KG REDDY
College of Engineering & Technology
Engineering India's Changemakers

(Affliated to JNTU, Hyderabad, Approved by AICTE, New Delhi)
Chilukur (V), Moinabad (M), Rangareddy Dist, Telangana-501504

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Applied Physics Lab Manual

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DEPARTMENT OF HUMANITIES AND SCIENCES

NAME OF THE LABORATORY	:	APPLIED PHYSICS LAB
YEAR AND SEM	:	I B.TECH & I SEM
LAB CODE	:	AP105BS/AP205BS

Head of the Department
Humanities & Science
K.G. Reddy College of Engg. & Tech,
Chilkur, Moinabad, R.R. Dist. T.S.

Principal
KG Reddy College of Engineering & Technology
Chilkur (V), Moinabad (M).
R.R.Dist., Telangana.

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INSTRUCTIONS FOR STUDENTS

(1) **Laboratory work** is the heart of the course and it should be completed satisfactorily. Your performance in the laboratory is taken into account in evaluating the performance in the course. The final grade is based on your performance in the weekly sessions, the reports you write and on how well you do in the examinations.

(2) **Preparation**: Before coming to the laboratory session you must carefully read the instructions given for performing the experiment of the day. Unless you come fully prepared with this background material you will not able to complete the required work and, what is more, you will miss the opportunity of learning all aspects of the experiment. Lack of background often makes the experiment uninteresting and much more time has to be spent later for an understanding of the points missed. Thus, for your own benefit, prior study of the instructions is very important.

(3) **You must bring** Observation notes for every lab session. You must get at least one observation of each kind checked and signed by your faculty, failing which your report will not be graded. You must complete all experimental work during the session.

(4) **Equipment needs your care**: On reaching the laboratory you should check the apparatus provided and ascertain if there are any shortages or malfunctions. If the apparatus is complicated, ask the instructor to inspect before you proceed with the actual performance of the experiment. Set up the equipment in accordance with the instructions. Proceed carefully and methodically. Make the required measurements and record them neatly in tabular form.

(5) **Acceptable results with given apparatus**: It is more important to see what result you get with given apparatus rather than what is the 'correct' result. The apparatus given to you is capable of certain accuracy and your result may be completely acceptable even if it differs

from 'correct' results. You must learn to do things on your own even if you might make mistakes some times.

(6) **Graphs**: Each graph should occupy one complete sheet; the information as to quantities plotted, scale chosen and units should be mentioned clearly on the graph in ink.

(7) Following is the Format of the Report:

- Your name, roll number, date, title of the experiment.
- A clear statement of what is to be done.
- Essential diagram of the experiment and the formulae used.
- Well – tabulated observations (Tables should be neat and self explanatory)

(8) **You must bring pen, pencil, eraser, calculator, scale and Observation notes**.

(9) You must keep your work place neat and clean and leave the lab neat and tidy.

(10) **GRADING:** The overall lab examination is for 100 marks. In that 75 marks for External examination at the end of the year and remaining 25 marks will be awarded for the internal examinations and Continuous evaluation.

- Lab internal examination will carry 10 marks and Continuous evaluation will carry remaining 15 marks for each experiment. In Continuous evaluation:

A. Experimentation 5 marks

B. Viva – voce 5 marks

C. Record 5 marks

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VISION

To establish a strong foundation in basic sciences such as Mathematics, Physics, Chemistry, which in turn help the students to excel in their core engineering discipline and also train them to acquire proficiency in English language communication.

MISSION

- To provide academic excellence in basic sciences in the perspective of engineering.
- Students and faculty are provided learning environment where they can master engineering discipline by applying knowledge from basic sciences.
- Inculcate research culture through project based assignments.

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PROGRAM EDUCATIONAL OBJECTIVES (PEO's):

PEO's: DESCRIPTION

PEO1	Have strong foundation in mathematical, scientific, engineering fundamentals and communication skills necessary to formulate, understand, analyze and solve technological problems.
PEO2	Have a technical background to design and develop systems in the main fields of electronics and communication systems.
PEO3	Practice the ethics of their profession consistent with a sense of social responsibility and develop their engineering design, problem solving skills and aptitude for innovations as they work individually and in multi disciplinary teams.
PEO4	Be receptive to new technologies and attain professional competence through lifelong learning such as advanced degrees, professional registration, publications and other professional activities.

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PROGRAM OUTCOMES (PO'S):

POs	DESRCRIPTION
PO1	An ability to apply knowledge of computing, mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems to real-world problems.
PO2	An ability to design and conduct experiments, as well as to analyze and interpret data.
PO3	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability, and sustainability.
PO4	An ability to function effectively on multidisciplinary teams.
PO5	An ability to analyze a problem, and identify, formulate and use the appropriate computing and engineering requirements for obtaining its solution.
PO6	An understanding of professional, ethical, legal, security and social issues and responsibilities.
PO7	Communicate effectively with the engineers and society at large through the ability to comprehend and write effective reports, make effective presentations, give and receive clear instructions.
PO8	Recognition of the need for, and an ability to engage in continuing professional development and lifelong learning.
PO9	Have an open mind and have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
PO10	An ability to use current techniques, skills, and tools necessary for computing and engineering practice.
PO11	Ability to recognize the importance of professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers in Electronics & communication Engineering.
PO12	Ability to understand the local and global impact of computing and engineering solutions on individuals, organizations, and society.

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PROGRAMME SPECIFIC OUTCOMES (PSO's):

PSO 1: Problem Solving Skills – Graduate will be able to apply latest electronics techniques and communications principles for designing of communications systems.

PSO2: Professional Skills – Graduate will be able to develop efficient and effective Communications systems using modern Electronics and Communications engineering techniques.

PSO3: Successful Career – To produce graduates with a solid foundation in Electronics and Communications engineering who will pursue lifelong learning and professional development including post graduation.

PSO4: The Engineer and Society– Ability to apply the acquired knowledge for the advancement of society and self.

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COURSE OBJECTIVES, COURSE OUTCOMES

Course Objectives

- The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
- To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipments.
- Design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

Course Outcomes

At the end of the course, student will able to

CO1: Apply the various procedures and techniques for the experiments.

CO2: Use the different measuring devices and meters to record the data with precision

CO3: Apply the mathematical concepts/equations to obtain quantitative results.

CO4: Develop basic communication skills through working in groups in performing the Laboratory experiments and by interpreting the results.

AP105BS/AP205BS: APPLIED PHYSICS LAB

B.Tech. I Year I Sem.

L	T	P	C
0	0	3	1.5

List of Experiments:

1. Energy gap of P-N junction diode:
   To determine the energy gap of a semiconductor diode.
2. Solar Cell:
   To study the V-I Characteristics of solar cell.
3. Light emitting diode:
   Plot V-I and P-I characteristics of light emitting diode.
4. Stewart – Gee's experiment:
   Determination of magnetic field along the axis of a current carrying coil.
5. Hall effect:
   To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect:
   To determine work function of a given material.
7. LASER:
   To study the characteristics of LASER sources.
8. Optical fibre:
   To determine the bending losses of Optical fibres.
9. LCR Circuit:
   To determine the Quality factor of LCR Circuit.
10. R-C Circuit:
    To determine the time constant of R-C circuit.

Note: Any 8 experiments are to be performed

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1. Energy-Gap of P-N junction Diode

Aim: To determine the energy gap of a semiconductor diode.

Apparatus: Forbidden energy gap kit, semiconductor diode (Germanium or Silicon) Centigrade thermometer.

Theory: In a semi conductor there is an energy gap between its conduction and valance bands. For conductor a certain amount of energy has to be given to the electron so that it goes from the Valance band to the Conduction band. Than we can measure the energy gap semiconductor diode. When a p-n junction is reverse biased then current is due to minority carriers whose concentration is dependent on the energy gap. The reverse current Is (saturated value) is a function of the temperature of the junction diode.

The current-voltage characteristics of a P-N junction is given by

$$I = I_S\, exp[(^{-qv}/_{nKT}) - 1]$$

Where 'I' is the forward junction current,

'I_S' is the reverse saturated current,

'V' is the junction voltage,

'q' is the electronic charge,

'k' is the Boltzmann constant

'T' is the temperature in Kelvin and

'η' is a constant

The reverse saturation current is given by $k = 1.38 \times 10^{-23}\ m^2\, kg\, s^{-2}\, k^{-1}$

$$I_S = BT^3 \exp(-Eg / \eta kT) \quad \text{......................} \quad \textbf{(2)}$$

Where 'B' is a constant and Eg is the energy gap.

$$E_g = 2 \times K \times Slope$$

Procedure:

a) Trace the circuit and switch on the Training Board.

b) Insert the thermometer provided into the opening of the Bakelite Cap.

c) Now switch on the oven and allow the oven temperature to rise upto 50°C. At this temperature switch off the oven. The temperature will further rise upto 70 to 80°C and will become stable.

d) After some time the temperature will begin to fall. Now fix the voltage at 5 volt.

e) Readings of Micro ammeter are noted for every 5° C fall in temperature.

Circuit Diagram:

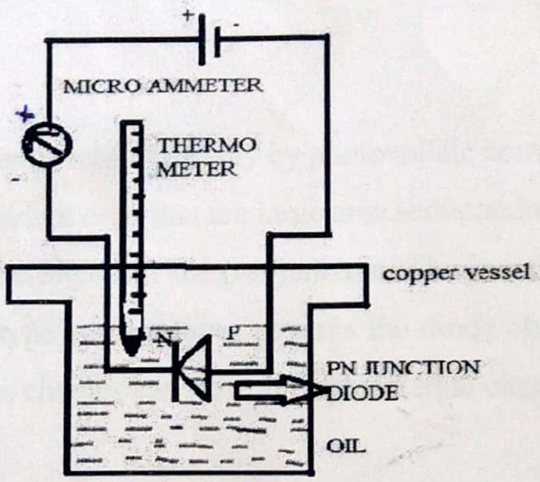
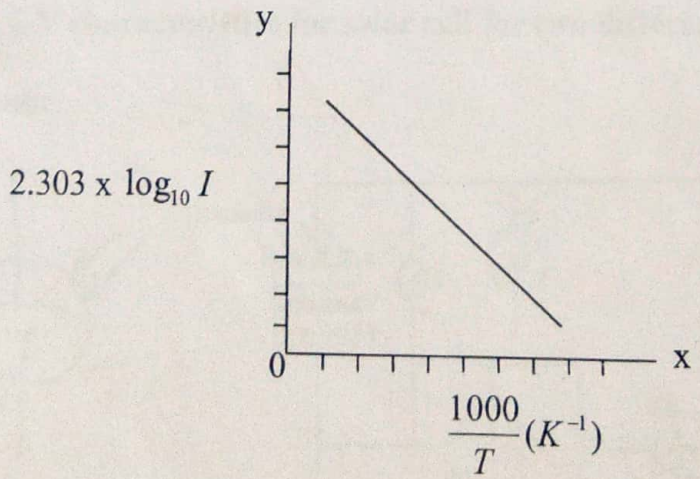


Table:

S. No	Temp (^{0}C)	Temp (K)	Current (I)	2.303xLog$_{10}$I	$\frac{1000}{T} K^{-1}$

Graph:



Result: The energy gap of the material of the given p-n junction diode is found to be--------- eV.

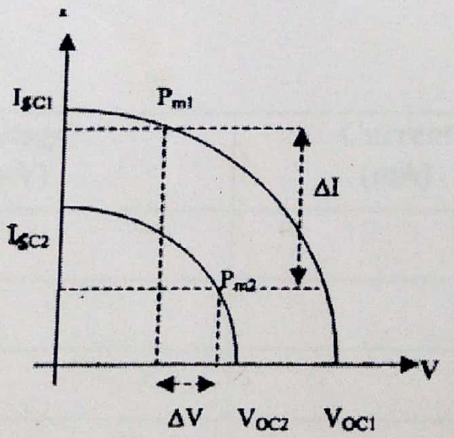
2. Solar cell

Aim: To study the V-I characteristics of solar cell.

Apparatus: Solar cell, rheostat, ammeter, voltmeter, illumination source, variac and connecting wires.

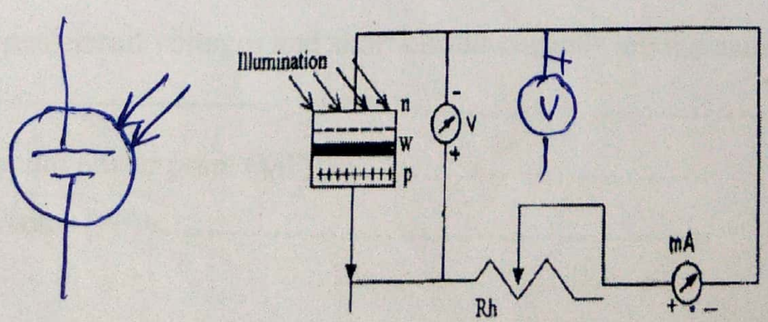
Theory:

Incident sunlight can be converted into electricity by photovoltaic conversion using a solar panel. A solar panel consists of individual cells that are large area semiconductor diodes, constructed so that light can penetrate into the region of the p-n junction. The junction formed between the n-type silicon wafer and the p-type surface layer governs the diode characteristics as well as the photovoltaic effect. The excess charges can flow through external circuit to produce power.



