



Estd.2001

Sri Indu

College of Engineering & Technology

UGC Autonomous Institution

Recognized under 2(f) & 12(B) of UGC Act 1956,
NAAC, Approved by AICTE &
Permanently Affiliated to JNTUH



NAAC

NATIONAL ASSESSMENT AND
ACCREDITATION COUNCIL



APPLIED PHYSICS LAB (R20)

I BTECH I& II SEMESTER

(COMMON TO ALL BRANCHES)

DEPARTMENT OF

HUMANITIES & BASIC SCIENCES

ACADEMIC YEAR 2021-22

DEPARTMENT OF
HUMANITIES & BASIC SCIENCES

Branch: COMMON TO ECE, EEE,CSE,IT,CSIT,CS,DS,IoT,AI&ML&AI&D

Class: B.Tech- I Year- I SEM & II SEM
PHYSICS LAB

Subject: APPLIED

Code: R20EAP 12L1

Academic Year: 2021-22

Regulation: R20

Core/Elective/H&S: H&S

Credits: 1.5

No of practical's per week: 03

SNO	Prepared By	Regulation	Date
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V.SWAPNA			

Verified By

Head of the Department

DEPARTMENT OF HUMANITIES AND SCIENCES

APPLIED PHYSICS LAB

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SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

INSTITUTION VISION

To be a premier Institution in Engineering & Technology and Management with competency, values and social consciousness.

INSTITUTION MISSION

- IM₁** Provide high quality academic programs, training activities and research facilities.
- IM₂** Promote Continuous Industry-Institute interaction for employability, Entrepreneurship, leadership and research aptitude among stakeholders.
- IM₃** Contribute to the economical and technological development of the region, state and nation.

DEPARTMENT VISION

To be a Technologically adaptive centre for computing by grooming the students as top notch professionals.

DEPARTMENT MISSION

The Department has following Missions:

- DM₁** To offer quality education in computing.
- DM₂** To provide an environment that enables overall development of all the stakeholders.
- DM₃** To impart training on emerging technologies like data analytics , artificial intelligence and internet of things.
- DM₄** To encourage participation of stake holders in research and development.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF Electronics & Communication Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1:** **Higher studies:** Graduates with an ability to pursue higher studies and get employment in reputed institutions and organization.
- PEO2:** **Domain knowledge:** Graduates with an ability to design and develop a product.
- PEO3:** **Professional career:** Graduates with excellence by multidisciplinary approach to achieve successful professional career.
- PEO4:** **Life Long Learning:** Graduates with an ability to learn advanced skills to face professional competence through life long learning.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

Department Of Electronics & Communication Engineering

PROGRAM OUTCOMES (POs) & PROGRAM SPECIFIC OUTCOMES (PSOs)

PO	Description
PO 1	Engineering Knowledge: L3 the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design / development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: L5, select, and L3 appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	The engineer and Society: L3 reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: L3 ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and L3 these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological Change
Program Specific Outcomes	
PSO 1	Develop software projects using standard practices and suitable programming environment.
PSO 2	Identify , formulate and solve the real life problems faced in the society, industry and other areas by L3ing the skills of the programming languages, networks and databases learned.
PSO 3	To L3 computer science knowledge in exploring and adopting latest technologies in different co-curricular activities.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF HUMANITIES AND SCIENCES

Academic Year: 2021-22 B.Tech IYear ISem

COs MAPPING WITH POs & PSOs

(R20EAP12L1) APPLIED PHYSICS LAB

Course outcomes	Statements
C116.1	Students can acquire the knowledge voltage and current characteristics of Semiconductor devices. (K4- Analyse)
C116.2	Students learn the practical knowledge in quantum concepts by Photo electric effect and magnetic material magnetization and demagnetization (K2- Understanding)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C116.1	3	2	3	-	3	-	-	-	-	-	-	-	3	3	2
C116.2	3	3	3	-	3	-	-	-	-	-	-	-	3	3	2
C116	3	2.5	3	-	3	-	3	3	2						

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution under UGC, New Delhi)

B.Tech. - I Year – I Semester

L T P C

0 0 3 1.5

(R21EAP12L1) APPLIED PHYSICS LAB

Course Objectives: The Objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Identify the types of semi conductors
3. Analyze the conduction behavior of Semi Conductor materials and Opto electronic devices.

Course Outcomes: At the end of course, the student will be able to

1. Explain the V-I Characteristics of some opto electronic & Semi conductor devices
2. Make use of Lasers and Optical Fibers for engineering applications.
3. Identify the Types of Semi conductors.

List of Experiments:

1. P-N junction diode:
V-I Characteristics of PN junction 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. Hall effect:
To determine Hall co-efficient of a given semiconductor.
5. Photoelectric effect:
To determine work function of a given material.
6. LASER:
To study the characteristics of LASER sources.
7. BH Curve:
To study the Phenomena of Magnetic Hysteresis loop.
8. Optical fiber:
Determination of numerical aperture of given optical fiber.
9. Energy gap:
Energy gap of material of p-n junction.

Demonstration Experiments:

10. LCR Circuit:

To Study the Resonance in LCR Circuit.

11. PIN Diode:

To study the V-I characteristics of PIN Diode.

12. Optical fiber :

To determine the bending losses of Optical fiber.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

B.TECH – DEPARTMENT OF HUMANITIES AND SCIENCES

Academic Year: 2021-2022 B.Tech IYear I Sem

(R20EAP12L1)APPLIED PHYSICS LAB LAB

LIST OF EXPERIMENTS

S.No	Name Of The Experiment
1	VI Characteristics of PN junction 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	Hall effect: To determine Hall co-efficient of a given semiconductor.
5	Photoelectric effect: To determine work function of a given material.
6	LASER: To study the characteristics of LASER sources.
7	Optical fiber: To determine the bending losses of Optical fibers.
8	BH Curve To study the Phenomena of Magnetic Hysteresis loop
9	LCR Circuit: To study the resonance in LCR circuit
10	To study the V-I characteristics of PIN diode



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
B.TECH – DEPARTMENT OF HUMANITIES AND SCIENCES

Academic Year: 2021-2022 B.Tech I Year I Sem

(R20EAP12L1) APPLIED PHYSICS LAB

Additional Experiments

Exp No.	Name of the experiment
1	Energy gap: Energy gap of material of p-n junction.
2	Optical fiber: To study the bending losses of optical fiber.



SRI INDU COLLEGE OF ENGG & TECH
LESSON PLAN
(Regulation :R20)
DEPARTMENT OF HUMANITIES AND SCIENCES

Prepared on
:4.10.20
21
Rev1:

Sub. Code & Title (R20EAP12L1)APPLIED PHYSICS LAB

Academic Year:2021-22

Year/Sem./Section

I/I/ECE(A,B,C,D)

Faculty Name & Designation

S. N o.	Topic (s)	Book Reference	Page (s)		Teaching Methodology	Proposed No. of hours	Actual Date of Handled	CO/RBT
			From	To				
1	VI Characteristics of PN junction diode	Manual			Demonstration on Black Board & Apparatus	3		L3
2	Solar Cell: To study the V-I Characteristics of solar cell.	Manual			Demonstration on Black Board & Apparatus			L3
3	Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.	Manual			Demonstration on Black Board & Apparatus			L5
4	Hall effect: To determine Hall coefficient of a given semiconductor.	Manual			Demonstration on Black Board & Apparatus			L3
5	Photoelectric effect: To determine work function of a given material.	Manual			Demonstration on Black Board & Apparatus			L5
6	LASER: To study the characteristics of LASER sources.	Manual			Demonstration on Black Board & Apparatus	3		L5
7	Optical fiber: To determine the bending losses of Optical fibers.	Manual			Demonstration on Black Board & Apparatus			L5

8	BH Curve To study the Phenomena of Magnetic Hysteresis loop	Manual			Demonstration on Black Board & Apparatus			L5
9	LCR Circuit: To study the resonance in LCR circuit	Manual			Demonstration on Black Board & Apparatus			L3
10	To study the V-I characteristics of PIN diode	Manual			Demonstration on Black Board & Apparatus	3		L5
11	Energy gap: Energy gap of material of p-n junction.	Manual			Demonstration on Black Board & Apparatus			L5
12	Optical fiber: To study the bending losses of optical fiber.	Manual			Demonstration on Black Board & Apparatus			L5



Sri Indu College of Engineering and Technology

(An Autonomous Institution Under UGC)

Department of

HUMANITIES & SCIENCES

APPLIED PHYSICS LAB MASTER TIME TABLE

NAME OF THE FACULTY	V.SWAPNA/ASHOK KUMAR CH/ N SHAILAJA(101-R&D Block) A LAVANYA/E BALA RAJU(304-A Main Block)	SUBJECTS	APPLIED PHYSICS LAB
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TIME	09:40am To 10:30am	10:30am To 11:20pm	11:20am To 12:10pm		12:40pm To 1:45pm	1:45pm To 2:50pm	2:50pm To 4:00pm
DAY	1	2	3		4	5	6
MON				L U N C H	ECE-A		
TUE							
WED					ECE-D		
THU					ECE-A		
FRI					ECE-B		
SAT							

HOD

PRINCIPAL

LAB MANUAL

APPLIED PHYSICS LAB SYLLABUS

<i>S.No.</i>	<i>Name of the Experiment</i>
1	V - I Characteristics of PN junction Diode
2	V – I Characteristics of Solar Cell
3	V – I and P – I Characteristics of Light Emitting Diode
4	Hall co – efficient of a given semiconductor : Hall Effect
5	work function of a material : Photo electric effect
6	V-I and L-I characteristics of LASER DIODE
7	Microscopic bending losses of a given Optical fibers
8	Phenomena of Magnetic Hysteresis Loop : B-H curve
9	LCR Circuit: To study the resonance in LCR circuit
10	To study the V-I characteristics of PIN diode
11	Energy gap: Energy gap of material of p-n junction.
12	Optical fiber: To study the bending losses of optical fiber.

