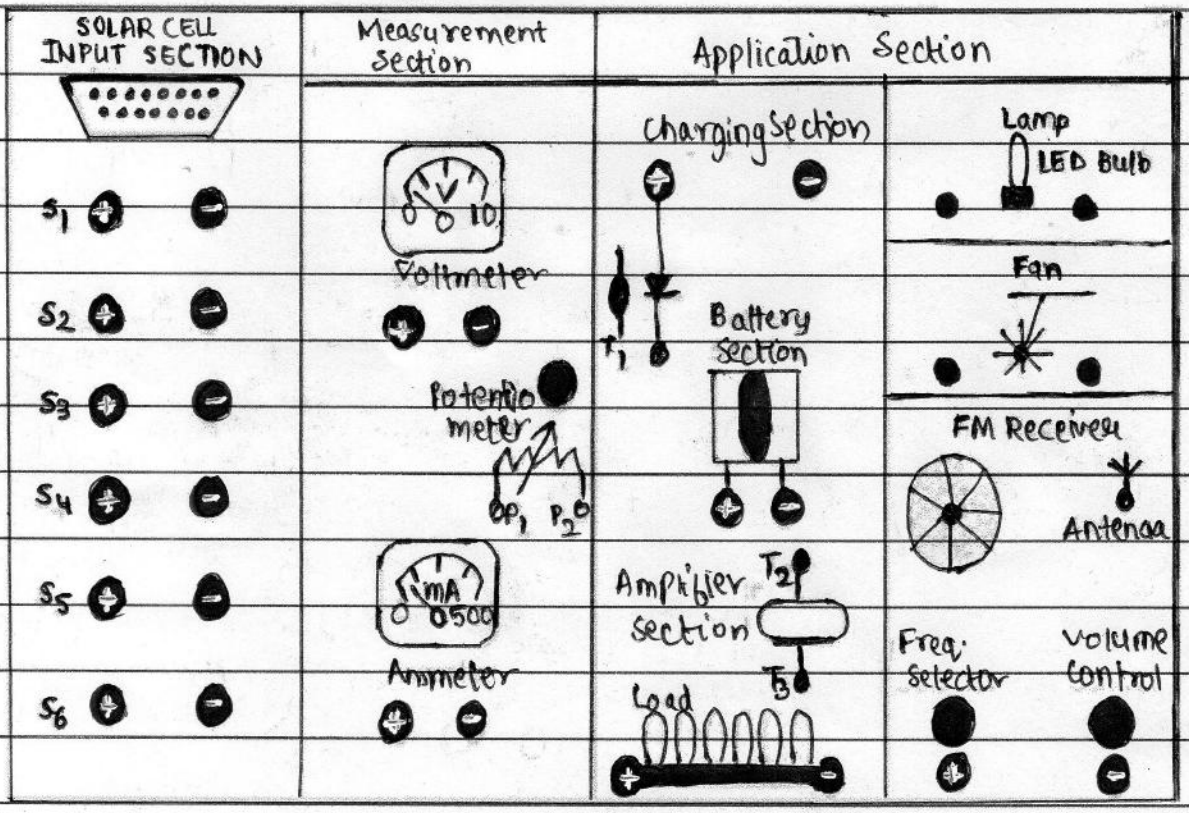
The formula for Resistance and MPP will be $R_{mpp} = \frac{V_{mpp}}{I_{mpp}}$

and efficiency of the solar cell is the ratio of produced electrical power and the incident radiant power. it may be represented as $\eta = \frac{P_{out}}{P_{in}}$

Diagram:



SOLAR ENERGY TRAINER



Procedure:

Place solar panel 45° w.r.t ground and such that light falls perpendicularly. Now DB15 connector connect Solar energy trainer NV6005 with the Solar panel. Now go for the readings

- Voltage and current in series and parallel Combination

Connect all six cell in series and note the readings Similarly in parallel.

Precaution :

Connections has to be made properly.