I-V characteristics for solar cell for two different illuminations

Circuit Diagram:



R_h = Rheostat.

Procedure:

1. Place Solar Cell directly in front of variable light intensity source and connect output of Solar Cell to voltmeter V1 on board.
2. Now gradually increase the intensity of light (bulb) and observe the output of solar cell on the voltmeter V1.
3. Then connect the circuit as shown in the circuit diagram.
4. Vary the intensity, and note voltage and current on V1 and M1 (Ammeter) respectively and as well as connecting load.
5. Plot graph, between voltage and current at different intensities with & without load.

Table:

S. No	Voltage (mV)	Current (mA)	P=VI

Result:

- The I-V characteristic for given solar cell have been studied.
- The open circuit voltages and short circuit currents are measured as:
  Voc=------------------------; Isc=.....................................
- Maximum power point (MPP)=................................
  Fill Factor (FF)=..

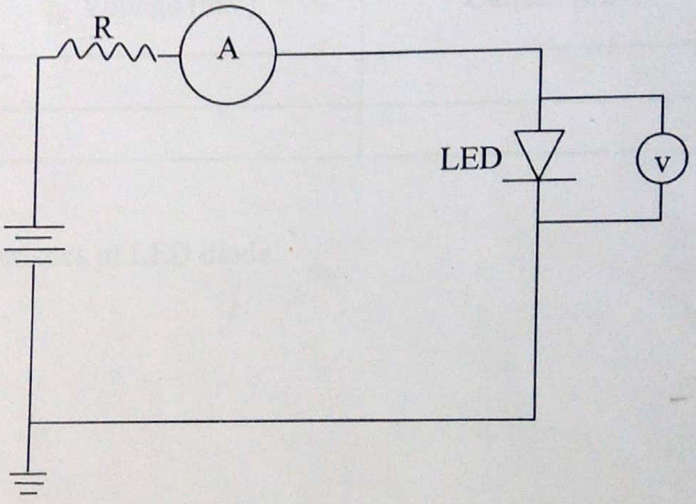
3. Light Emitting Diode (LED)

Aim: To Plot V-I and P-I characteristics of light emitting diode.

Apparatus: light emitting diode, volt meter and ammeter, laser characteristics trainer kit

Procedure (LED):

1. The main component of the apparatus is circuit board containing LEDs, each with a different emission wavelength. A particular LED can be connected to the circuit as shown in figure.



2. The voltage is varied with the help of power supply which is externally connected.
3. Turn the power supply on and very slowly increase the voltage until the LED just starts to glow.
4. Continuously monitor the current as function of voltage across the LED.
5. Plot the graph with voltage on X-axis and current on Y-axis, which gives the current voltage characteristic of LED.

Table:

S.No	Voltage (mV)	Current (mA)

Graph:

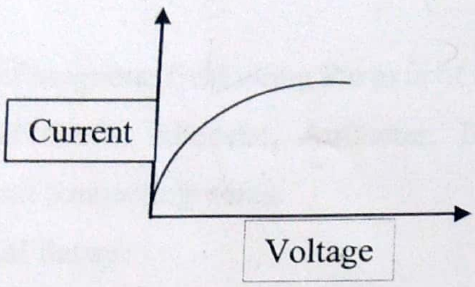


Table:

S.No	Voltage (mV)	Current (mA)

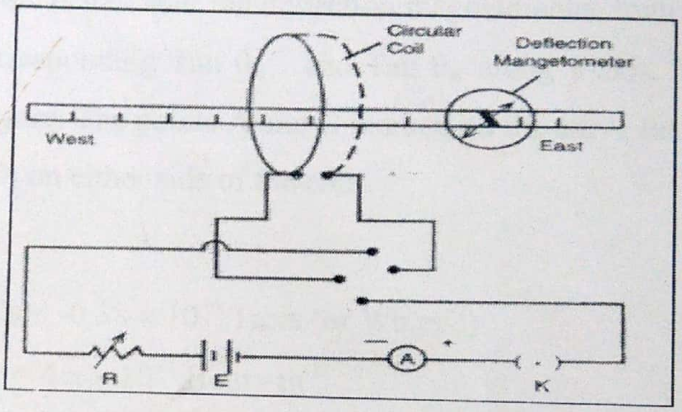
Result: Studied I-V characteristics of LED diode.

4. Stewart - Gee's Experiment

Aim: To Determination of magnetic field along the axis of a current carrying coil.

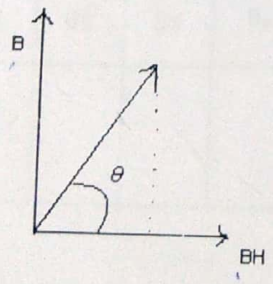
Apparatus: Stewart and Gee's, Rheostat, Ammeter, Battery eliminator, Plug key single, Commutator four plugs and connecting wires.

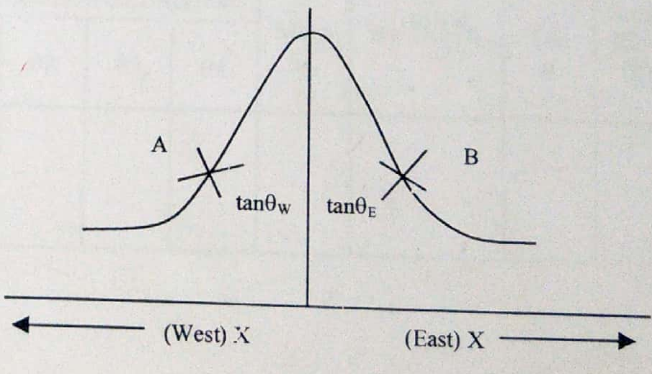
Diagram of Experimental Setup:



Arrangement for the measurement of magnetic field along the axis of a current carrying coil

Graph:





Theory:

The magnetic field (B) at a point on the axis of a circular coil carrying current "i" is given by the expression $B = \frac{\mu_0 \mu i a^2}{2(x^2+a^2)}$ T

Where 'n' is the number of turns, "a" the mean radius of the coil, 'x' is the distance of the point from the center of the coil along the axis, and 'i' is the current passing through the coil.

Procedure:

The magnetometer is set at the center of the coil and rotated to make the aluminum pointer read (0^0-0^0) in the magnetometer. The key K is closed and the rheostat is adjusted so as the deflection in the magnetometer is about 60°. The current in the commutator is reversed and the deflection in the magnetometer is observed. The deflection in the magnetometer before and after reversal of current should not differ much. If the difference is above 2° or 3°, necessary adjustments are to be made.

The experiment is repeated by shifting the magnetometer towards West from the center of the coil in steps of 2cm, each time and deflections are noted before and after the reversal of current. The mean deflection is denoted as θ_w.

A graph is drawn between x [the distance of the deflection magnetometer from the center of the coil along x-axis] and the corresponding Tan θ_E and Tan θ_w along y-axis. The shape of the curve is shown in the above figure. The points A and B marked on the curve lie at distance equal to half of radius of the coil (a/2) on either side of the coil.

Observations:

Horizontal component of earth's = -0.38×10^{-4} Tesla (or $Wb.m^{-2}$)

μ_0 magnetic permeability of air = $4\pi \times 10^{-7}$ Henry m^{-1}

Tabular Form:

Distance from the Center of Coil x	Deflection in East Direction				Mean θ_E	Deflection in West Direction				Mean θ_W	$\theta = \frac{\theta_E + \theta_W}{2}$	Tan θ	Log(R^2+x^2)	B_x = Be Tanθ
	θ1	θ2	θ3	θ4		θ1	θ2	θ3	θ4					

Result:

Experimental value of exponent (slope) =.................

Theoretical value of slope = -1.5

Experimental value of intercept =..........................

Theoretical value of intercept =............................

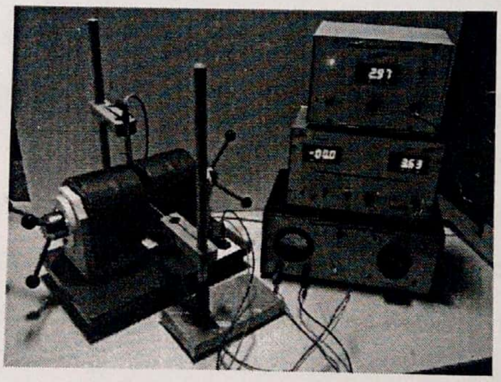
5. Hall Effect

Aim: To determine Hall co-efficient of a given semiconductor.

Apparatus: Hall effect set up, Hall probes, electromagnet with power supply, semiconductor sample, current supply with meter, volt meter and digital Gauss meter.

Theory:

As you are undoubtedly aware, a static magnetic field has no effect on charges unless they are in motion. When the charges flow, a magnetic field directed perpendicular to the direction of flow produces a mutually perpendicular force on the charges. When this happens, electrons and holes will be separated by opposite forces. They will in turn produce an electric field (E_h) which depends on the cross product of the magnetic intensity, H, and the current density, J.



$$E_h = R\, J \times H$$

Where R is called the Hall coefficient.

Now, let us consider a bar of semiconductor, having dimension, x, y and z. Let J is directed along X and H along Z then E_h will be along Y.

Then we could write

$$R = \frac{V_h/y}{JH}$$

Where V_h is the Hall voltage appearing between the two surfaces perpendicular to y and I = J $_{yz}$

In general, the Hall voltage is not a linear function of magnetic field applied, i.e. the Hall coefficient is not generally a constant, but a function of the applied magnetic field. Consequently, interpretation of the Hall Voltage is not usually a simple matter. However, it is easy to calculate this (Hall) voltage if it is assumed that all carriers have the same drift velocity. We will do this in two steps (a) by assuming that carriers of only one type are present, and (b) by assuming that carriers of both types are present.

PROCEDURE:

- Connect the widthwise contacts of the Hall Probe to the terminals marked 'Voltage' and lengthwise contacts to terminals marked 'Current'.
- Switch 'ON' the Hall Effect set-up and adjustment current (say few mA).
- Switch over the display to voltage side. There may be some voltage reading even outside the magnetic field. This is due to imperfect alignment of the four contacts of the Hall Probe and is generally known as the 'Zero field Potential'. In case its value is comparable to the Hall Voltage it should be adjusted to a minimum possible (for Hall Probe (Ge) only). In all cases, this error should be subtracted from the Hall Voltage reading.
- Now place the probe in the magnetic field as shown in fig. 3 and switch on the electromagnet power supply and adjust the current to any desired value. Rotate the Hall probe till it become perpendicular to magnetic field. Hall voltage will be maximum in this adjustment.
- Measure Hall voltage for both the directions of the current and magnetic field (i.e. four observations for a particular value of current and magnetic field).
- Measure the Hall voltage as a function of current keeping the magnetic field constant. Plot a graph.
- Measure the Hall voltage as a function of magnetic field keeping a suitable value of current as constant.
- Measure the magnetic field by the Gaussmeter.

Sample Details:

Sample	: Ge Crystal n-type
Thickness	: 5×10^{-2} cm
Resistivity	: 10 ohm.cm
Conductivity	: 0.1Coulomb / Volt sec cm

Formula:

Hall Coefficient (R) $R = \frac{V_h z}{IH}$

Carrier Density (n) $R = \frac{1}{nq} \rightarrow n = \frac{1}{Rq}$

Carrier Mobility (μ) $\mu = R\sigma$

Table:

S. No	Hall Current (I_x)	Hall Voltage (V_h)

Result: Hall co-efficient of a given semiconductor is ……………………

6. Photoelectric Effect

Aim: To determine work function of a given material.

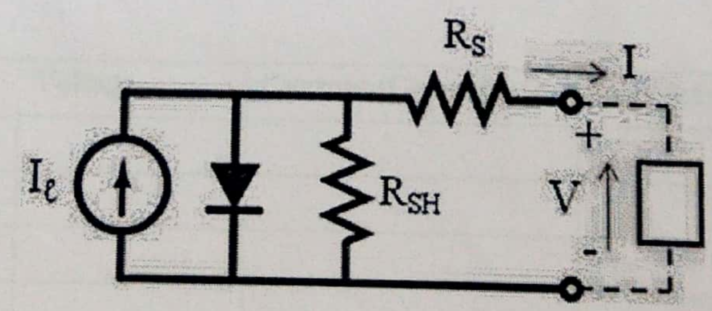
Apparatus: Photo cell, Multimeter, Voltmeter, Optical fibres and a source of a light.

1. Determine an experimental value of Planck's constant.
2. To determine work function of a given material.

Theory: Photo cell consists of one electrode made of photoelectric material and another electrode of ordinary metal sealed in an evacuated glass bulb. When suitable monochromatic light falls on the photoelectric material, electron are ejected from its surface. When the potential applied between cathode and anode, the photoelectrons are attracted by the anode and photoelectric current flows.

Einstein explained photoelectric effect from quantum theory of radiation. A part of energy of the incident photon $h\upsilon$ is spent in releasing the electron from the surface of the metal, called work function (w_o) or photoelectric work function, the remaining energy of the photon imparts kinetic energy to the photoelectron.