Experiment – 1

V - I Characteristics of PN junction Diode .

AIM: - To study the characteristics of a semiconductor diode.

MICRO BOARD CONSISTS OF: - Two dual range meters internally connected for both forward and reverse bias, switch selectable and dual positive going power supply. 0-3v & 0-30v.

THEORY: A PN junction diode is a two terminal junction device. It conducts only in one direction (only on forward biasing).

FORWARD BIAS: On forward biasing, initially no current flows due to barrier potential. As the applied potential exceeds the barrier potential the charge carriers gain sufficient energy to cross the potential barrier and hence enter the other region. The holes, which are majority carriers in the P-region, become minority carriers on entering the N-region, and electrons, which are the majority carriers in the N-region, become minority carriers on entering the P-region. This injection of minority carriers results in the current flow, opposite to the direction of electron movement.

REVERSE BIAS: On reverse biasing, the majority charge carriers are attracted towards the terminals due to the applied potential resulting in the widening of the depletion region. Since the charge carriers are pushed towards the terminals no current flows in the device due to majority charge carriers. There will be some current in the device due to the thermally generated minority carriers. The generation of such carriers is independent of the applied potential and hence the current is constant for all increasing reverse potential. This current is referred to as Reverse Saturation Current (I_0) and it increases with temperature. When the applied reverse voltage is increased beyond the certain limit, it results in breakdown. During breakdown, the diode current increases tremendously.

PROCEDURE:

FORWARD BIAS: - When external voltage is applied to the PN – Junction in such a direction it cancels the potential barriers, the permitting current flow, it is called forward biasing.

1. Connections are made as shown in **Fig 1**.
2. Flip the DPDT switch towards 1.5v and 30mA.
3. Connect the power supply and keep the voltage control knobs at minimum position.
4. Switch 'ON' the power supply, by slowly increasing the voltage in steps, notedown the readings of Voltmeter & Ammeter.
5. Plot the graph values of Voltage & Current on a graph sheet.

CIRCUIT DIAGRAM :

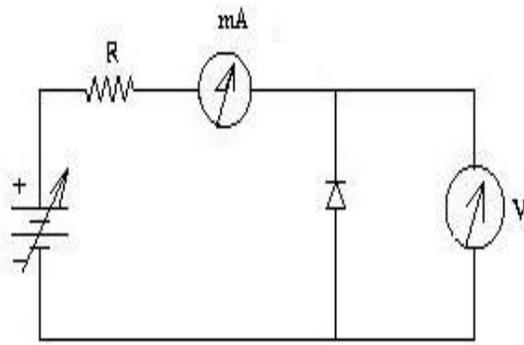


Figure 1 (Forward Biased)

REVERSE BIAS: - When an external voltage is applied to a PN – junction diode, in such a direction that the potential barrier is increased, (at this junction current does not flow) it is called reverse biasing.

1. Connections are made as shown in **Fig 2**.
2. Flip the DPDT switch towards 30v and 30mA.
3. Connect the power supply, keep the voltage control knobs at minimum position.
4. Switch 'ON' the power supply, by slowly increasing the voltage in steps, notedown the readings of Voltage and Ammeter.
5. Plot the values of Voltage & Current on a graph sheet.

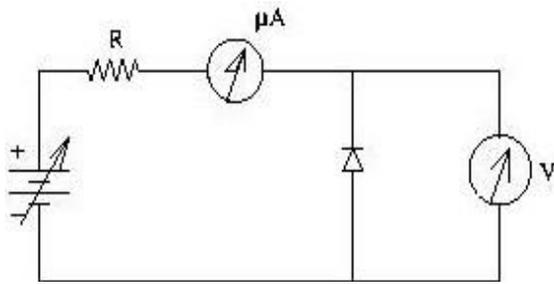
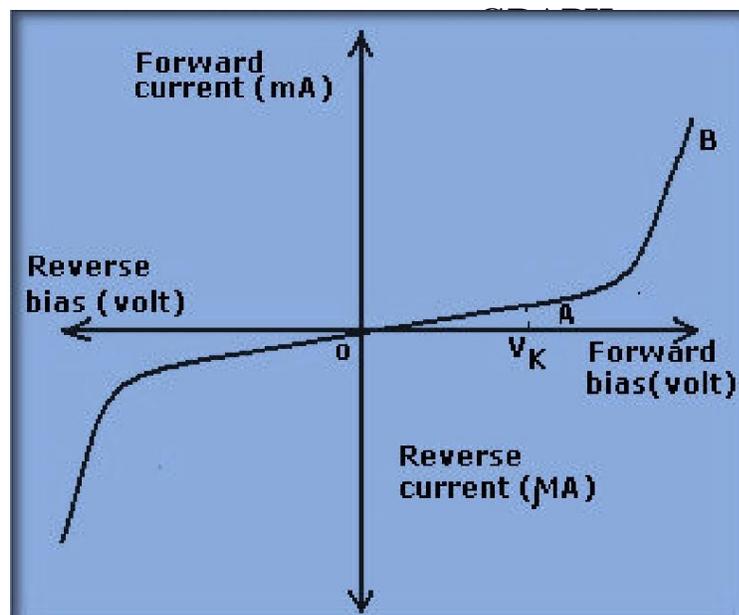


Figure 2 (Reverse Biased)

**OBSERVA
TION
TABLE:**

S.No.	When diode is forward biased		When diode is reverse biased	
	Current(mA)	Voltage(V)	Current(μA)	Voltage(V)
1.				
2.				
3.				
4.				
5.				



PRECAUTIONS:

1. Make sure that the connections are tight.
2. Take care to use suitable forward and reverse voltages across the diode so that suitable forward and reverse currents flow through the diode. Otherwise the diode may be damaged.

RESULT: Forward and Reverse bias characteristics of the PN junction diode was Studied

VIVA QUESTIONS:

1. *What is PN junction diode?*
2. *What is the working of diode?*
3. *How PN junction is formed?*
4. *How do you forward bias on a diode?*
5. *What happens when a PN junction diode is reverse biased?*
6. *What is the difference between forward bias and reverse bias?*
7. *Why does the depletion layer increase in reverse biasing?*
8. *What are Semiconductors? Give examples?*
9. *What are the types of Semiconductor?*
10. *What is Intrinsic Semiconductor?*
11. *.What is Extrinsic Semiconductor?*
12. *What are the types of Extrinsic Semiconductor?*
13. *What is P-type Semiconductor?*
14. *What is N-type Semiconductor?*
15. *What is doping?*
16. *Why N - type or pentavalent impurities are called as Donor impurities?*
17. *Why P- type or trivalent impurities are called as acceptor impurity?*
18. *Define drift current?*
19. *Define the term diffusion current?*
20. *What is application of PN junction diode?*
21. *What is forward bias in a PN junction?*
22. *What is reverse bias in a PN junction?*
23. *What is Reverse saturation current?*
24. *Experimentally find out whether the given diode is made of Germanium or Silicon.?*

Experiment 2

SOLAR CELL

AIM: To study the V-I characteristics of Solar cell.

MICRO BOARD CONSISTS OF:

Solar Cell/Photovoltaic cell mounted on the wooden base.

Single directional mercury coated variable intensity source, Voltmeter, Ammeter, Load resistance.

THEORY:

The solar cell is a semiconductor device, which converts 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 Fig. 1a Working principle of a solar cell 2 energy L5 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. The e.m.f generated by the photo-voltaic cell in the open circuit, i.e. when no current is drawn from 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 ISC, the voltage becomes zero.

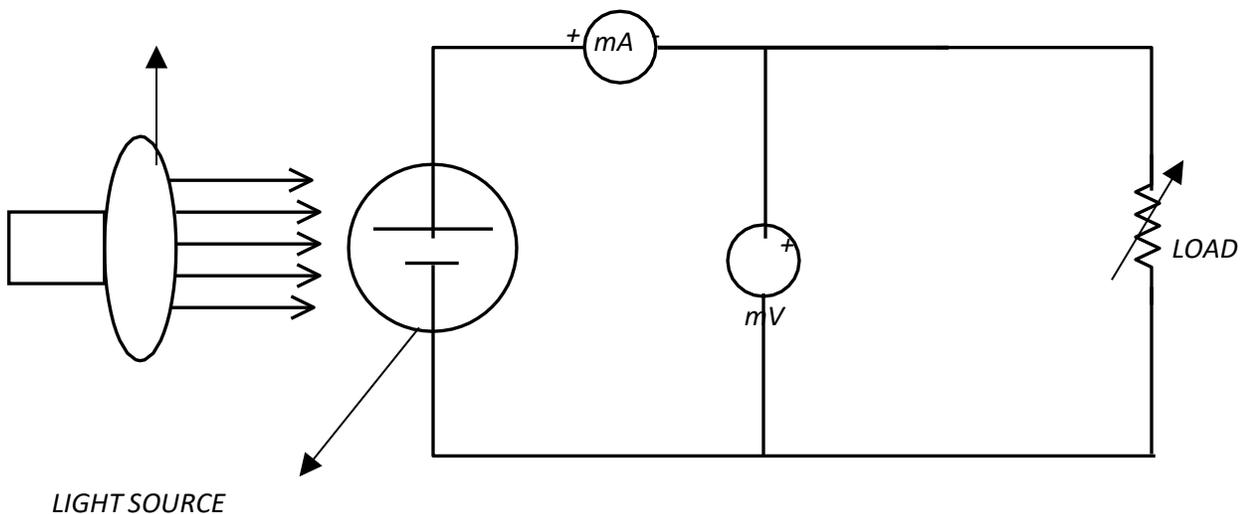
Sunlight consists of a little particles of solar energy called photons. As the photovoltaic cell is exposed this sunlight, many of the photons are reflected, pass right through or absorbed by the solar cell. When enough photons are absorbed by the negative layer of the photovoltaic cell, electrons are freed from the negative semiconductor material. Due to the manufacturing process of the positive layer, these freed electrons naturally migrate to the positive layer creating a voltage differential, similar to a household battery.

When the 2 layers are connected to an external load , the electrons flow through the circuit creating electricity. Each individual solar energy cell produces only 1-2 watts. To increase power output, cells are combined in a weather-tight package called a solar module. These modules (from one to several thousand) are then wired up in serial and/or parallel with one another, into what's called a solar array, to L5 the desired voltage and amperage output required. Due to the natural abundance of silicon, the semi-conductor material that PV cells are primarily made of, and the practically unlimited resource in the sun, solar power cells are very environmentally friendly. They burn no fuel and have absolutely no moving parts which makes them virtually maintenance free, clean, and silent.

PROCEDURE:

Connect the circuit as per the circuit diagram shown in fig (1). Place the solar cell at a particular distance say 1cm from the variable light source. Vary intensity of the light source, note down the voltage and current in the tabular column. Next note the short circuit current I_{sc} , when the voltage across the solar cell is zero & open circuit voltage V_o by removing the load resistance across the solar cell. Calculate power $P=VI$ for each reading. Plot the graph between the voltage V_s Current , mark the maximum power point, Repeat the experiment by changing the distance between the solar cell & light source.

CIRCUIT DIAGRAM:



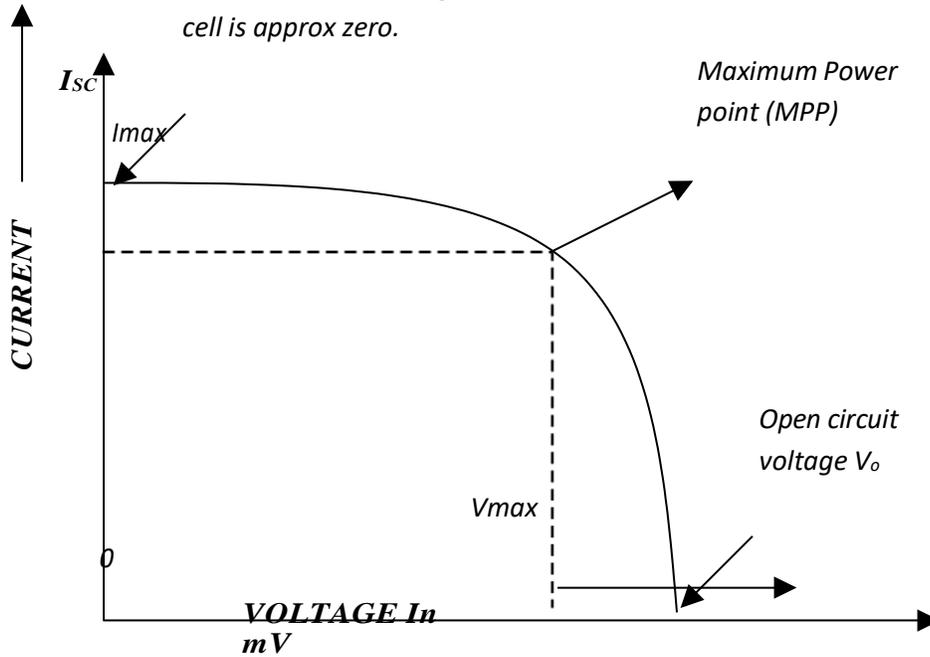
SOLAR CELL Fig : (1)

TABULAR FORM:

<i>S.N O</i>	<i>Load Resistance (Ω)</i>	<i>Voltage in (mV)</i>	<i>Current in(mA)</i>	<i>POWER P =VI(Watt)</i>

MODEL GRAPH:

The short circuit current I_{sc} , is the maximum current from the solar cell and occurs when the voltage across the solar cell is approx zero.



PRECAUSTIONS:

1. *Make sure that the connections are tight.*
2. *After the completion of experiment switch off the power supply.*
3. *Avoid parallax error.*

RESULT:

We studied the characteristics of Solar cell.

VIVA QUESTIONS:

1. *What is a solar cell?*
2. *Explain the operation of photovoltaic cell.*
3. *How does the photon proceed in a solar cell?*
4. *What are the uses of solar cell?*
5. *what is solar cell Fill factor?*
6. *How does photovoltaic cell work?*
7. *what are the different types of solar cells?*
8. *. what are the characteristics of solar cell?*
9. *what is the working principal of the solar cell?*
10. *what is drift current in solar cell ?*
11. *what is open circuit voltage in solar cell ?*
12. *what is maximum power point in solar cell (MPP)?*
13. *How PN junction works in solar cell?*
14. *solar cell is which biased?*

Experiment 3

LTGHT EMITTING DIODE

AIM: To study of V/ I (Electrical) characteristics and L/ I (optical) characteristics of Light Emitting Diode.

APPARATUS :

Mikron /Micro Light emitting Diode Characteristics board comprising of:

1. *Light emitting diode*
2. *0-5V variable Supply for Light emitting diode*
3. *20mW Digital Optical power meter to measure optical power of Light emitting diode*
4. *20V Digital Voltmeter to measure voltage across Light emitting diode*
5. *200mA DC Digital Ammeter to measure Light emitting diode Current*

THEORY: -

When a PN junction diode is forward biased , the potential barrier is lowered and the majority charge carriers start crossing the junction. A PN junction diode, which emits light on forward biasing, is known as light emitting diode. The emitted light may be in the visible range or invisible range and the intensity of light depends on the applied potential.

PRINCIPLE: -

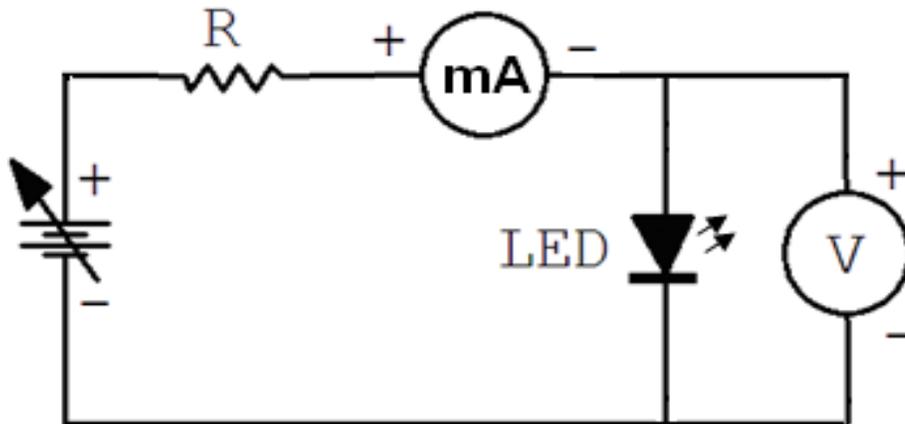
In a PN junction charge carrier recombination takes place when the electrons cross from the n-layer to the P-layer. The electrons are in the conduction band on the p-side while holes are in the valence band on the p-side. The conduction band has a higher energy level compared to the valence band and so when the electrons recombine with a hole the difference in energy is given out in the form of heat or light. In case of silicon or germanium, the energy dissipation is in the form of heat, whereas in case of gallium- arsenide and gallium phosphide, it is in the form of light. But this light is in the invisible region & so these materials cannot be used in the manufacture of LED. Hence gallium –arsenide phosphide which emits light in the visible region is used to manufacture an LED.

CONSTRUCTION: -

An n-type layer is grown on a substance and a p-type layer is grown over it by diffusion process. The P-layer is kept at the top because carrier recombination takes place in it. The terminals anode and cathode are taken out of the n-layer and P-layer respectively. The anode connections are made at the edge in order to provide more surface area for

the emission of light. A metal film is applied to the bottom of substance to reflect light to the surface of the device and also to provide connection for the cathode terminal. Finally the structure are provided with an encapsulated (cover) to protect them from destruction.