Circuit Diagram:



Formula:

$$h\upsilon = h\upsilon_o + \frac{1}{2}mv^2$$

$$h\upsilon = w_o + eV_s$$

$$V_s = V_o = \left(\frac{h}{e}\right)\upsilon - \left(\frac{W_o}{e}\right)$$

Here stopping potential V_s (V_o)

Work function $W_o = h\upsilon$

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

$$Therefore\ work\ function\ W_o = hV_o$$

Here, Electronic charge = e

V2 stopping potential corresponding to wavelength 2

V1 stopping potential corresponding to wavelength 1

Velocity of light = C

Wavelength of green filter λ_1=5645 x 10^{-10} m

Wavelength of blue filter λ_2 =5265 x 10^{-10} m

Procedure:

In this experiment there are two parts. In first part, insert the optical filter in the window and make the switches to downward (applying the positive voltage to anode). Now slowly increase the applied voltage and measure the corresponding current for different voltage values. Repeat the experiment for different filters. Draw the graphs between V and I for different filters.

Observations:

S. No	Voltage	Current (Green filter)	Current (Blue filter)

Result: Work function of a given material ....

$h = \frac{e(V_2 - V_1)\lambda_1\lambda_2}{c(\lambda_1 - \lambda_2)} = \frac{1.6 \times 10^{-19} C}{3 \times 10^8 \times}$

$c = \nu\lambda \quad \nu = \frac{c}{\lambda}$

7. LASER

Aim: To study the characteristics of LASER sources.

Apparatus: light emitting diode, volt meter and ammeter, laser characteristics trainer kit

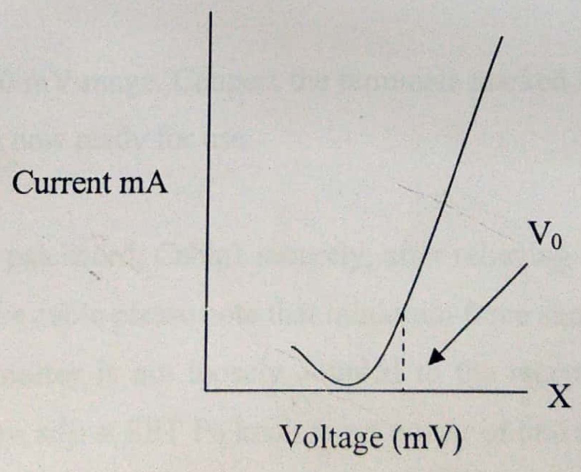
Procedure:

1. Connect the Laser diode circuit and inbuilt Optical power meter.
2. Slowly increase supply voltage using variable Power supply coarse and fine knobs.
3. Note down the optical power measured by the optical power meter in mW at increasing current through the laser diode of 5 mA to 26 mA at 1 mA step.
4. Plot a graph of Laser diode optical power V/s Laser diode current.
5. Calculate the slope of this curve.
6. This slope is efficiency of Laser diode in terms of mW/mA.

Table:

S.No	Voltage (mV)	Current (mA)

Graph:



Result: Studied the I-V characteristics of Laser diode.

8. Optical Fibre (Bending Losses)

Aim: To determine the bending losses of Optical fibres.

Apparatus: Fiber optic analog transmission Kit, Fiber optic analog transmission Kit, One meter & two meter PMMA fiber patch card and inline SMA Adaptors.

Theory:

The optical power at a distance L, in an optical fiber is given by P_L = Po 10 (-αL10) where Po is the launched power and α is the attenuation coefficient in decibels per unit length. The typical attenuation coefficient value for the fiber under consideration here is 0.3 dB per meter at a wavelength of 660 nm. Loss in fibers expressed in decibels is given by -10log (Po/P_F) where, Po is the launched power and PF is power at the far end of the fiber. Typical losses at connector junctions may very from 0.3 dB to 0.6 dB. Losses in fibers occur at fiber-fiber joints or splices due to axial displacement, angular displacement, separation (air core), mismatch of cores diameters, mismatch of numerical apertures, improper cleaving and cleaning at the ends.

Procedure:

Step 1:

Connect one and of Cable1 to the 660 nm LED port of the TNS20EA-TX and the other end to the F_O PIN port (power meter port) of TNS20EA-RX.

Step2:

Set the DMM to the 2000 mV range. Connect the terminals marked Po on TNS20EA-RX to the DMM the power meter is now ready for use.

Step3:

Connect the optical fiber patchcord, Cable1 securely, after relieving all twists and strains on the fibre. While connecting the cable please note that minimum force should be applied. At the same time ensure that the connector is not loosely coupled to the receptacle. After connecting the optical fibre cable properly, adjust SET Po knob to set power of 660 nm LED to a suitable value, say, - 15.0 dBm (the DMM will read 150 mV). Note this as P_{01}

Step 4:

Wind one turn of the fiber on the mandrel, and note the new reading of the power meter Po2. Now the loss due to bending and strain on the plastic fiber is Po1-Po2 dB. For more accurate readout set the DMM to the 200.0 mV range and take the measurement. Typically the loss due to the strain and bending the fiber is 0.3 to 0.8 dB.

Step5:

Next remove the mandrel and relieve Cable1 of all twists and strains. Note the reading P_{01}. Repeat the measurement with Cable 2 (3 meters) and note the reading Po2. Use the in-line SMA adaptor and connect the two cables in series. Note the measurement Po3.

Step6:

Repeat the entire experiment with LED2

Table:

S. No	Po1 (dB)	Po2 (dB)	Po3 (dB)	Loos in Cable 1 (dB)	Loss in Cable 2(dB)	Loss in 3 metres fibre (dB	Loss per metre (dB) at 660 nm

Result: Studied the various types of losses that occur in optical fibers and measured the losses in dB of two optical fiber patch cords.

9. LCR Circuit

Aim: To determine the Quality factor of LCR Circuit.

Apparatus: Series and Parallel Resonance LCR circuit Board with meters and power supply, function generator 1 kHz to 200 kHz, plug key, connecting wires.

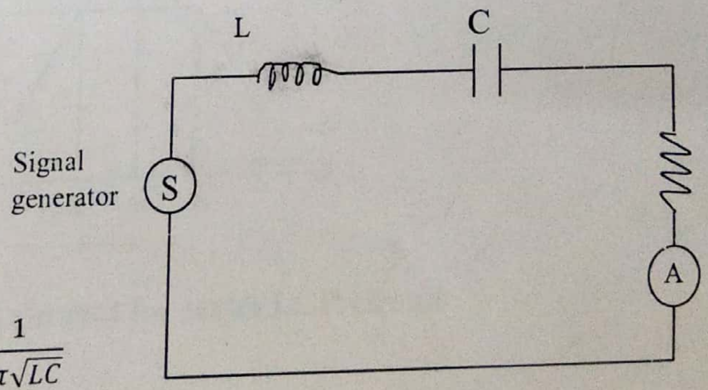
Theory:

In a series LCR resonant circuit, the impedances of an inductor and a capacitor are equal in magnitude and are in opposite directions. Hence, the impedance of the circuit is only the resistance. Therefore, the current is maximum at the resonant frequency. The resonant frequency is given by: $f_{series} = \frac{1}{2\pi\sqrt{LC}}$.

In a parallel circuit, the impedance is maximum at the resonant frequency and the current is minimum. The resonant frequency is given by:

$$f_{parallel} = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \left(\frac{R}{L}\right)^2}$$

Series Resonance Circuit:



Formula:

- Band width $\Delta f = f_a - f_b$
- Resonant Frequency: $f_{series} = \frac{1}{2\pi\sqrt{LC}}$
- Quality factor: $Q = \frac{f_0}{f_a - f_b}$

Procedure:

1. The capacitance(C), inductance (L), resistance (R) and a milli ammeter (mA) are connected in series with a function generator as shown in the figure
2. The capacitance (C) and resistance (R) are set to be particular values.
3. The frequency oscillator is adjusted to a minimum value of 1 kHz.
4. The current shown by milli-ammeter is noted.

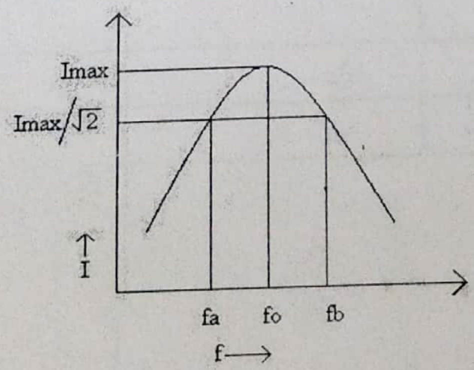
5. Keeping the C and R values as a constant, the frequency of function generator in increased in steps, the corresponding milli-ammeter (current) reading are noted.
6. The same procedure is repeated for different resistance, for the same range frequency and the readings are tabulated.
7. A graph is drawn with frequency along the X-axis and the current along the Y-axis

The frequency at which the current is maximum is the resonant frequency.

Table:

S.No	Frequency (KHz)	Current (mA)

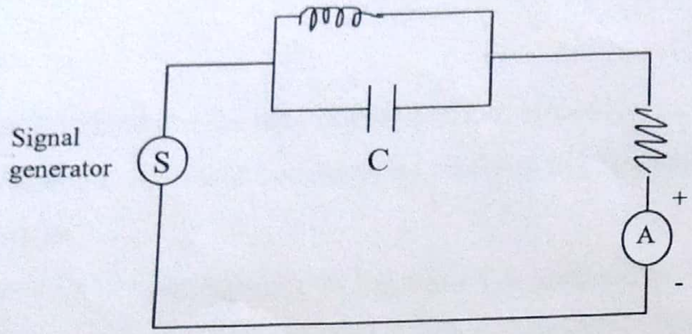
Model Graph:



Frequency versus current for series LCR circuit

Parallel Resonant Circuit:

1. The inductance (L), the resistance (R), are connected in parallel to the capacitor (C).
2. The milli-ammeter (mA) and function generator are connected as shown in figure
3. The capacitance (C) and the resistance (R) are set to be particular values.
4. The audio frequency of function generator is adjusted for a minimum value of frequency
5. The current in the circuit shown by the milli-ammeter is note
6. Keeping the C and R values to be constant, the frequency is increased in steps, the corresponding milli-ammeter readings are noted



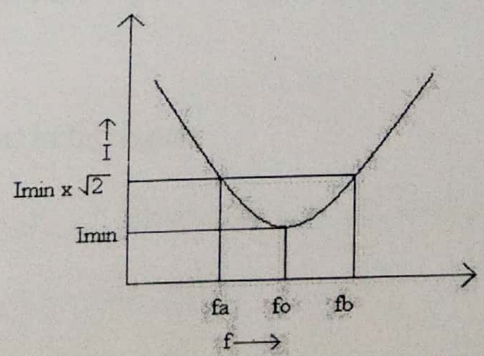
7. A graph is drawn with the frequency along the X-axis and the current along the Y-axis. The frequency at which the current is minimum is the resonant frequency.

To determine resonant frequency in parallel mode

Table:

S.No	Frequency (KHz)	Current (mA)

Model Graph:



Frequency verses current graph for parallel LCR circuit

Result:

1. The resonant frequency fs = ..., fp............................
2. Quality factor Qs = ...,...............Qp............................
3. Band width Δfs =........................ Δf_p.................. ....

10. R-C Circuit

Aim: To determine the time constant of R-C circuit.

Apparatus: RC Time constants boards with two Digital meters, Stop clock, tap key, connecting wires.

Theory: When the tap key (K) in figure is pressed, a constant e.m.f., works in the circuit. The condenser plates receive the charge till the potential difference across them becomes equal to E. When the key is released, the discharge of the condenser takes place. Let q be the charge on the capacitor at a time t after the key is released. The instantaneous value of the potential difference across the capacitor is given by q/c and E=0; i.e,

$$\frac{q}{c} - IR = 0$$

When a condenser is discharged through a resistance ,the charge falls in accordance with the formula .

$$q = q_0 \frac{e^{-t}}{RC}$$

Thus, it is to be observed

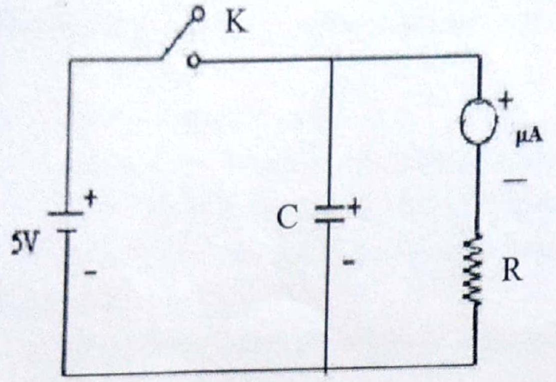
(i) Smaller is the time constant, more rapid is the discharge of the capacitor.

(ii) The current in a R.C. Circuit falls exponentially with time.

Procedure:

1. Connect the circuit as shown in the figure
2. Switch on the DC power supply of voltage for a given set of R and C
3. The capacitor is getting charged up through the resistor.
4. Disconnect the connection between capacitor and DC power supply.
5. The capacitor starts discharging through resistor simultaneously start the stop watch and note the reading in multi meter for every 5 seconds.
6. Tabulate the readings and draw a graph between Vc on y-axis and time (t) on X-axis and point out the time constant

Circuit Diagram:



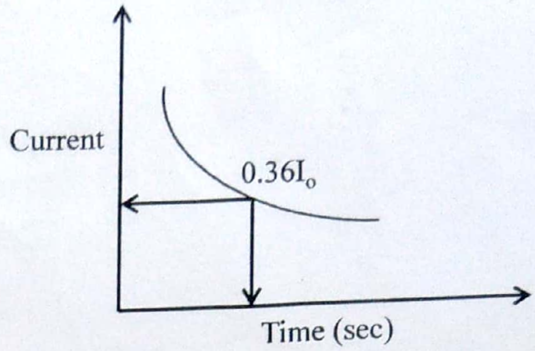


Table:

S. No	Time in Sec (t)	Discharging Current (mA)
1		
2		
3		
4		
5		

Precautions:

Pay particular attention to the polarity of the wiring, while using an electrolytic capacitor which, if wired backwards will leak a measurable current and may be damaged

Result: Theoretically τ = R x C = ………… sec

From graph: Discharging τ = ……………. sec

Viva Questions

Energy-Gap of P-N junction Diode

1. What is energy gap?
2. What is the importance of determining energy gap?
3. How is reverse current related to the temperature?
4. Why is the current in the reverse bias very small?

Solar Cell

1. What is the basic principle of solar cell?
2. What is fill factor?
3. What does the energy output of a solar cell depend upon?

Light Emitting Diode (LED)

1. What is the basic principle of LED?
2. What is threshold current?
3. What are the characteristics on LED?
4. Explain by what mechanism an LED emits light.

Stewart - Gee's Experiment

1. What is magnetic field?
2. Define Magnetic field strength?
3. What is Biot-Savart's law?
4. What is the use of commutator in the experiment?
5. What is tangent galvanometer?

Hall Effect

1. What is Hall effect?
2. What is Hall voltage?
3. What are the uses of finding the Hall coefficient?
4. For material, if the Hall coefficient has positive sign, what do you infer?
5. What are n-type and p-type semiconductors?

Photoelectric Effect

1. What is photoelectric effect?
2. What is meant by threshold frequency?
3. How it is related to the intensity of photon?
4. What is the basic principle of photoelectric effect?

LASER

1. What is LASER?
2. What is threshold current?
3. What are the characteristics of laser diode?
4. Explain how the laser diode differs from an LED in its light emission characteristics?

Optical Fibre

1. What is the basic principle of an optical fibre?
2. Define total internal reflection?
3. How do you measure the losses in an optical fiber?
4. What is the significance of finding the losses?
5. What are various types of losses that occur in optical fibres?

LCR Circuit

1. What is an oscillator?
2. What types of oscillations occur in the LCR Circuit?
3. What is quality factor? What is its importance?
4. When does the electrical resonance occur in the circuit?

R-C Circuit

1. What is the time constant of R-C circuit?
2. What do you learn by doing this experiment?
3. In what way the charging and discharging of capacitor occur over time?

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Department of Electronics & Communication Engineering

Academic Year: 2018-19 I.B. Tech Semester: I Section-A

Day to Day lab evaluation

Name of the Lab: AP LAB
Roll No.: 18QM1A0401 **Name of the Student: A. Sai vamshi Reddy**

S.No.	Name of the Experiment	Date of Experiment	Record of previous experiment (3 marks)	Observation (2 marks)	Execution of experiment (5 marks)	Viva-Voce (5 marks)	Total (15 marks)	Remarks by Faculty
1	Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode	31/7/2019	3	2	5	3	13	Good
2	Solar Cell: To study the V-I Characteristics of solar cell.	14/8/2019	3	2	5	2	12	Good
3	Light emitting diode: V-I and P-I characteristics of light emitting diode	28/8/2019	3	2	5	3	13	Good
4	Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.	11/9/2019	3	2	5	3	14	Good
5	Hall effect: To determine Hall co-efficient of a given semiconductor	25/9/2019	3	2	5	3	13	Good
6	Photoelectric effect: To determine work function of a given material	9/10/2019	3	2	5	3	13	Good

Document Softcopy Location:

7	LASER: To study the characteristics of LASER sources	23/10/2019	3	2	5	4	14	Good
8	Optical fibre: To determine the bending losses of Optical fibres	6/11/21019	3	2	5	3	13	Good
9	LCR Circuit: To determine the Quality factor of LCR Circuit	20/11/2019	3	2	5	2	12	Good
10	R-C Circuit: To determine the time constant of R-C circuit	4/12/2019	3	2	5	3	13	Good
	Average						13	

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Department of Electronics & Communication Engineering

Academic Year: 2018-19 I.B. Tech Semester: I Section-A

Day to Day lab evaluation

Name of the Lab: AP LAB
Roll No.: 18QM1A0402 **Name of the Student: A. Sainath**

S.No.	Name of the Experiment	Date of Experiment	Record of previous experiment (3 marks)	Observation (2 marks)	Execution of experiment (5 marks)	Viva-Voce (5 marks)	Total (15 marks)	Remarks by Faculty
1	Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode	31/7/2019	3	2	5	5	15	Excellent
2	Solar Cell: To study the V-I Characteristics of solar cell.	14/8/2019	3	2	5	5	15	Excellent
3	Light emitting diode: V-I and P-I characteristics of light emitting diode	28/8/2019	3	2	5	5	15	Excellent
4	Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.	11/9/2019	3	2	5	5	15	Excellent
5	Hall effect: To determine Hall co-efficient of a given semiconductor	25/9/2019	3	2	5	5	15	Excellent

Document Softcopy Location:

6	Photoelectric effect: To determine work function of a given material	9/10/2019	3	2	5	5	15	Excellent
7	LASER: To study the characteristics of LASER sources	23/10/2019	3	2	5	5	15	Excellent
8	Optical fibre: To determine the bending losses of Optical fibres	6/11/21019	3	2	5	5	15	Excellent
9	LCR Circuit: To determine the Quality factor of LCR Circuit	20/11/2019	3	2	5	5	15	Excellent
10	R-C Circuit: To determine the time constant of R-C circuit	4/12/2019	3	2	5	5	15	Excellent
	Average						**15**	

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Department of Electronics & Communication Engineering

Academic Year: 2018-19 I.B. Tech Semester: I Section-A

Day to Day lab evaluation

Name of the Lab: AP LAB

Roll No.: 18QM1A0403 **Name of the Student: A. Annapurna**

S.No.	Name of the Experiment	Date of Experiment	Record of previous experiment (3 marks)	Observation (2 marks)	Execution of experiment (5 marks)	Viva-Voce (5 marks)	Total (15 marks)	Remarks by Faculty
1	Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode	31/7/2019	3	2	5	4	14	Excellent
2	Solar Cell: To study the V-I Characteristics of solar cell.	14/8/2019	3	2	5	3	13	Excellent
3	Light emitting diode: V-I and P-I characteristics of light emitting diode	28/8/2019	3	2	5	4	14	Excellent
4	Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.	11/9/2019	3	2	5	4	14	Excellent
5	Hall effect: To determine Hall co-efficient of a given semiconductor	25/9/2019	3	2	5	4	14	Excellent

Document Softcopy Location:

6	Photoelectric effect: To determine work function of a given material	9/10/2019	3	2	5	5	15	Excellent
7	LASER: To study the characteristics of LASER sources	23/10/2019	3	2	5	4	14	Excellent
8	Optical fibre: To determine the bending losses of Optical fibres	6/11/21019	3	2	5	3	13	Excellent
9	LCR Circuit: To determine the Quality factor of LCR Circuit	20/11/2019	3	2	5	5	15	Excellent
10	R-C Circuit: To determine the time constant of R-C circuit	4/12/2019	3	2	5	4	14	Excellent
	Average						**14**	

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Department of Electronics & Communication Engineering

Academic Year: 2018-19 I.B. Tech Semester: I Section-A

Day to Day lab evaluation

Name of the Lab: AP LAB
Roll No.: 18QM1A0404 **Name of the Student: A. Nagalakshmi**

S.No.	Name of the Experiment	Date of Experiment	Record of previous experiment (3 marks)	Observation (2 marks)	Execution of experiment (5 marks)	Viva-Voce (5 marks)	Total (15 marks)	Remarks by Faculty
1	Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode	31/7/2019	3	2	5	5	15	Excellent
2	Solar Cell: To study the V-I Characteristics of solar cell.	14/8/2019	3	2	5	5	15	Excellent
3	Light emitting diode: V-I and P-I characteristics of light emitting diode	28/8/2019	3	2	5	5	15	Excellent
4	Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.	11/9/2019	3	2	5	5	15	Excellent
5	Hall effect: To determine Hall co-efficient of a given semiconductor	25/9/2019	3	2	5	5	15	Excellent

Document Softcopy Location:

6	Photoelectric effect: To determine work function of a given material	9/10/2019	3	2	5	5	15	Excellent
7	LASER: To study the characteristics of LASER sources	23/10/2019	3	2	5	5	15	Excellent
8	Optical fibre: To determine the bending losses of Optical fibres	6/11/21019	3	2	5	5	15	Excellent
9	LCR Circuit: To determine the Quality factor of LCR Circuit	20/11/2019	3	2	5	5	15	Excellent
10	R-C Circuit: To determine the time constant of R-C circuit	4/12/2019	3	2	5	5	15	Excellent
	Average						15	

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Department of Electronics & Communication Engineering

Academic Year: 2018-19 | I.B. Tech | Semester: I | Section-A

Day to Day lab evaluation

Name of the Lab: AP LAB
Roll No.: 18QM1A0405

Name of the Student: A.Sindhra

S.No.	Name of the Experiment	Date of Experiment	Record of previous experiment (3 marks)	Observation (2 marks)	Execution of experiment (5 marks)	Viva-Voce (5 marks)	Total (15 marks)	Remarks by Faculty
1	Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode	31/7/2019	3	2	5	4	14	Excellent
2	Solar Cell: To study the V-I Characteristics of solar cell.	14/8/2019	3	2	5	3	13	Excellent
3	Light emitting diode: V-I and P-I characteristics of light emitting diode	28/8/2019	3	2	5	4	14	Excellent
4	Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.	11/9/2019	3	2	5	4	14	Excellent

Document Softcopy Location:

5	Hall effect: To determine Hall co-efficient of a given semiconductor	25/9/2019	3	2	5	4	14	Excellent
6	Photoelectric effect: To determine work function of a given material	9/10/2019	3	2	5	5	15	Excellent
7	LASER: To study the characteristics of LASER sources	23/10/2019	3	2	5	4	14	Excellent
8	Optical fibre: To determine the bending losses of Optical fibres	6/11/21019	3	2	5	3	13	Excellent
9	LCR Circuit: To determine the Quality factor of LCR Circuit	20/11/2019	3	2	5	5	15	Excellent
10	R-C Circuit: To determine the time constant of R-C circuit	4/12/2019	3	2	5	4	14	Excellent
	Average						14	

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Department of Humanities& Sciences

Academic Year: 2018-19 IB. Tech Applied Physics

Rubrics for Applied Physics Laboratory

1. Scheme of Evaluation for Day to Day Lab Evaluation **Total:15 marks**

Day to day lab evaluation	Marks Allotted (5)	Marks Allotted (4)	Marks Allotted (3)	Marks Allotted (2)	Marks Allotted (1)	Marks Allotted (0)
Record of previous Expt.(5)	Students has done excellent write up part including aim ,theory ,procedure and has made correct equipment connection as per standard circuit diagram correctly	Students has done Good write up part including Aim, theory ,procedure and has made a few incorrect equipment connection as per standard circuit diagram .	Students has done average write up part including aim, theory ,procedure and has made average equipment connection as per standard circuit diagram .	Students has done below average write up part including aim ,theory ,procedure and has made a few correct equipment connection as per standard circuit diagram	Only aim is available Students has made incorrect equipment connection	Not relevant to the question.
Execution(5)	Measure all data and got correct answer after calculation.	Measure all data and got incorrect answer after calculation..	Unable to measure data and got incorrect answer.	Measure data but Not done any calculation	Not done any calculation	Not done anything
Viva-voce(5)	Answered all question	Few mistake in the answer	An average answer	Below average answer	Unable to answer	Not answer any question

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2. Scheme of Evaluation for Lab Mid Examination **Total: 10 Marks**

Lab. Exam. Pattern	Marks Allotted (5)	Marks Allotted (4)	Marks Allotted (3)	Marks Allotted (2)	Marks Allotted (1)	Marks Allotted (0)
Write Up (5)	Students has done excellent write up part including aim ,theory ,procedure and has made correct equipment connection as per standard circuit diagram correctly	Students has done Good write up part including Aim, theory ,procedure and has made a few incorrect equipment connection as per standard circuit diagram .	Students has done average write up part including aim, theory ,procedure and has made average equipment connection as per standard circuit diagram .	Students has done below average write up part including aim ,theory ,procedure and has made a few correct equipment connection as per standard circuit diagram	Only aim is available Students has made incorrect equipment connection	Not relevant to the question.
Execution and Viva-voce(5)	Well executed and Answered all question	Good execution and Few mistake in the answer	Average execution and An average answer	Below average execution and answer	No execution and Unable to answer	Not answer any question

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3. Scheme of Evaluation for Lab External Examination **Total:75 marks**

Lab. Exam. Pattern	Marks Allotted	Marks Allotted	Marks Allotted	Marks Allotted	Marks Allotted
Write Up (30) Aim(5) Apparatus(5) Procedure(5) Theory(15)	Written all write up part (30)	Apparatus and procedure missing (20)	Only written aim and apparatus. (10)	Written only Aim. (5)	Not written anything. (0)
Execution(30) Circuit Connection(5) Tabulation(10) Graph(5) Calculation(10)	Execute all (30)	Calculation missing(20)	Only done Tabulation.(10)	Only done circuit Diagram.(5)	Not done anything. (0)
Viva-voce(15)	Answered all question	Few mistake in the answer	An average answer	Below average answer	Unable to answer