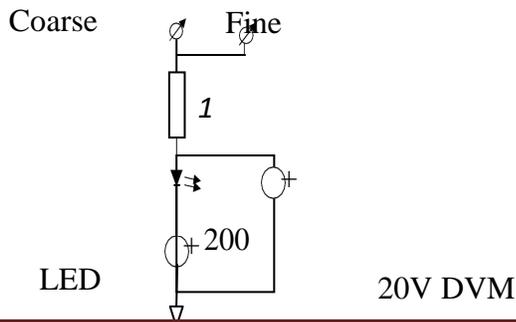
CIRCUIT DIAGRAM:



Procedure for V/I characteristics of a Light emitting diode:

1. Connect the Light emitting diode circuit as shown below
2. Slowly increase supply voltage using variable Power supply using coarse and fineknobs.
3. Note down current through the Light emitting diode at increasing values of Lightemitting diode voltage of 0.5V, 1.0V, 1.5V, 2.5 V.
4. Do not exceed current limit of 30mA else the Light emitting diode may get damaged.
5. Plot a graph of Light emitting diode voltage Vs Light emitting diode current .0-5V

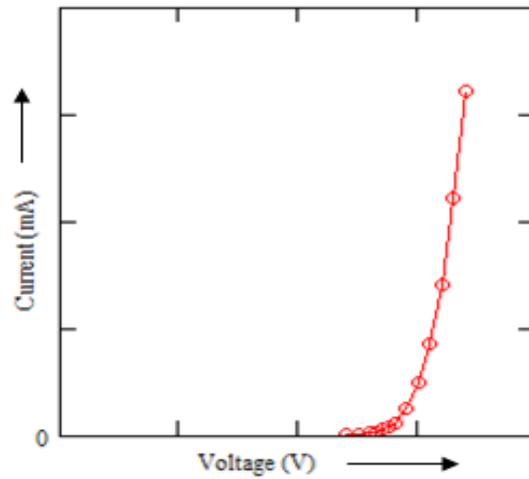
Variable Supply



TABULAR FORM FOR V/I CHARACTERISTICS :

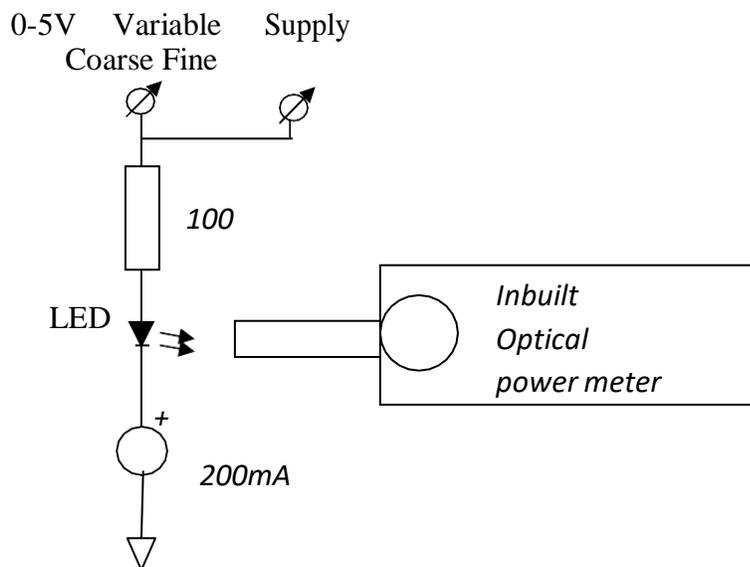
<i>S.No</i>	<i>Voltage in (mV)</i>	<i>Current in (mA)</i>

MODEL GRAPH:

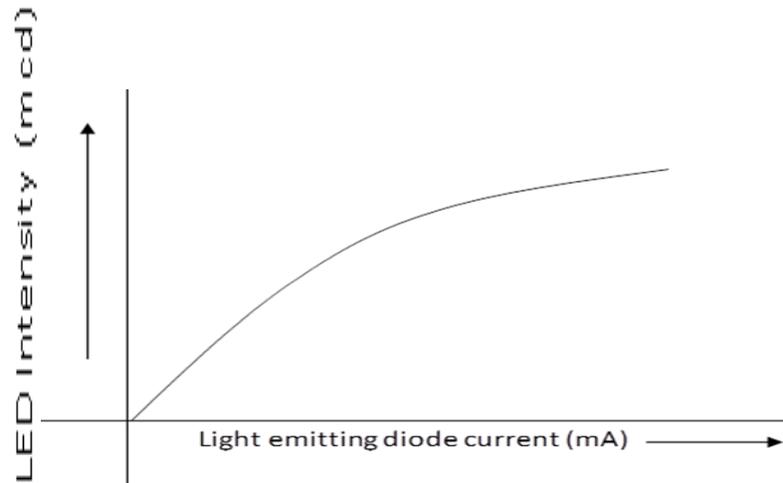


Procedure for L/I characteristics of a Light emitting diode:

1. Connect the Light emitting diode circuit as shown below:
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 Light emitting diode of 1mA to 20 mA at 1 mA step.
4. Do not exceed current limit of 30mA else the Light emitting diode may get damaged.
5. Plot a graph of Light emitting diode intensity V/s Light emitting diode current as shown in figure2



MODEL GRAPH :



PRECAUTIONS:

1. *1 Make sure that the connections are tight.*
2. *After the completion of experiment switch off the power supply.*
3. *Avoid parallax error*

RESULT :

We studied V/I (Electrical) characteristics and L/I (optical) characteristics of Light Emitting Diode.

VIVA QUESTIONS:

1. *How LED is fabricated?*
2. *What is a Lighting Emitting Diode and how it works?*
3. *What if LED?*
4. *What happens when LED in reverse biased?*
5. *what material is used in LED manufacture?*
6. *What are the characteristics of LED?*
7. *What symbol we use for Light Emitting Diode?*
8. *what is the difference between ordinary diode and Led?*
9. *What are the I-V Characteristics Light Emitting Diodes*

Experiment 4 HALL EFFECT

AIM: To determine Hall Coefficient of a semiconductor crystal.

APPARATUS: I.C regulated power supply, Electromagnets, Constant current power supply, Hall Sensor & Semiconductor Crystal.

Theory:

When a transverse magnetic field (B) is applied to a semiconductor carrying an current, a voltage is induced in the direction perpendicular to both current (I) & magnetic field (B). This phenomenon is known as Hall Effect. If the sign of Hall Coefficient is positive the semiconductor is of P-type & if the sign of Hall Coefficient is negative the semiconductor is of n-type.

Hall current Vs Hall Voltage at constant Magnetic field.:

Procedure:

- 1. Connect the IC regulated power supply terminals to Electromagnetic coils in their respective sockets.*
- 2. Connect Hall probe to Gauss meter. Switch "ON" the Gauss meter, set the Gaussmeter reading to "0.00" by adjusting the knob.*
- 3. Now place the Hall probe in the magnetic field exactly at the center of the electromagnet cores. Set the gauss meter reading to 0.5KG magnetic field. This is achieved by L3ing suitable current to electromagnets & by simultaneously positioning the electromagnet cores by turning the knobs.*
- 4. Connect the crystal mounted PCB to constant current power supply to their respective sockets.*
- 5. Remove Hall probe from the magnetic field and place crystal in the same position without disturbing the position of magnetic cores.*
- 6. Switch "ON" the constant current power supply & L3 current in steps of 0.1mA, rotate the crystal till it becomes perpendicular to magnetic field. Hall voltage will be maximum in this adjustment, note the corresponding Hall voltage at constant magnetic field.*
- 7. Plot the graph between current (I) and hall voltage (V_H) which is a straight line & find the slope.*
- 8. Repeat the above steps from 3 to 7 for different values of magnetic fields say 0.75KG, 1KG, 1.25KG, 1.5KG, 1.75KG & 2KG.*

NOTE:

1. *There may be some voltage even outside the magnetic field. This is due to the imperfect alignment of the four contacts of the crystal and is generally known as the “Zero Field Potential”.*
2. *In all the cases this error should be subtracted from the Hall voltage reading.*
3. *Gap between the magnetic cores should remain fixed for one set of readings.*

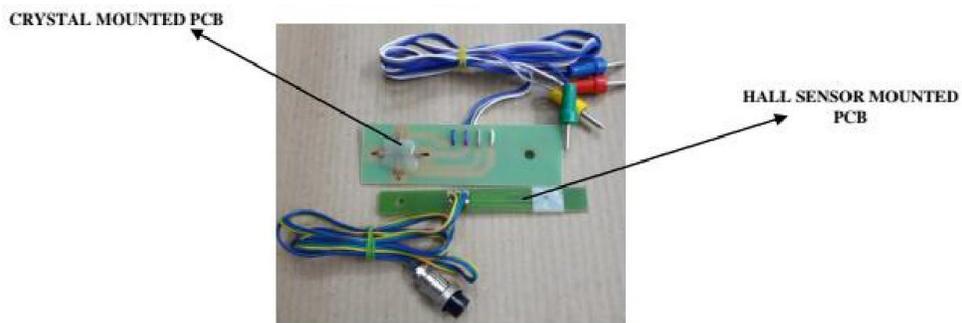
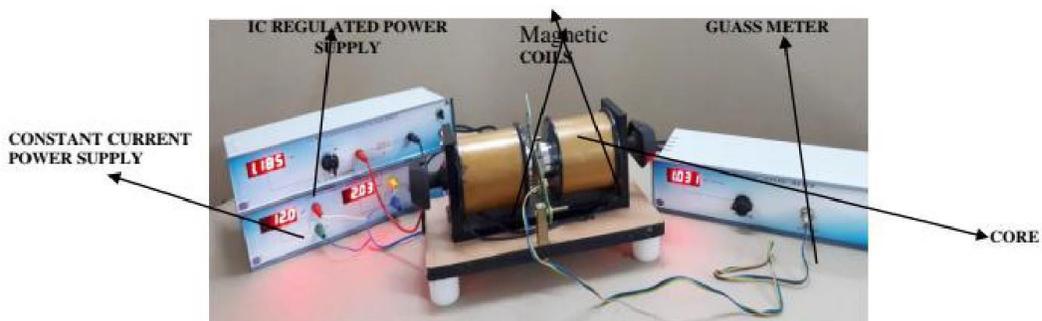


Fig. 1. Hall effect Setup

Tabular form :

S. NO	HALL CURRENT (mA)	HALL VOLTAGE (mV)
1	0.1	
2	0.2	
3	0.3	
4	0.4	
5	0.5	
6	0.6	
7	0.7	
8	0.8	
9	0.9	
10	1	
11	1.1	
12	1.2	
13	1.3	
14	1.4	
15	1.5	
16	1.6	
17	1.7	
18	1.8	
19	1.9	
20	2	
21	2.1	
22	2.2	
23	2.3	
24	2.4	
25	2.5	

MODEL GRAPH:



Calculation of Hall Coefficient (R_H) :

$$\text{Hall Coefficient } (R_H) = \frac{V_H \times Z}{I \times B}$$

Where V_H/I = Slope of 2KG graph
 Z = Thickness of the crystal

B = Magnetic Field (2KG in this case)
Substituting the values in the equation :

$$\text{Hall Coefficient (R}_H\text{)} = \frac{20.478 \times 7 \times 10^{-2}}{2 \times 10^3}$$
$$= 71.673 \times 10^3 \text{ cm}^3 \text{ col}^{-1}$$

As per the calculation since the sign of Hall coefficient is positive, the semiconductor is P-type.

PRECAUTIONS:

1.

RESULT: The Hall coefficient of the semiconductor crystal is :

VIVA QUESTIONS:

1. What is Hall effect and Hall voltage?
2. What is the principle of Hall effect?
3. How does Hall voltage develop?
4. why is Hall potential developed?
5. What is Hall effect measurement?
6. What is Hall current?
7. What is p type and n type semiconductor?
8. Can Hall effect be observed in metal?
9. What is Fleming's Left Hand Rule?
10. Define mobility?

EXPERIMENT 5
PHOTO ELECTRIC EFFECT

- I. To determine Planck's constant 'h' from the stopping voltages measured at different frequencies of light.
- II To determine the work function " ϕ " of a metal.

INTRODUCTION:

Electrons can be liberated from the surface of certain metals by irradiating them with light of a sufficiently short wavelength; this is known as the photoelectric effect. Their energy depends on the frequency (ν) of the incident light, but not on the intensity; the intensity only determines the number of liberated electrons. This fact contradicted the principles of classical physics, and was first interpreted in 1905 by Albert Einstein, and was one of the founding principles which gave rise to the subject of quantum mechanics. Einstein postulated that light consists of a flux of particles; called photons, whose energy E is proportional to the frequency:

$$E = h\nu \text{-----} (1)$$

The proportionality factor h is known as Planck's constant, and is regarded as a fundamental constant of nature. In this conception of light as being particle in nature, each photoelectron (ejected electron) exits the material with the kinetic energy

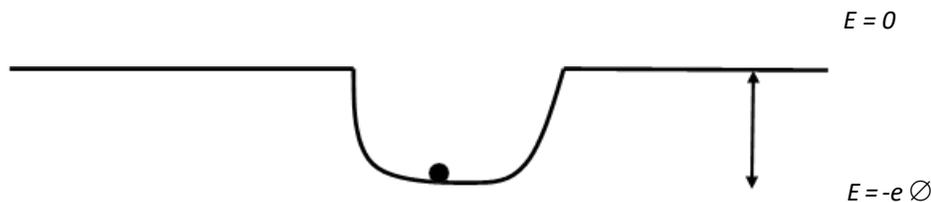
$$E_{ke} = h\nu - W_K \text{-----}(2)$$

where W_K is the work function of the electrons, and is equal to the amount of energy required to release the electrons from the particular material. We can determine Planck constant h by exposing a photocell to monochromatic light, i.e. light of a specific wavelength, and measuring the kinetic energy E_{ke} of the ejected electrons.

Theory:

An electron in a metal can be modelled as a particle in an average potential well due to the net attraction and repulsion of protons and electrons. The minimum depth that an electron is located in the potential well is called the work function of the metal (ϕ) (see Fig. 1). In other words, it is a measure of the amount of work that must be done on the electrons (located in the well) to make it free from the metal. Since different metal atoms have different number of protons, it is reasonable to assume that the work function (ϕ) depends on the metal. This is also supported by the fact that different

metals have different values for electrical properties that should depend on the electron binding including conductivity. The electron in the potential well of a metal is shown below in Fig. 1. It is analogous to a marble trapped in a water-well. The shallower the well (i.e. the lower the work function (“ ϕ ”), less is the energy required to cause the emission of the electron. If we shine a light with sufficient energy then an electron is emitted.



Electron in a potential well at a depth “ ϕ ”

When a photon with frequency “ ν ” strikes the surface of a metal, it imparts all of its energy to a conduction electron near the surface of the metal. If the energy of the photon ($h\nu$) is greater than the work function (ϕ), the electron may be ejected from the metal. If the energy is less than the work function, the electron will simply acquire some kinetic energy that will dissipate almost immediately in subsequent collisions with other particles in the metal. By conservation of energy, the maximum kinetic energy with which the electron could be emitted from the metal surface

T_{max} , is related to the energy of the absorbed photon $h\nu$, and the work function ϕ , by the relation,

$$T_{max} = \frac{1}{2} mV_{max}^2 = h\nu - e\phi$$

Now consider the case of electrons being emitted by a photocathode in a vacuum tube, as illustrated Fig.2. In this case, all emitted electrons are slowed down as they approach the anode, and some of their kinetic energy is converted into potential energy. There are three possibilities that could happen.

1. *First, if the potential is small then the potential energy at the anode is less than the kinetic energy of the electrons and there is a current through the tube.*
2. *The second is if the potential is large enough the potential energy at the anode is larger than the kinetic energy and the electrons are driven back to the cathode. In this case, there is no current.*
3. *The third case is if the voltage just stops the electrons (with maximum kinetic*

energy T_{\max}) from reaching the anode. The voltage required to do this is called the "stopping potential" (V_0).

Thus Eq. 1 can be rewritten as,

$$e V_0 = h\nu - e\phi$$

$$V_0 = \frac{h}{e} \nu - \phi$$

It is worth noting here that, since the anode and cathode surfaces are different, an additional contact potential "A" comes into the picture which simply gets added to the work function " ϕ ". Eq. (3) can be written in terms of wavelength as

$$V_0 = \left(\frac{h}{e} \right) \left(\frac{c}{\lambda} \right) - (\phi + A)$$

$$\phi = \left(\frac{h}{e} \right) \left(\frac{c}{\lambda} \right) - V_0 - A$$

Where ϕ is the work function

h is the Planck's constant

e is the charge of electron = 1.602×10^{-19} coulombs

ν is the Frequency of particular color filter

V_0 is the stopping potential for particular color filter

A is the contact potential for the photo tube is = 0.5 V

CIRCUIT DIAGRAM OF PHOTO ELECTRIC EFFECT :

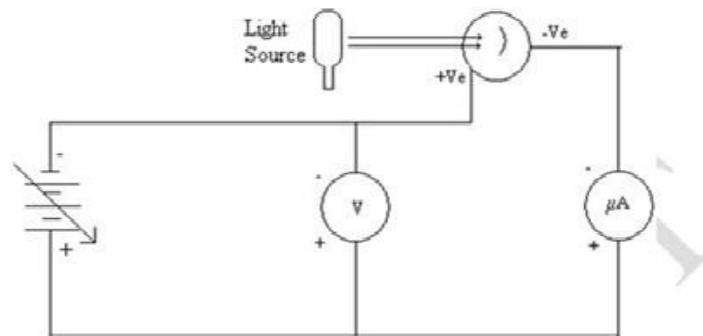


Figure 1

Experiment set up :

The experimental set-up consists of a light source with four different colors, a vacuum photo tube, a built-in power supply and main unit. The base of the phototube is built into a dark room and front side of it a arrangement is given to mount filters.

PROCEDURE :

1. Make the connections as shown in fig 1. Switch light source to 100 Watt mode.
2. Keep voltage control knob to its minimum position and switch on the main unit and light source.
3. Arrange the light source and photo tube in such a way that light falls on the phototube. The distance between photo tube and light source is adjusted such that there is sufficient flow of current.
4. Do not place a color filter in the path of the light.
5. After placing the filter there will be some reading in micro ammeter this is called photo current at zero anode potential.
6. Now slowly increase the voltage till current in micro ammeter becomes zero, this voltage is called as stopping potential V_0 . Wait 2 minutes and note down this reading in this space provided.
7. Repeat the experiment with different color filters and note down their stopping

potential values.

8. *Plot the graph by taking Stopping potential on Y- axis , frequency on X – axis and calculate the slope.*
9. *Calculate plank’s constant by using the formulae $h = \text{slope} \times e$*
10. *Repeat the experiment by switching the light source to 60 Watt mode.*

WORK FUNCTION :

Calculate the work function ϕ for all the filters by substituting the values of planks constant, frequency , stopping potential and charge of electron . Note down readings inthe tabular form.