Faculty Member

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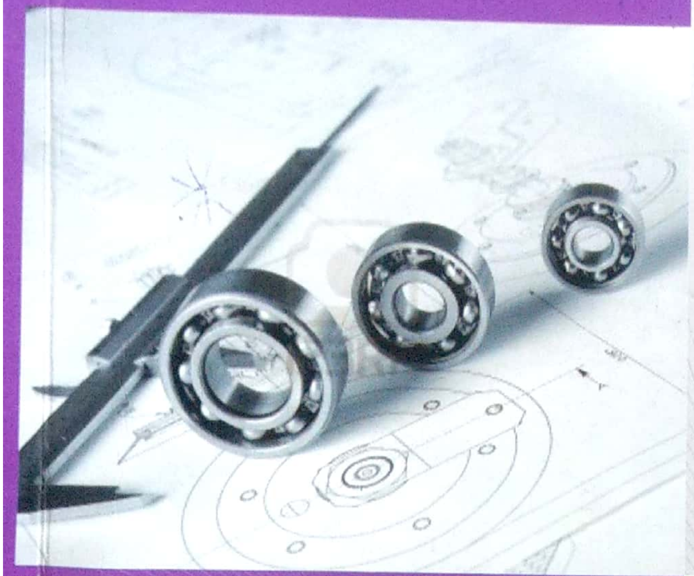

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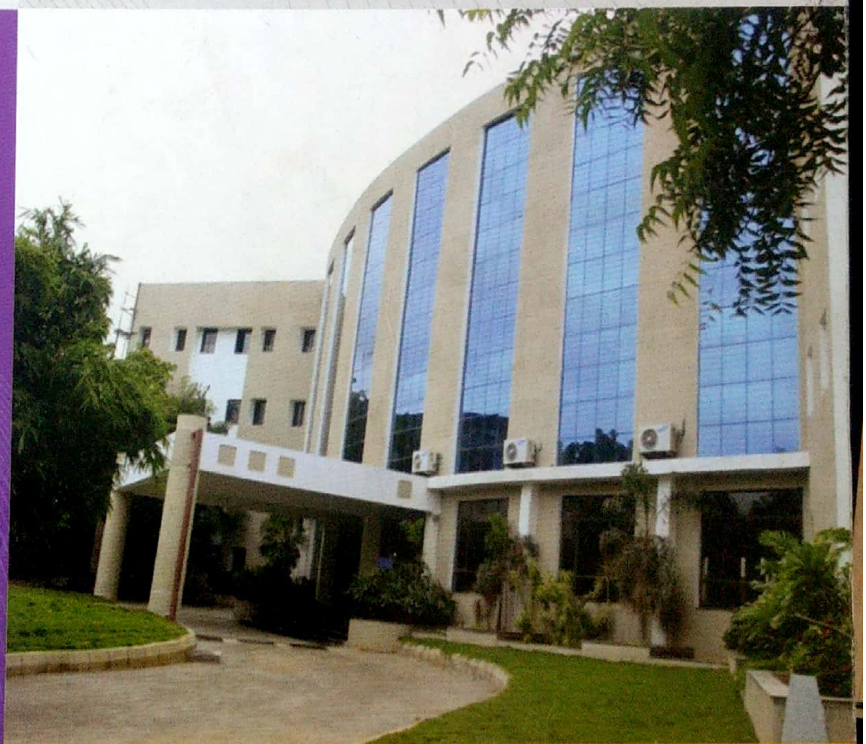
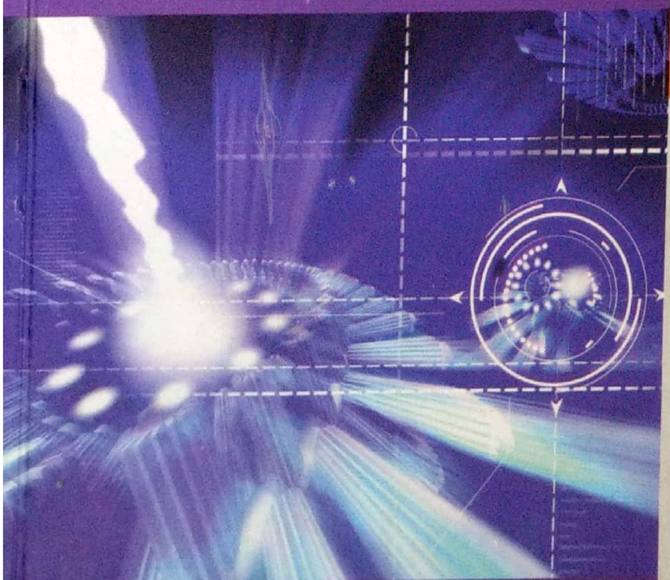
Keep your thoughts positive
because your thoughts
become your words. Keep your
values positive because
your values become your destiny.
:Mahatma Gandhi





PRACTICAL RECORD BOOK

Academic year 20 -20

Name: M. Ravali Reddy

Roll No: 18QM1A0562

Course: B-tech Year/Sem I/II

Subject: AP Lab

Scanned by CamScanner

GENERAL INSTRUCTIONS

1. Wearing apron is mandatory for all students attending the laboratory sessions.

2. Electrical Machines and Electronics laboratories are to be attended with shoes on. However, footwear has to be left out before entering computer laboratories.

3. Students should come prepared to the laboratory for performing the experiment as per the instruction given in the manual.

4. The Girl students must ensure that long matted hair and dupatta are fully covered and tied so that it is not caught in the machine. This is essential to avoid accidents.

5. The observation book with Aim, Apparatus required circuit diagrams, Tabular columns, Formulae, Expected graphs and precautions etc. Pertaining to the experiments has to be completed in the laboratory itself.

6. Material such as scale, pencil, erase to draw necessary figures or graphsc and calculator should be brought to the laboratory.

7. After completing the experiment, observation tables may be completed and graphs drawn. Conclusions must be noted in the observation book and signature of the faculty must be obtained in the observation note book before leaving in the laboratory.

8. The oberved results, graphs, conclusion etc., Noted in the laboratory should be transfered to the laboratory record book at home by the student and the same must be submitted in the next laboratory session.

9. After submitting the record in the first week, if any corrections are to be made in the record book, the corrections may be completed before the student comes to the lab in the next week.

Note: The above instructions must be adhered to and complied with.

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Phone : 08417-252890, 252897, 9000633008

Certificate

This is the Bonafide record work done by

Mr/Miss. M. Ravali Reddy

of 1st year *B.Tech* 1st year CSE *Branch Bearing Hall Ticket No.* 18QM1A0562

in the Applied physics *Laboratory during the Academic Year* 2018-19

Internal Examiner | External Examiner | Head of the Dept.

Date :

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Sl. No.	Name of Experiment	Date of Experiment Performed	Date of Experiment Submitted	Page No.	Marks Awarded	Remarks
01)	LCR circuit.	31/1/19.	4/1/19.		10	
02).	Light emitting diode.	04/1/19.	28/1/19.		9	
3).	R-C circuit.	07/2/19.	31/1/19.		15	
4).	LASER.	14/2/19.	7/2/19.		12	
5).	Solar cell.	7/02/2019	25/03/2019		15	
6).	Optical fibre.	25-03/2019	4/04/2019.		15	
7)	Energy gap of p-n junction diode.	4-4/2019	12/04/2019		15	
8)	Stewart Gee's Experiment.	4-4/2019	15/04/2019.		14	

S.No	Frequency	current.
1).	1k	3.0
2).	2k	3.8
3).	3k.	4.4
4).	4k	5.0
5).	5k	5.5
6).	6k	5.8
7).	7k	6.0
8)	8k	6.2
9)	9k	6.4
10)	10k	6.5
11)	11k	6.6
12)	12k	6.6
13)	13k	6.6
14)	14k	6.6
15).	15k	6.6
16)	16k	6.5
17)	17k	6.4
18)	18k	6.3
19)	19k	6.2
20)	20k	6.0
21)	21k	5.8
22)	22k.	5.2
23).	23k	3.6
24)	24k	3.4
25	25k.	3.0
		2.2

Date : 04 | 01 | 2017 PAGE # :

LCR Circuit

Aim: To determine the Quality factor of LCR circuit.

Apparatus: Series Resonance, LCR circuit Board with meters and power supply, function generator 1kHz to 200 kHz, connecting wires.

Theory: In a series LCR circuit resonant circuit, the impedance of an conductor inductor and a capacitor are equal in magnitude and are in opposite direction. Hence, the impedance of the circuit is only the resistance. Therefore, the current is maximum at resonant frequency. The resonant frequency is given by

$$f_{series} = \frac{1}{2\pi\sqrt{LC}}$$

In a parallel circuit, the impedance is maximum at the resonant frequency and the current is minimum. The resonant frequency is given by

$$f_{parallel} = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \left(\frac{R}{L}\right)^2}$$

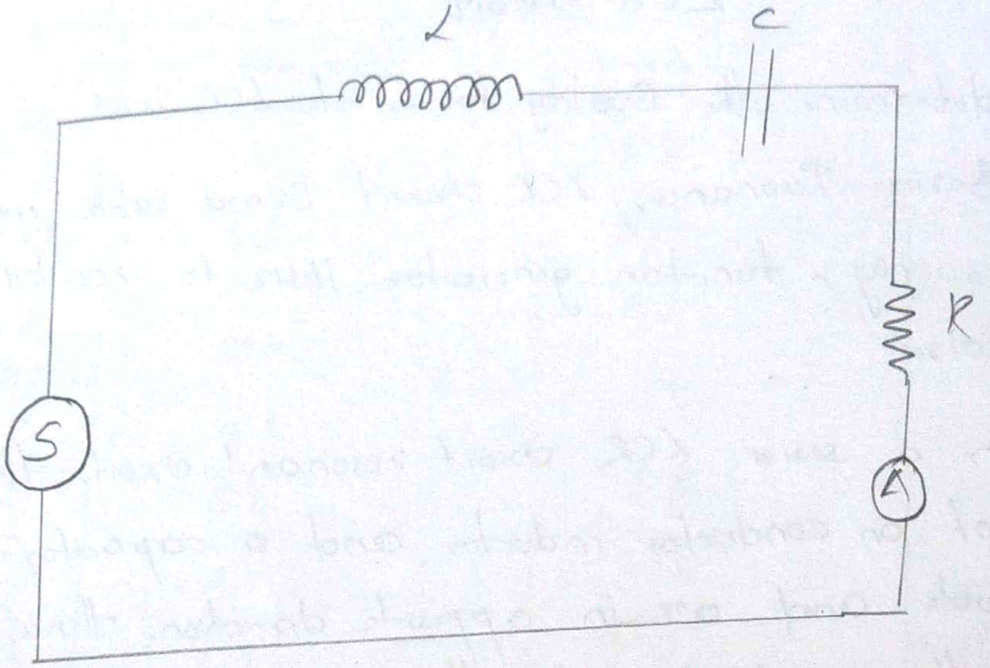
Series Resonance circuit:

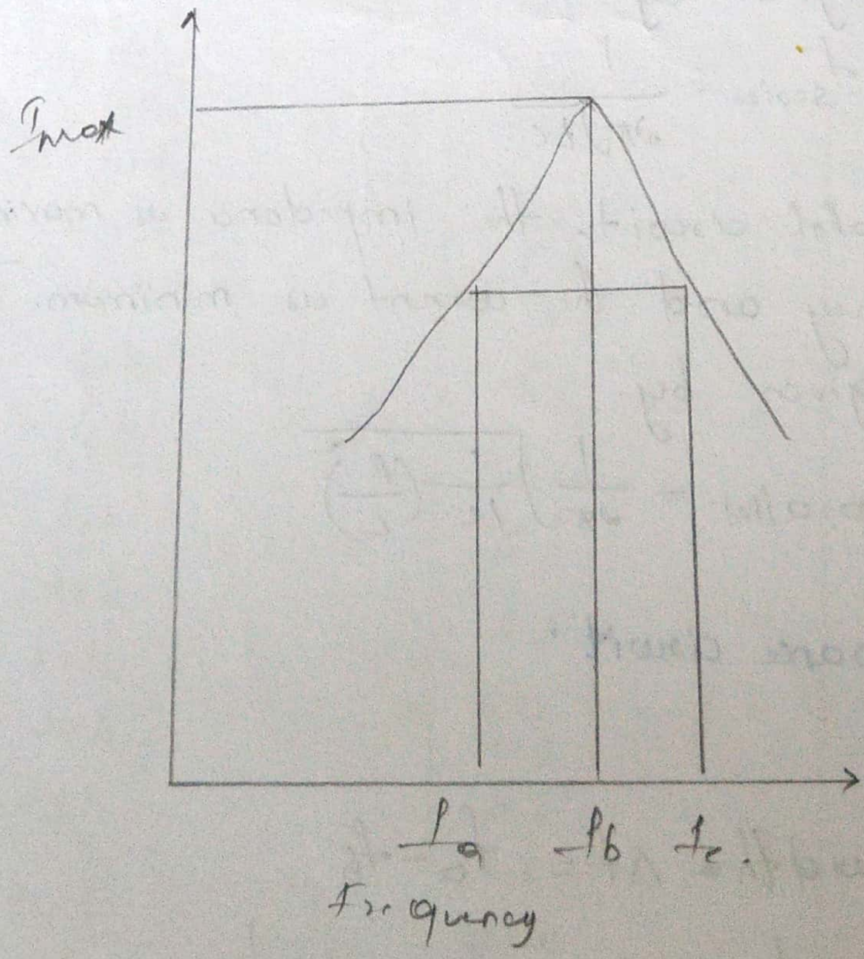
Formulae.