OBSERVATIONS AND TABULATION :

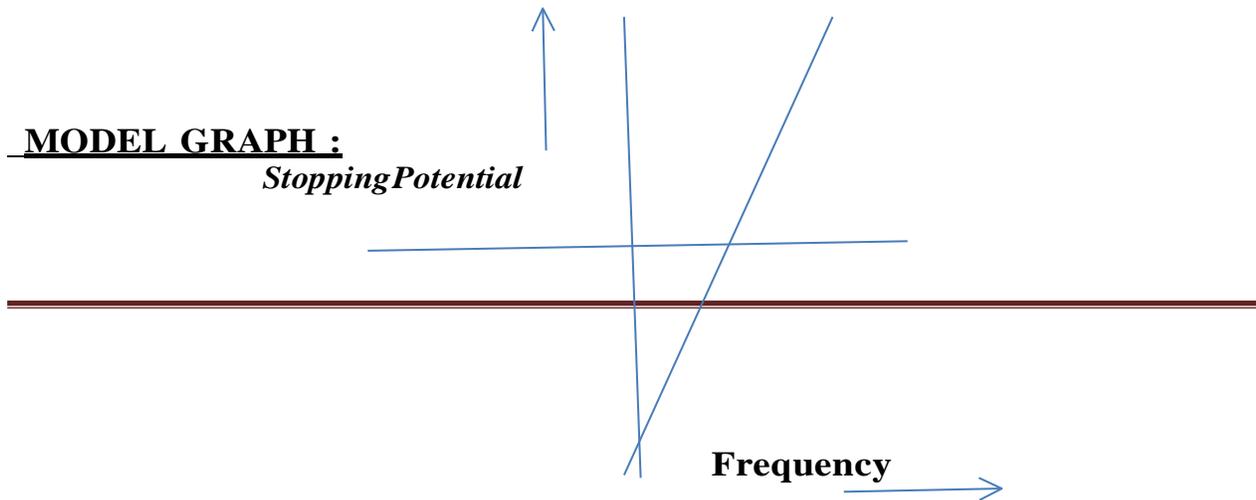
Specifications of filters

<i>Color</i>	<i>Blue</i>	<i>Green</i>	<i>Yellow</i>	<i>Red</i>
<i>Frequency(Hz)</i>	6.06×10^{14}	5.4×10^{14}	5.2×10^{14}	4.5×10^{14}

<i>Fliter</i>	<i>Frequency(Hz)</i>	<i>Stopping potential (V)</i>	<i>Work function (ϕ)</i>
<i>Red</i>	4.5×10^{14}		
<i>Yellow</i>	5.2×10^{14}		
<i>Green</i>	5.4×10^{14}		
<i>Blue</i>	6.06×10^{14}		

MODEL GRAPH :

Stopping Potential



PRECAUTIONS :

1. Rotate all the knobs very slowly.
2. Handle the filters with care and avoid touching their surfaces.
3. Avoid parallax error.

RESULT : 1. Planck's constant ' h ' :

2. Work function of the metal is (ϕ) :

**VIVA
QUESTIONS:**

1. What is Einstein's photoelectric effect?
2. Why is photoelectric current proportional to intensity?
3. Can electrons be ejected from the metal by increasing the intensity of the light?
4. What is the work function in photoelectric effect?
5. What is the work function in photoelectric effect?
6. What is the importance of Planck's constant?
7. What does Planck's constant represent?

EXPERIMEN

T 6LASER

DIODE

AIM: To study of V/I (Electrical) characteristics and L/I (optical) characteristics of LASER diode

INTRODUCTION :

A laser diode is a laser where the active medium is a semiconductor similar to that found in a light-emitting diode. The most common and practical type of laser diode is formed from a p-n junction and powered by injected electric current. These devices are sometimes referred to as injection laser diodes to distinguish them from (optically) pumped laser diodes, which are more easily produced in the laboratory.

A laser diode, like many other semiconductor devices, is formed by doping a very thin layer on the surface of a crystal wafer. The crystal is doped to produce an n-type region and a p-type region, one above the other, resulting in a p-n junction, or diode.

When an electron and a hole are present in the same region, they may recombine or "annihilate" with the result being spontaneous emission — i.e., the electron may re-occupy the energy state of the hole, emitting a photon with energy equal to the difference between the electron and hole states involved. (In a conventional semiconductor junction diode, the energy released from the recombination of electrons and holes is carried away as phonons, i.e., lattice vibrations, rather than as photons.) Spontaneous emission gives the laser diode below lasing threshold similar properties to an LED. Spontaneous emission is necessary to initiate laser oscillation, but it is one among several sources of inefficiency once the laser is oscillating.

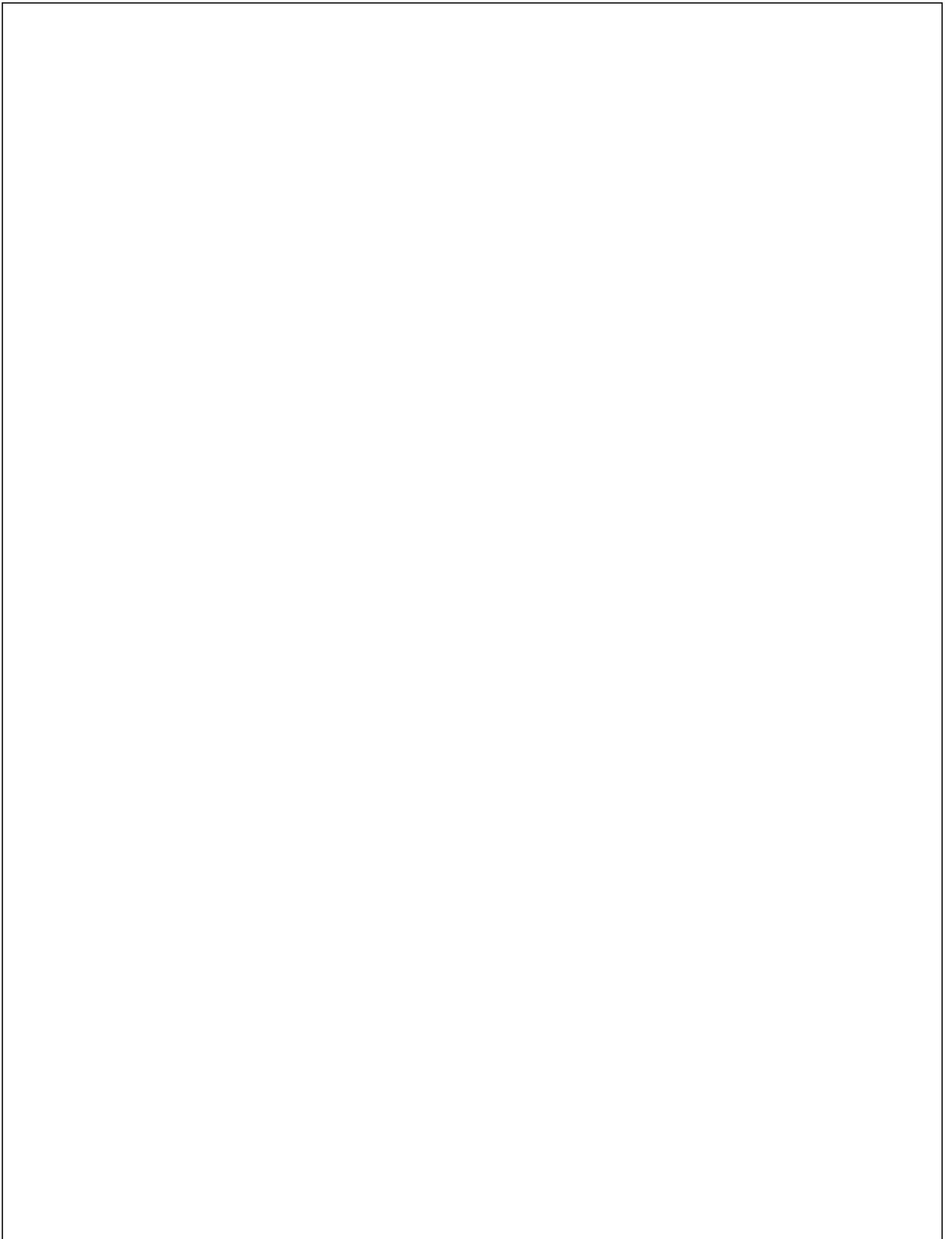
In the absence of stimulated emission (e.g., lasing) conditions, electrons and holes may coexist in proximity to one another, without recombining, for a certain time, termed the "upper-state lifetime" or "recombination time" (about a nanosecond for typical diode laser materials), before they recombine. Then a nearby photon with energy equal to the recombination energy can cause recombination by stimulated emission. This generates another photon of the same frequency, travelling in the same direction, with the same polarization and phase as the first photon. This means that stimulated emission causes gain in an optical wave (of the correct wavelength) in the injection region, and the gain increases as the number of electrons and holes injected across the junction increases. The spontaneous and stimulated emission processes are vastly more efficient in direct band gap semiconductors than in indirect band gap semiconductors; therefore silicon is not a common material for laser diodes.