Band width $\Delta f = f_a - f_b$.

Resonant frequency $= f_{series} = \frac{1}{2\pi\sqrt{LC}}$

Quality factor : $Q = \frac{f_0}{f_a - f_b}$.


L
C
R
S
A


Imax
fa
fb
fc
Frequency

Procedure.

1). The Capacitance (C), inductance (L), resistance (R) and a milli ammeter (mA) are connected in series with a function generator as shown in the figure.

2). The capacitance (C) and Resistance (R) are set to be particular values.

3). The frequency oscillator is adjusted to a minimum value of 1 kHz.

4). The current shown by milliammeter is noted.

5) Keeping C and R values as a constant, the frequency of function generator is increased in steps, the corresponding milliammeter (current) reading are noted

6). The same procedure is repeated for different resistance, for the same range frequency and the readings are tabulated.

7). A graph is drawn with frequency along the X-axis and the current along the Y axis. The frequency at which the current is maximum is the resonant frequency.

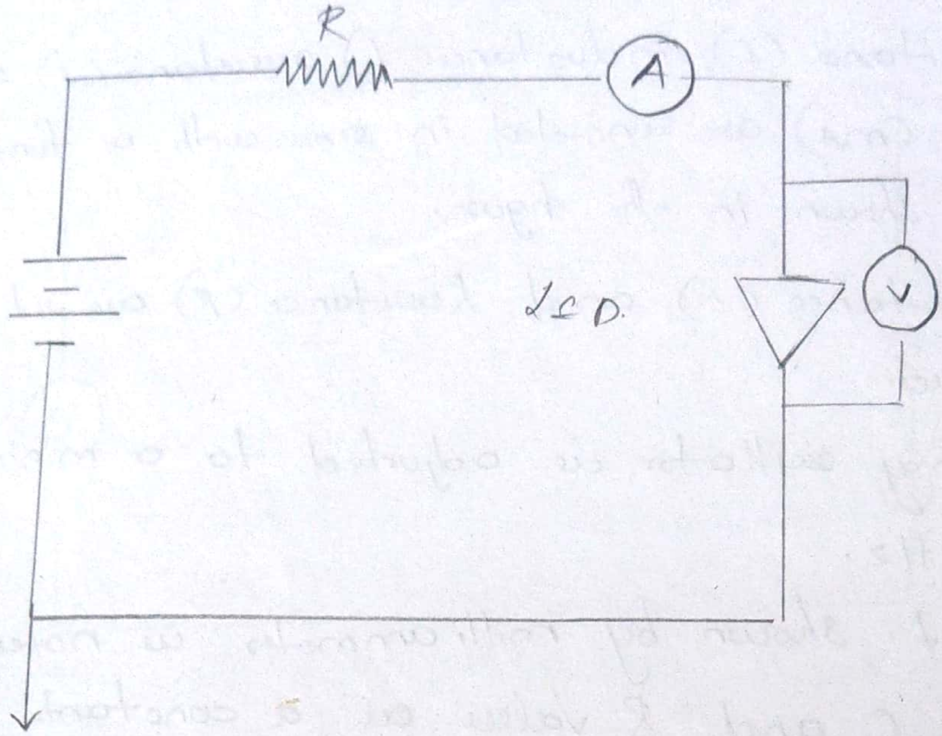
Result.

1). The resonant frequency $f_r = 1.468 \times 10^3$ Hz.

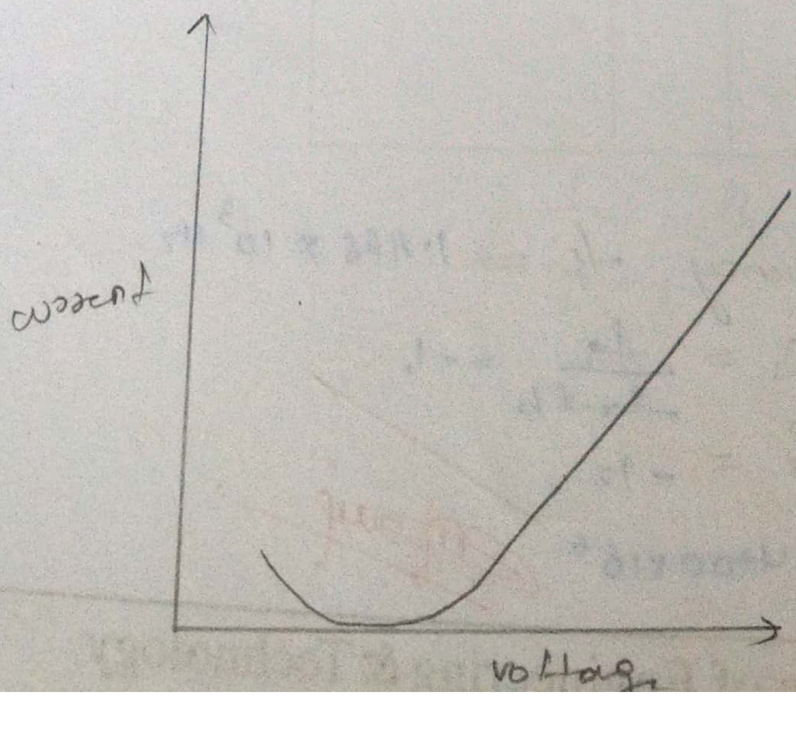
2). Quality factor $Q = \frac{f_a}{f_a - f_b} = -1.$

3). Band width $\Delta f_r = -12.$

L=25 C= 4700×10^{-6}.



S.NO	voltage	current	VI
1)	0.5	0.1	0.05
2)	1.0	0.1	0.1
3)	1.5	0.1	0.15
4)	2	0.4	0.8
5)	2.5	1.5	4.5
6)	3.0	3.1	9.3



2). Light Emitting Diode (LED).

Aim: To plot VI and PI characteristics of light emitting diode.

Apparatus: light emitting diode, volt meter and ammeter, laser characteristics trainer kit.

Procedure (LED)-

1). The main component of the apparatus is circuit board containing LEDs each with a different emission wave length. A particular LED can be connected to the circuit as shown in figure.

2). The voltage is varied with the help of power supply which is externally connected.

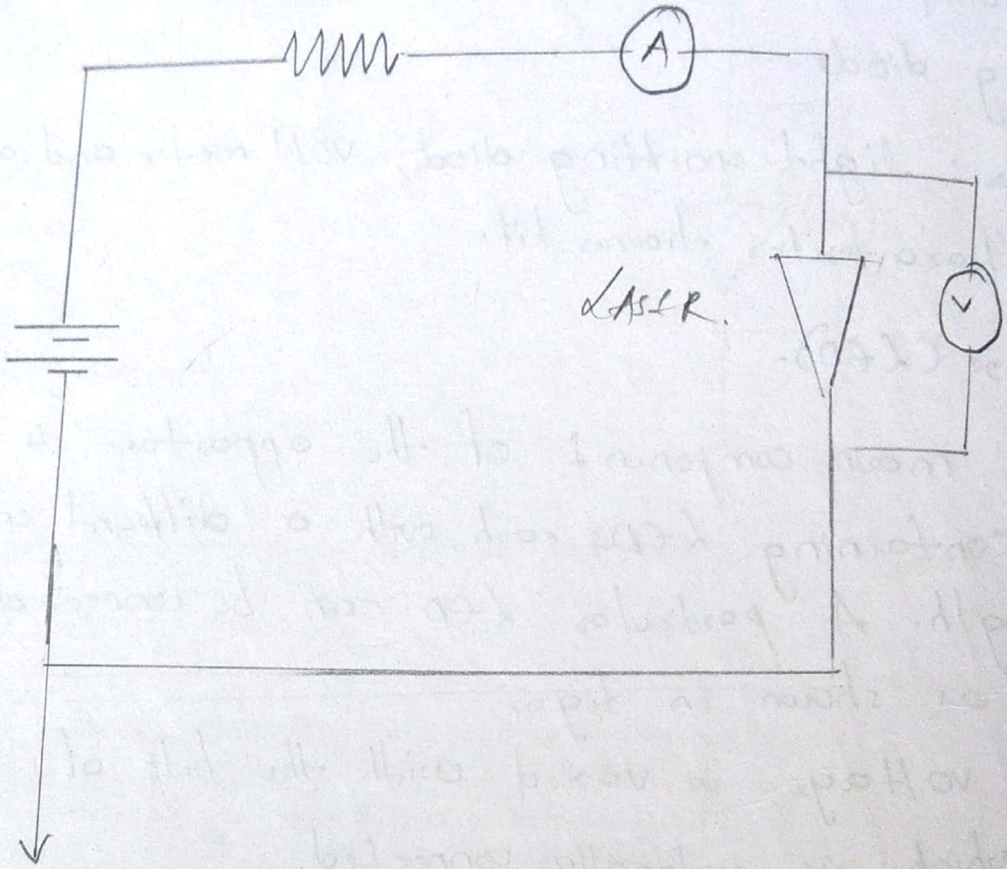
3). Turn the power supply on and very slowly increase the voltage until the LED just starts to glow.

4). Continuously monitor the current as function of voltage across the LED.

5). Plot the graph with voltage on X-axis and current on Y-axis, which gives the current voltage characteristics of LED.

Result.

Studied I.V and ~~P.I~~ characteristics of LED diode.



SNO	voltage	current (mA)
1).	0.06	0.2
2).	0.08	0.2.
3)	0.16	1.4
4)	0.18	2.0
5)	0.19	2.4

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LASER.

Aim: To study the charactrstics of LASER sources.

Apportx: light emitting diode, volt meter and ammeter, laser charactorstic kit

Procedure:

1). Connect the laser diode circuit and inbuilt optical power meter.

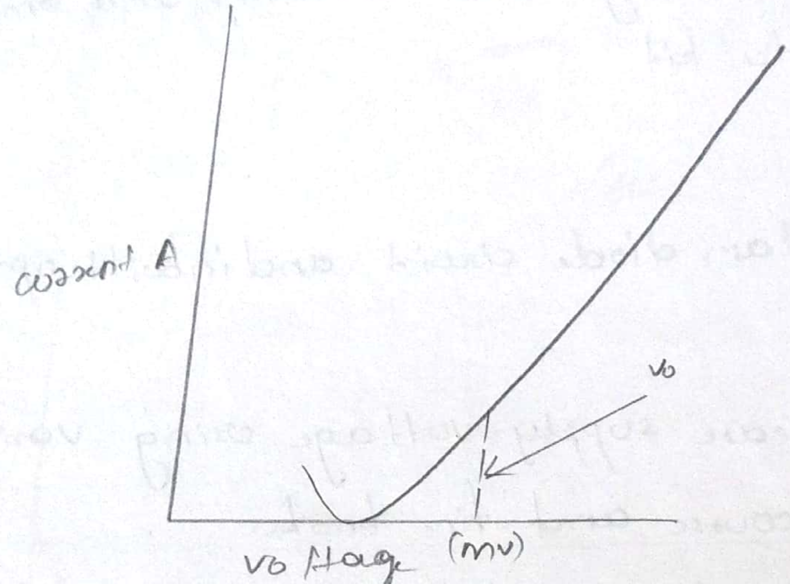
2). Slowly increase supply voltage using variable power supply course and fine knobs.

3). Note down the optical power measured by the optical power meter in mW at increasing current through laser diode of 5mA to 26mA at 1mA step.

4). Plot a graph of laser diode optical power Vs laser diode current.