Experimental Procedure :

Apparatus:

Mikron/Micro Laser Diode Characteristics board comprising of:

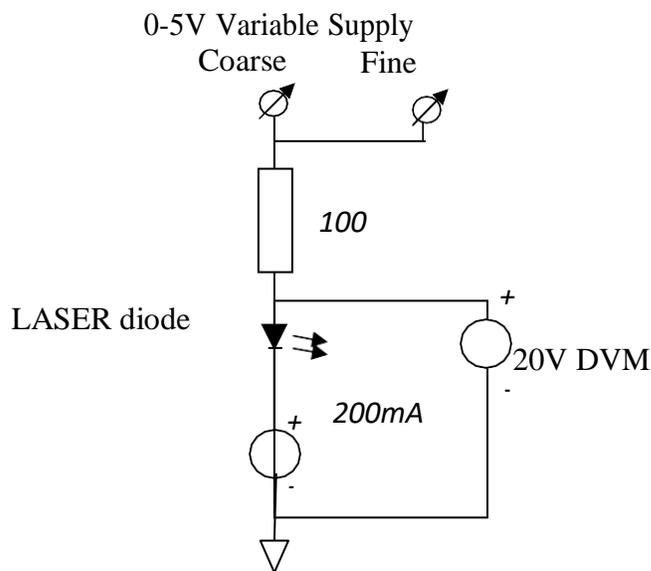
1. Laser diode



2. 0-5V variable Supply for laser diode
3. 20mW Digital Optical power meter to measure optical power of Laser diode
4. 20V Digital Voltmeter to measure voltage across laser diode
5. 200mA DC Digital Ammeter to measure Laser diode Current

Procedure for V/I characteristics of a LASER diode:

1. Connect the Light emitting diode circuit as shown below:



2. Slowly increase supply voltage using variable Power supply using coarse and fine knobs.
3. Note down current through the Light emitting diode at increasing values of LASER diode voltage of 0.5V, 1.0V, 1.5V, 2.5 V.
4. Do not exceed current limit of 30mA else the LASER diode may get damaged.
5. Plot a graph of LASER diode voltage V/s LASER diode current .

Electrical Characteristics :

The V/I Curve.

The voltage drop across the laser is often acquired during electrical characterization. This characteristic is similar to the analogous characteristic of any other type of semiconductor diode and is largely invariant with temperature, as depicted in Figure 1. (Note: Diode laser manufacturers usually place the forward voltage on the X axis, in compliance with conventional practice in the electronics industry for other types of diodes. Companies

manufacturing instrumentation to characterize diode lasers often

present the curve in the manner of Figure 1, with the forward current on the X axis. Conventional electronics people would call this an I/V curve, rather than accept our nomenclature of a V/I curve). The typical voltage drop across a diode laser at operating power is 1.5 volts. V/I data are most commonly used in derivative characterization techniques.

TABULAR FORM For V/I Characteristics:

<i>S.NO</i>	<i>Voltage in (Volts)</i>	<i>Current in (mA)</i>

MODEL GRAPH :



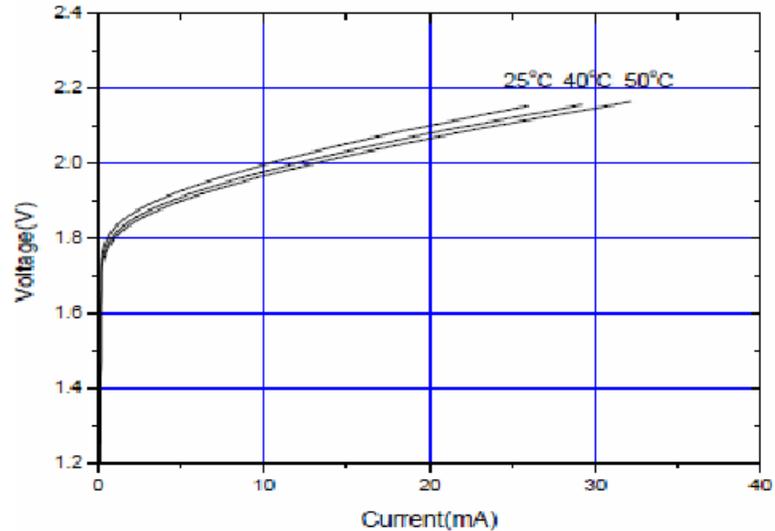
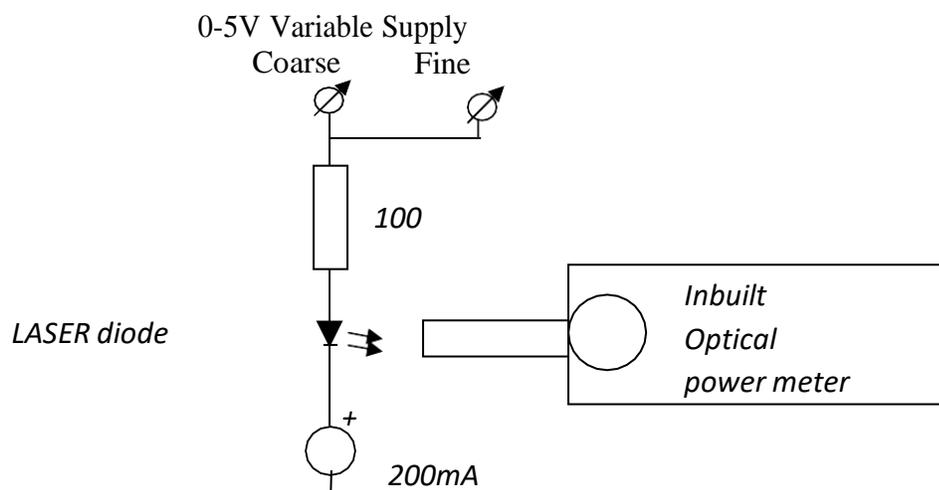


FIG: V/ I CURVE

Procedure for L/I characteristics of a laser diode :

1. Connect the Laser diode circuit as shown below:



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 5mA to 26 mA at 1 mA step.*
4. *Do not exceed current limit of 30mA else the laser diode may get damaged.*
5. *Plot a graph of Laser diode optical power V/s Laser diode current as shown in figure2 .(As this experiment is conducted at room temperature, only one graph for a single temperature will be obtained.)*
6. *Calculate the slope of this curve.*
7. *This slope is efficiency of Laser diode in terms of m W/mA.*
8. *Draw a line through the curve cutting the X axis. The point of intersection of X axis and this line will give the threshold current of Laser diode*

TABULAR FORM : *For L / I Characteristics:*

<i>S.NO</i>	<i>Current in (mA)</i>	<i>Power in (m Watt)</i>

OPTICAL CHARACTERISTICS

L/I Curve :

The most common of the diode laser characteristics is the L/I curve (Figure 2). It plots the drive current applied to the laser against the output light intensity. This curve is used to determine the laser's operating point (drive current at the rated optical power) and threshold current (current at which lasing begins). The efficiency of a diode laser is also derived from the L/I curve. It is most commonly expressed as slope efficiency and measured in units of mW/mA.

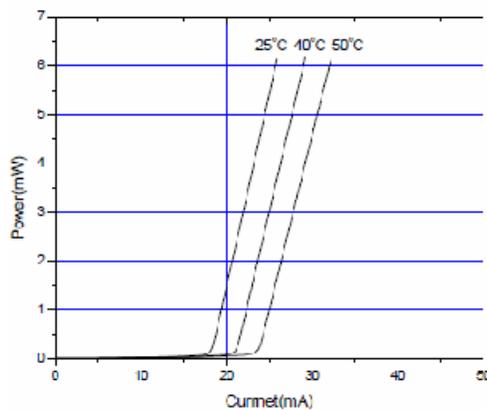


Figure 2 : The L/I Curve

PRECAUTIONS :

1. *1.Rotate all the knobs very slowly.*
2. *Handle the filters with care and avoid touching their surfaces.*
3. *Avoid parallax error*

RESULT :

We studied the V/ I (Electrical) characteristics and L/ I (optical) characteristics of LASER diode

VIVA
QUESTIONS:

1. *What is semiconductor diode laser?*
2. *What is LASER?*
3. *What are the characteristic of laser radiation?*
4. *What does diode laser mean?*
5. *What is the principle of laser diode?*
6. *What is Laser explain its principle?*
7. *What are the characteristics of laser diode?*
8. *How is population inversion achieved in diode laser?*
9. *Difference between the symbols of LED and Laser diode?*
10. *What is the difference between Laser diode and Led?*
11. *How is a laser diode made?*

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EXPERIMENT 7
BENDING LOSSES IN OPTICAL FIBER

AIM: The aim of the experiment is to study bending losses that occur in optical fibers and measure losses in dB m of three fiber cables of 1 meter, 3 meter and 5 meters at two wavelengths 660nm and 850nm.

APPARATUS: Cable wires of length 1m ,3m,and 5m connectors :650nm and 850nm LED sources , mandrel, Transmitter kit and Receiver kit .