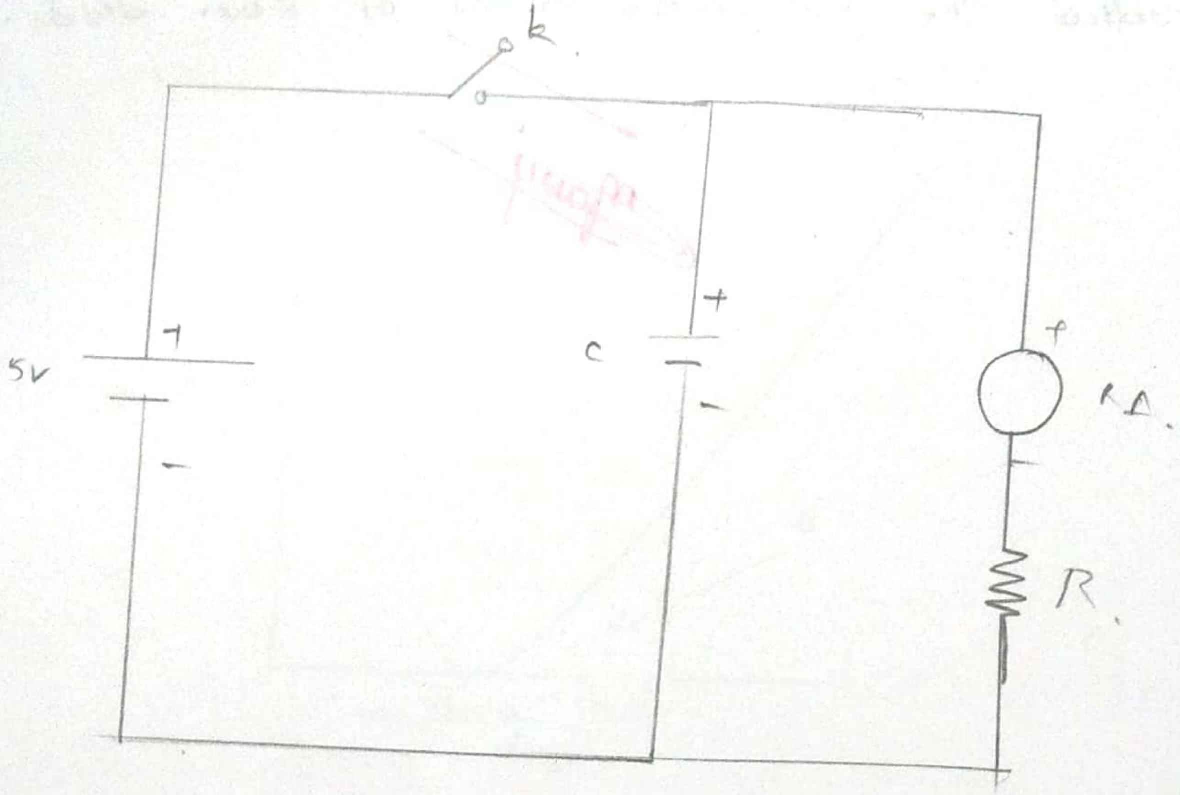
5). Calculate the slope of this curve.

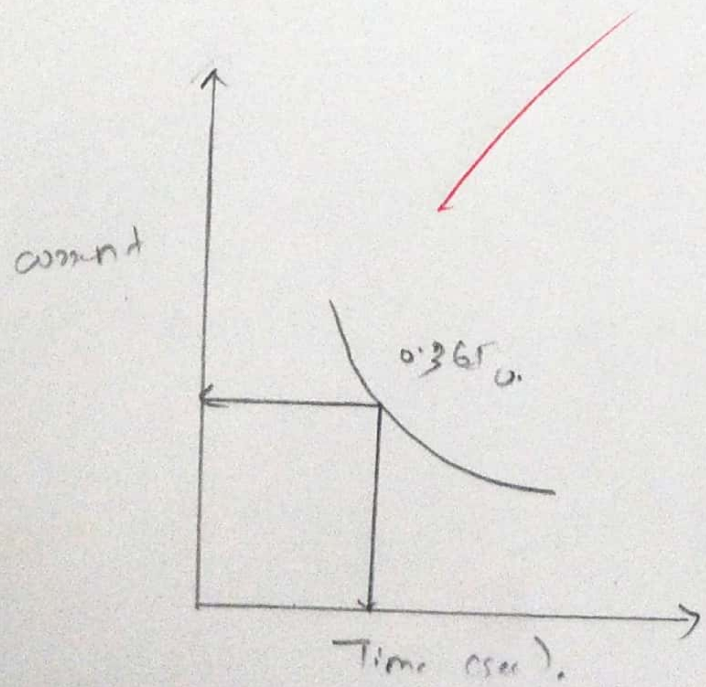
6). This slop is efficiency of Laser diode in mW/mA.


current A
Vo
voltage (mv)

Result:

Studied the v-I characteristics of Laser diode.


k
5V
C
R


current
Time (sec).

R.C circuit.

Aim: To determine the time constant of R.C circuit.

Apparatus: RC time constants board with two Digital meters, stop clock, tap key, connecting wires.

Theory: When the tap key (K) in figure is pressed, a constant e.m.f works in the circuit. The condenser plates receive the charge till the pottential difference across them becomes equal to E. When the key is released, the discharge of the condenser takes place. Let q be the charge on the capacitor at a time t after the key is released. The instantaneous value of the pottential difference across the capacitor is given by q/c and E=0, i.e

$$\frac{q}{c} - IR = 0.$$

When a condenser is discharged through a ressistance, the charge falls in accordance with the formulae.

$$\frac{q}{c} - IR = 0.$$

When a condenser is discharged through a ressistance the charge falls in accordance with the formulae

$$q = q_0 \frac{e^{-t}}{RC}$$

Procedure.

1). Connect the circuit as shown in the figure.

2) Switch on the DC power supply of voltage for a given set of R and C.

3). The capacitor is getting charged up through the resistor

S.NO	Time in sec	Dischorging cu(mA)
1	0	900
2	5	3.20.
		1.20
3	10	0.58.
4	15	0.24.
5	20	0.12
6)	30	0.06
7)	35.	0.07.

Mona Bhonu Jason

4). Disconnect the section between capacitor and DC power supply.

5). The capacitor starts discharging through resistor simultaneously start the stop watch and note the reading in multi meter for every 5 seconds.

6). Tabulate the readings and draw a graph between Vc on y-axis and time (t) on x-axis and point out the time constant.

Precautions.

Pay particular attention to the polarity of the wiring while using an electrolyte capacitor which if wired backwards will look a measurable current and may be damaged.

Result.

Theoritically $t = R \times C$ = 47 sec.

From graph Discharging t = 5 sec.

Theoritically $T = 4700 \times 10^{-6} \times 10 \times 10^{3}$

$= 4700 \times 10 \times 10^{3}$

$= \frac{47000}{1000} = 47sec.$

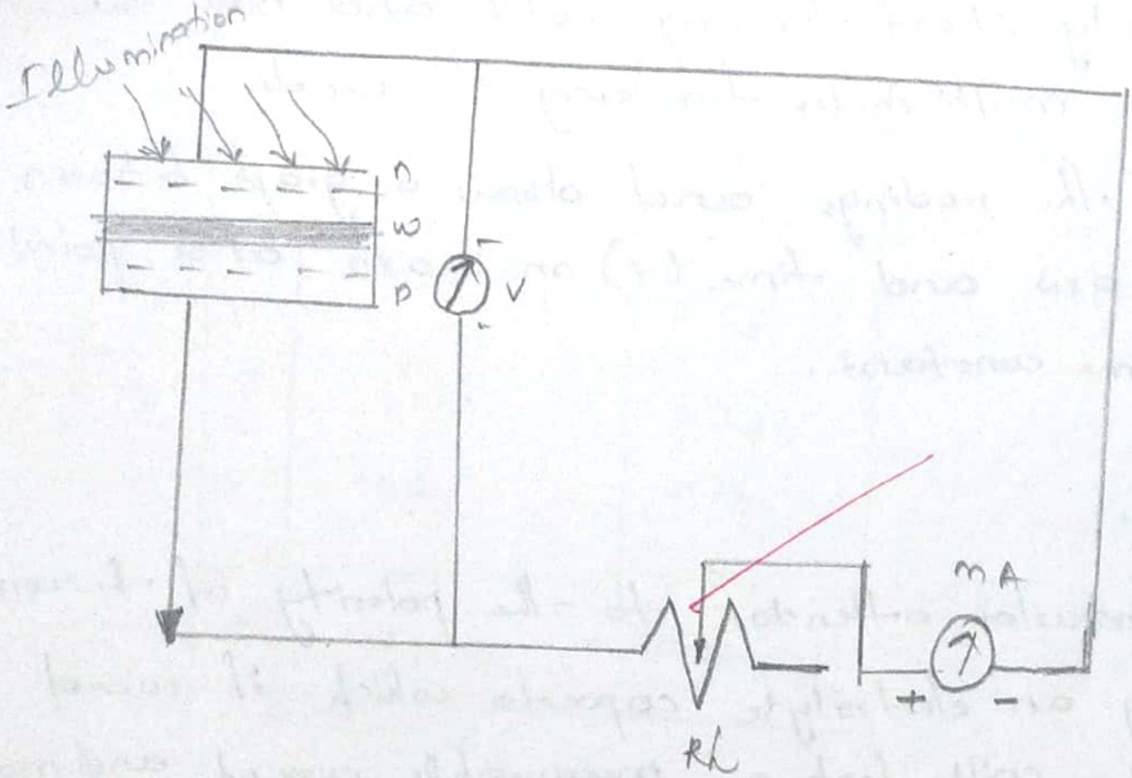
$K = 4700 \mu F$

$4700 \times 10^{-6} \mu$.

$q =$ 10 k Ω ⇒ 10×10^{3} Ω.

$\mu F \rightarrow \mu = 10^{6}$

$k\Omega + \Omega = 10^{3}$.


Illumination
n
n
p
V
mA
+
−
Rh

Date : | | | | | | PAGE # : 7

Experiment no - 5

Solar cell.

Aim: To study the V-I characteristics of solar cell.

Apparatus: Solar cell, Ammeter, voltmeter, illumination source, variac and connecting wire.

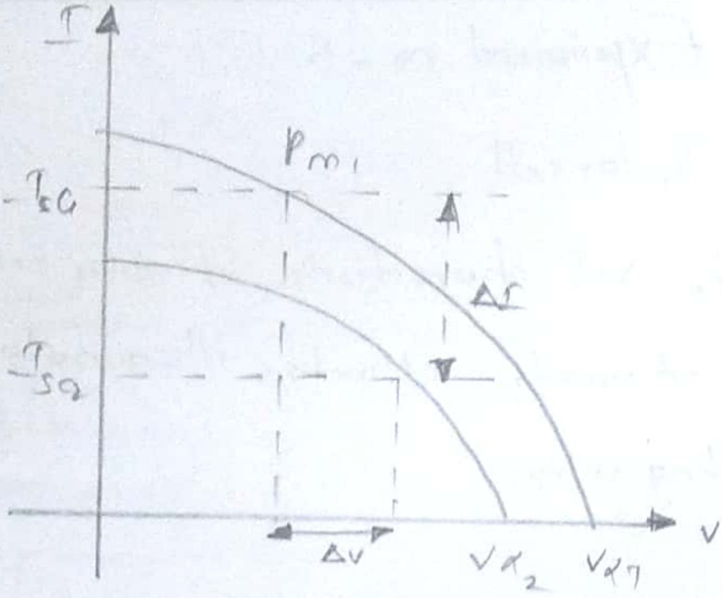
Theory:-

Incident sunlight can be converted into electricity by photovoltaic conversion using a solar panel. A solar panel consist of individual cells that are large area semiconductor diode, constructed so that light can penetrate into the region of the p-n junction. The junction formed between the n-type silicon wafer and the p-type surface layer governs the diode characteristics as well as the photovoltaic effect. The excess charges can flow through external circuit to produce power.

Procedure

1). Place solar cell directly infront of variable light intensity source and connect output of solar cell to voltmeter, V-I on board.

2). Now gradually increase the intensity of light (bulb) and observe the output of solar cell on the voltmeter V-I



I-V characteristic for solar cell for a different illumination.

Tabular form.

S.No	Voltmeter (mV)	Ammeter (mA)	P = VI
1)	0.09	10.0	0.9
2)	3.56	9.5	33.82
3)	3.66	9.0	32.94
4)	3.73	8.5	31.70
5)	3.78	8.0	30.24
6)	3.83	7.5	25.724
7)	3.86	7.0	27.02
8)	3.89	6.5	25.865
9)	3.90	5.5	23.4
10)	3.93	5.0	21.615
11)	3.96	4.0	19.5
12)	3.97	4.5	0.

3). Then connect the circuit as shown in the circuit diagram.

4). Vary the intensity, and note voltage and current on V.I and M.I (ammeter) respectively and as well as connecting load.

5). Plot graph between voltage and current at different intensities with and without load.

Result:

The V-I characteristics of a given solar cell have been studied. The open circuit voltage and short circuits are measured as $V_{oc} = 3.99$ $I_{sc} = 10.0$

Maximum power point (MPP) = 33.82

form factor (FF) = $\frac{MPP}{I_{sc} \times V_{oc}}$

= 0.84

25/03/19

Experiment - 07

Optical fibre (Bending losses)

Aim: To determine the bending losses of optical fibre.

Apparatus: fibre optic analog, transmission kit, one meter and two meters, PMMA fibre patch cord and inline SMA adaptor.

Theory: The optical power at a distance L, in an optical fiber is given by $P_L = P_{10}\, 10(-\alpha L \cdot 10)$ where P_0 is the launched power and α is the attenuation co-efficient in decibels per unit length. The typical attenuation co-efficient value for the fibre under consideration here is 0.3 dB per meter, at a value length of 660 nm loss in there expressed in decibels is given by -10 loge (p_0/p_f) where, p_0 is the launced power and p_f is power at the far end of the fiber. Typical losses at connected junctions may vary from 0.3 dB to 0.6 dB losses in fibres occur at fiber joints of slipes due to axial displacement angular displacement, separation (air core) ~~mismaten~~ mismatch of core diameters mismatch of numerical aperture, improper cleaving and cleaning of the ends.

Date: 25/03/2019 PAGE #:

Procedure.

step 1:- Connect one end of cable to the 660nm port of the TNS20EA-TX and the other end of the to PIN port [power meter point] of TNS20EA-RX

step 2:

Set the DMN to the 200mv range. control connect the terminals marked PO on TNS20EA-RH to the DMM to the power meter is now ready for use.

step 3:-

Connect the optical fibre patch cord, cable 1, securely after relieving all twists and strains on the fibre while connecting the cable please not that minimum force should be applied. At the same time there that the connector is not loosely coupled to the receptacle after connecting the optical fibre cable properly adjust SET PO ~~knob~~ to set power at 660nm LED to ~~suitable~~ value say -15.0dBm the Dmm will read 150mv) note this as

Table 1:

S.No	PO1(dB)	PO_2(dB)	PO_3(dB)	Loss in cable 1 (dB)	Loss in cable 2 (dB)	Loss in 3 meter fiber (dB)
1.	1m	2m	3m	122.3	124.4	146.9

Table 2.

S.NO	Turns	loss.
1	1	145.5
2	2	146.7
3	3	147.2
4	4	148.2
5	5	164.5

Draw proper table

Step 4.

When one turn of the fibre on the mandrel, and note the reading of the power meter. P_{O_2}. ~~Note the~~ Now the loss due to bending and strain on the plastic fibre is $P_{O_1} - P_{O_2}$ dB. For more accurate read out set the DMM to the 2000mV range and take the measurement. Typically the loss due to the strain and bending the fibre 0.03 to 0.5dB.

Step 5

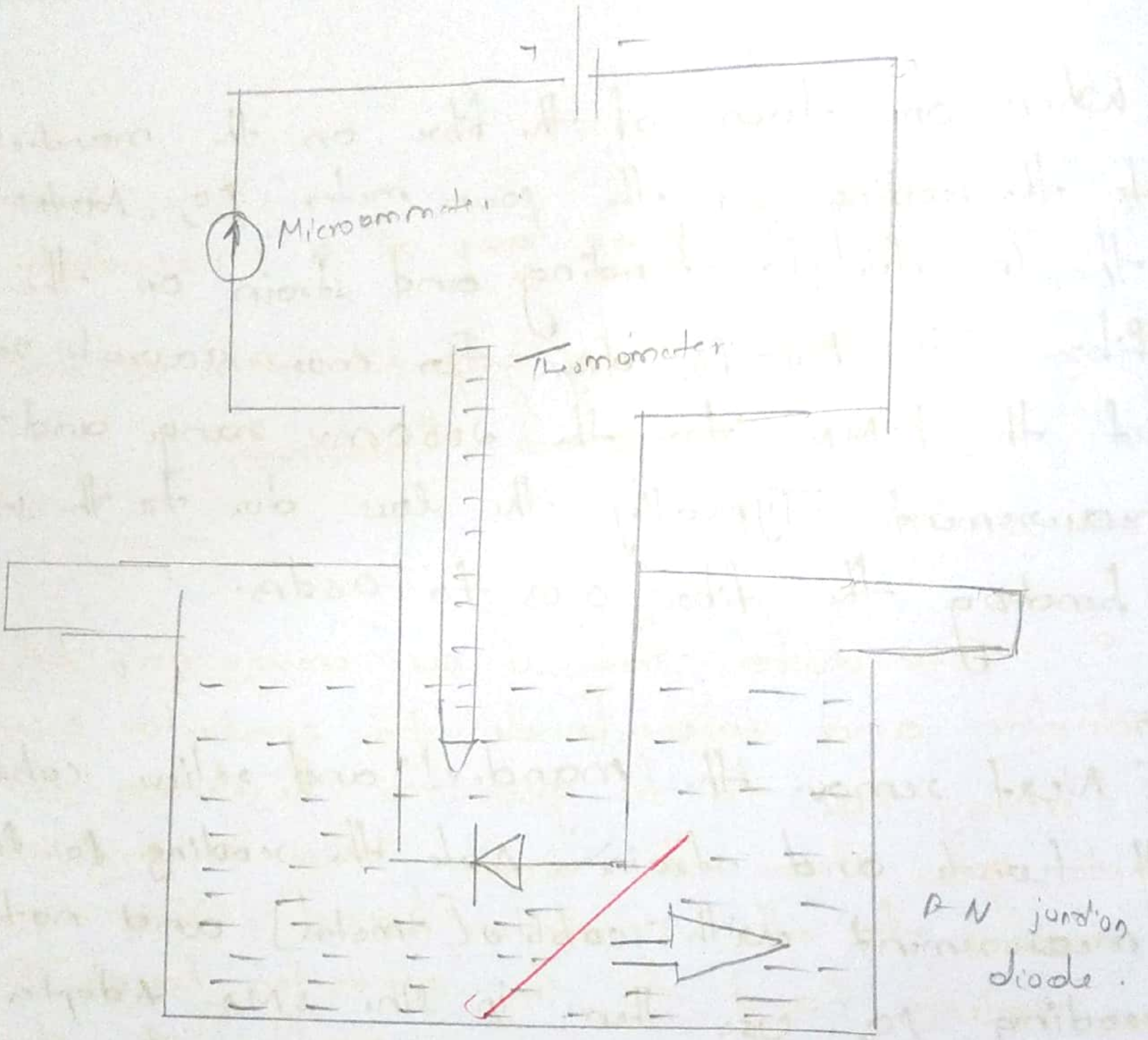
Next remove the mandrel and relieve cable 1 of all twists and strains. Note the reading P_{O_1}. Repeat the measurement with cable 2 [3 meters] and note the reading P_{O_2}. Use them in line. SMA Adapter. and connect two cables in series. Note the measurement P_{O_3}

Step 6

Repeat the entire experiment with CBD2

Result.

studied the various types of losses that occur in optical fibres and measure the losses in dB of two optical fibres patch cords.


Microammeter
Thermometer
PN junction diode.

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Experiment - 7

Energy gap of p-n junction diode.

Aim: To determine the energy gap of a semiconductor diode.

Apparatus: For bidden energy gap kit, semiconductor diode (Ge or silicon) centigrade thermometer.

Theory:-

In a semiconductor there is an energy gap between its induction and valence bonds. For conductor a certain amount energy has to be given to the electron so that it gets goes from the diode. When a p-n junction valence band to the conduction band. When a p-n junction valence band to the conduction band. Then we can measure the energy gap semiconductor diode. When a p-n junction is reverse biased then current is due to minority carrier whose concentration is dependent on the energy gap. The reverse current is a function of the temperature of the junction diode.

The current - voltage characterising of a p-n junction is given by

$$I = I_s \exp\left[(11.9v)/\eta T\right) - 1]$$

S.No	Temp (°C)	Temp (K)	Content (x)	2.303 × log x	$\frac{100}{T}$ ro.
1	80	80+273	30	3.466	2.872
2	75	75+273	32	3.401	2.873
3	70	70+273	28	3.332	2.915
4	65	65+273	26	3.258	2.958
5	60	60+273	24	3.178	3.003
6	55	55+273	22	3.091	3.048
7	50	50+273	20	2.996	3.095
8	45	45+273	18	2.890	3.144
9	50	50+273	10	2.773	3.044

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where "I" is the forward junction current

"I_s" is the reverse saturated current,

"v" is the junction voltage,

"q" is the electronic charge

"k" is the Boltzman constant

"T" is the temperature in kelvin and

"n" is a constant.

The reverse saturation current is given by

$$I_s = BT^3 \exp[-Eg/nkT) - ②$$

Where 'B' is a constant and Eg is the energy gap

$$Eg = 2 \times k \times slope$$

Procedure

1). Trace the circuit and switch on the training board.

2). Insert the thermometer provided into the opening of the bakelite cap.

3). Now switch on the oven and allow the oven temperature to rise upto 50°c. ~~At~~ this temperature switch off the oven. ~~The~~ temperature will begin to rise further upto 70° to 80°c and will become stable.

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4). After sometime the temperature will begin to fall. Now fix the voltage at 5 volts.

5). Readings of micro ammeter are noted for every 5°c fall in temperature.

Result.

The energy gap of the material of the given p-n junction diode is found to be ______ eV.

$E_g = B \times slope.$

$B = 8.61 \times 10^{-5} (K^{-1})$

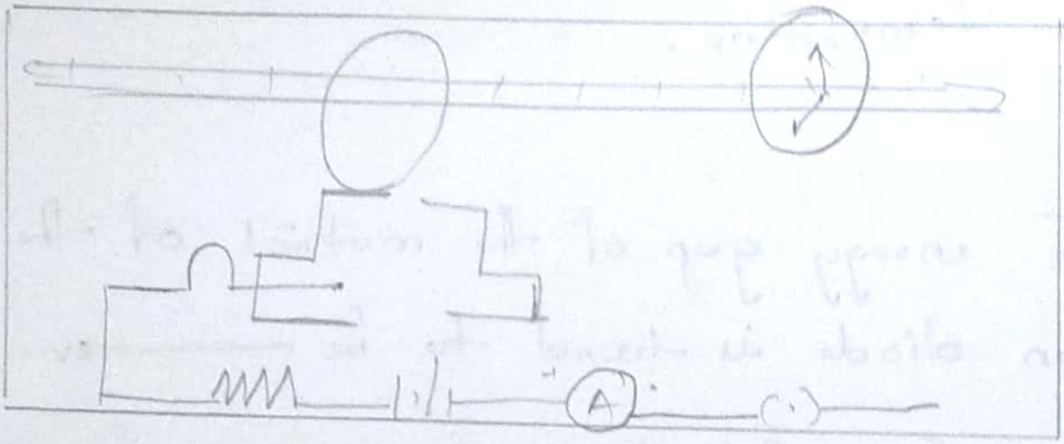
$E_g = 8.61 \times 10^{-5} \times 3.076.$

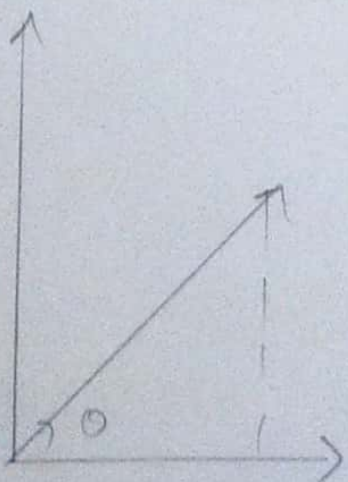
$slope = \frac{y_2 - y_1}{x_2 - x_1}.$

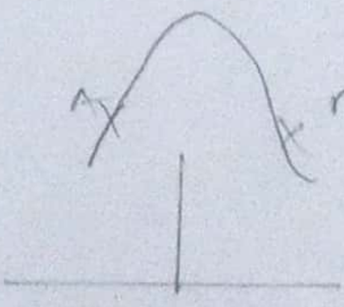
$= 26.505 \times 10^{-5}$

$= 26.505 \times 10^{-4} eV.(K^{-1})$

$= 0.026 eV$


A


θ


A
B

Experiment - 8

Stewart - Gee's Experiment.

Aim: To determination of magnetic field along the axis of a current carrying coil.

Apparatus: Stewart and Gee's, Rheostat, Ammeter, Battery eliminator, Plug key single, commutator four plug and connecting wires.

Theory: The magnetic field (B) at a point on the axis of a circular coil carrying current "i" is given by the expression

$$B = \frac{\mu_0 n i a^2}{2(x^2+a^2)}$$

When "n" is the number of turns, "a" the mean radius of the coil, 'x' is the distance of point from the center of the coil along the axis, and 'i' is the current passing through the coil.

Procedure:

The magnometer is set at the center of the coil and rotated to make the aluminium pointer read (0°-0°) in the magnometer. The key k is closed and rheostat is adjusted so as the deflection in the magnometer is about 60°. The current in the commutator is reversed and the deflection in the magnometer is observed.

Distance from the centre of the coil (x)	Diflection in east direction				Mean θ_E	Diflection in west direction				Mean θ_W	$\theta = \frac{\theta_E + \theta_W}{2}$	Tan θ	$\log(R^2+x^2)$	$B_x = B_E \tan\theta$
	θ_1	θ_2	θ_3	θ_4		θ_1	θ_2	θ_3	θ_4					
0	10	14	11	15	12.5	35	45	50	65	48.75	30.625	-1.011	2	0.00
5	30	34	35	40	34.75	20	20	35	45	30	32.375	1.425	2.09	-0.00
10	10	10	15	14	12.25	5	5	40	35	21.25	12.25	-0.992	2.301	0.00
15	15	5	20	20	15	8	10	30	25	18.25	16.625	1.3052	2.511	-0.00
20	10	25	22	35	23	5	15	20	35	23.75	23.37	5.286	2.698	-0.00
25	20	20	25	35	26.25	10	15	15	20	20	27.5	-0.978	2.860	-0.00

The deflection in the magnometer before and after reversal of current should not differ much. If the difference is above 2° or 3°, necessary adjustments are to be made.

The experiment is repeated by shifting the magnometer toward west from the center of the coil in 2 steps of 2cm, each time and deflection are noted before and after the reversal of current. The mean deflection is denoted as θ_W.

A graph is drawn between x and the corresponding $\tan\theta_E$ and $\tan\theta_W$ along y-axis. The shape of the curve is shown above the figure. The point A and B marked on the curve lie at distance equal to half of the coil $(a/2)$ on either side of the coil.

Observation

Number of turns of coil = 100

Radius of coil, R = 10cm.

Mean radius a = 5.

current in the coil, I = 1A.

Horizontal component of

B_E = 0.38

μ_0 magnetic permeability of coil = $4\pi \times 10^{-7}$

Result:

Experiment value of exponent (slope) = -1.0

Theoritical value of slope = -1.5