FORMULA:

$$\text{dB m} = 10 \times \log \left(\frac{\text{Power meter Reading in } \mu\text{W}}{1000} \right)$$

THEORY:

Y:

Radiative losses occur whenever an optical fiber undergoes a bend of finite Radius of curvature. Fibers can be subject to two types of bend:

- a. *Macroscopic bend having radii that are large compared to the fiber diameter.*
- b. *Random microscopic bend of the fiber axis that can arise when the fibers are incorporated into cables. Let us examine large-curvature radiation losses, which are known as macro-bending losses. For slight bend the excess loss is extremely small and is essentially unobservable. As the radius of curvature decrease, the loss increases exponentially until at a certain critical radius the curvature loss becomes observable. A sharp bend in a fiber can cause significant losses as well as the possibility of mechanical failure. The ray is safely outside of the critical angle and is therefore propagated correctly. If the core bends, the normal will follow it and the ray will now find itself on the wrong side of the critical angle and will escape. The tighter the bend cause the worse the losses. Therefore; the critical radius determined by attached instruments indicated a loss of over 6dB. If bending radius is smaller than critical radius causes damage in optical fiber.*

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PROCEDURE:

a) Losses at 660nm LED :

1. Connect the power cords of both R_x and T_x
2. Short m1 terminals (+ve and - ve) terminals of 660nm LED on the T_x units with patch card connected (+ve) terminal of 660nm LED to the (+ve) terminal of milliammeter and (-ve) terminal of 660nm LED to (-ve) terminal of milliammeter.
3. Relieve all the twists and strains in the fiber cable ensure that it is a straight as possible.
4. Connect one end of the cable 1 to the 660nm LED fiber connection
5. Move the switch S_1 or R_x unit towards 850nm LED
6. Switch on both T_x and R_x Units.

TABULAR FORM: At 660nm LED

<i>S.No</i>	<i>Power meter reading P_{01} in μW</i>	<i>Power meter reading P_{02} in μW</i>	<i>Power meter reading P_{01} in dB</i>	<i>Power meter reading P_{02} in dB</i>	<i>Losses in $P_{01} - P_{02}$ dB</i>

b) Losses at 850nm LED :

1. Connect the power cords of both R_x and T_x
2. Short m1 terminals (+ve and - ve) terminals of 850nm LED on the T_x units with patch card connected (+ve) terminal of 850nm LED to the (+ve) terminal of milliammeter and (-ve) terminal of 850nm LED to (-ve) terminal of milliammeter.
3. Relieve all the twists and strains in the fiber cable ensure that it is a straight as possible.
4. Connect one end of the cable 1 to the 850nm LED fiber connection
5. Move the switch S_1 or R_x unit towards

6. Switch on both T_x and R_x Units.

TABULAR FORM: At 850nm LED

<i>S.No</i>	<i>Power meter reading P_{01} in μW</i>	<i>Power meter reading P_{02} in μW</i>	<i>Power meter reading P_{01} in dB</i>	<i>Power meter reading P_{02} in dB</i>	<i>Losses in $P_{01} - P_{02}$ dB</i>

PRECAUTIONS:

1. There should be no twists or breaks in the fiber of length 1m ,3, and 5m.2.Must and should the bending's applied for executing losses .
- 3.Handle with care the connectors should be fixed correctly.

RESULT:

The bending losses in all wires is same

VIVA QUESTIONS

1. What is the definition of fiber optic cable?
2. What is optical Fiber and how does it work?
3. What are the 3 main layers of Fiber optic cabling and list their function?
4. How many types of fiber optic cable are there?
5. On which scientific principle does optical Fiber work?
6. What is critical angle and total internal reflection?
7. What is total internal reflection under what conditions does it take place?
8. What is a necessary condition for total internal reflection in a medium?
9. Explain Snell's law in optical fiber communication?
10. Define numerical aperture, acceptance angle and cone?
11. Explain types of Losses in optical fiber?
12. Explain types of bending losses?
13. What is dB loss?

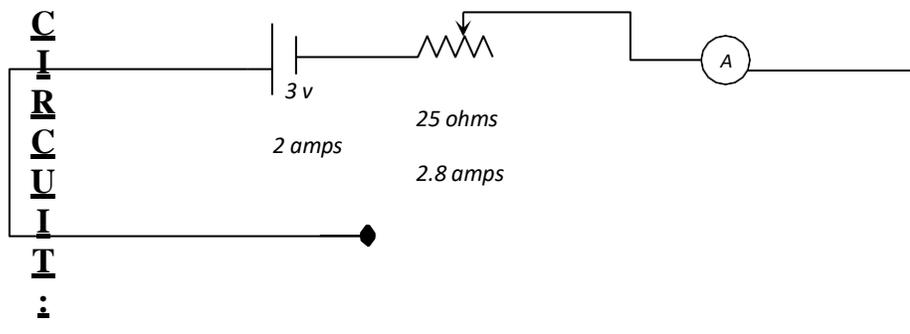
EXPERIMENT 8
B-H
CURVE

AIM:

To draw Hysteresis Curve Intensity of Magnetization verify Magnet field. B– H Curve.

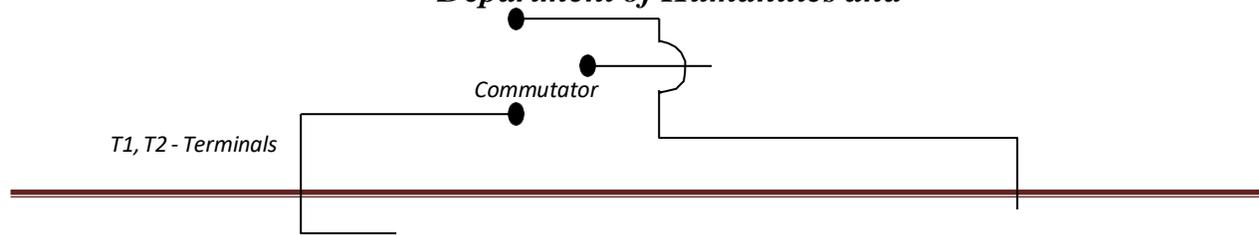
APPARATUS:

Hysteresis curve bench with one solenoid with specimen rod, one compensating coil & one Magnetometer box, Rheostat, Battery Eliminator, Plug key one way, Plug key Commutator, Ammeter

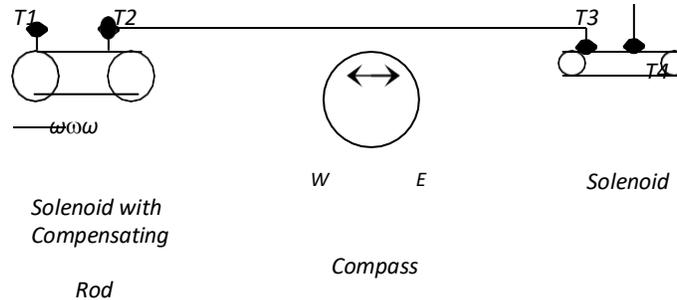


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T3, T4 - Terminals



T H E O R Y :

Consider a magnetic material being subjected to a cycle of magnetization. The graph intensity of magnetization (B) vs. magnetizing field (H) gives a closed curve called B-H loop. The intensity of magnetization B does not become zero when the magnetizing field H is reduced to zero. Thus the intensity of magnetization M at every stage lags behind the applied field H. This property is called magnetic hysteresis. The B-H loop is called hysteresis loop. The shape and area of the loop are different for different materials.

Lets assume that we have an electromagnetic coil with a high field strength due to the current flowing through it, and that the ferromagnetic core material has reached its saturation point, maximum flux density. If we now open a switch and remove the magnetising current flowing through the coil we would expect the magnetic field around the coil to disappear as the magnetic flux reduced to zero. However, the magnetic flux does not completely disappear as the electromagnetic core material still retains some of its magnetism even when the current has stopped flowing in the coil. This ability for a coil to retain some of its magnetism within the core after the magnetisation process has stopped is called Retentivity or remanence, while the amount of flux density still remaining in the core is called Residual Magnetism,

The reason for this that some of the tiny molecular magnets do not return to a completely random pattern and still point in the direction of the original magnetising field giving them a sort of "memory". Some ferromagnetic materials have a high retentivity (magnetically hard) making them excellent for producing permanent magnets. While other ferromagnetic materials have low retentivity (magnetically soft) making them ideal for use in electromagnets, solenoids or relays. One way to reduce this residual flux density to zero is by reversing the direction of the current flowing through the coil, thereby making the value of H, the magnetic field strength negative. This effect is called a Coercive Force, H_C .

If this reverse current is increased further the flux density will also increase in the reverse direction until the ferromagnetic core reaches saturation again but in the reverse direction from before. Reducing the magnetising current, i once again to zero will produce a similar amount of residual magnetism but in the reverse direction.

Then by constantly changing the direction of the magnetising current through the coil from a

positive direction to a negative direction, as would be the case in an AC supply, a Magnetic Hysteresis loop of the ferromagnetic core can be produced.

PROCEDURE: -

The solenoid with compensating rod, compass box, Solenoid are placed in a line along Tan A position T1. The solenoids axis coincides with the aluminum printer (East West direction). The arrangement is placed on a one meter wooden bench.

The experiment will be
performed in 5 steps: -I Stage:-

II Stage: -

III Stage:

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0 to 2 amps by adjusting Rheostat. The rodgets magnetized. The deflection is noted against increasing current.

Decreasing the current from maximum to zero by

Reverse the current using commutator. Increase the current. The deflection decreases to zero and moves in the opposite direction.

Decrease the current from Maximum to Zero.

Reverse the current using commutator. Increase the current.

Department of Humanities & Sciences

LAB MASTER TIME TABLE

**SUBJECTS: APPLIED PHYSICS LAB & ENGINEERING PHYSICS LAB
(R20EAP12L1&R20EPH11L1)**

TIME	09:40am To 10:30am	10:30am To 11:20pm	11:20am To 12:10pm		12:40pm To 1:45pm	1:45pm To 2:50pm	2:50pm To 4:00pm
DAY	1	2	3		4	5	6
MON				L U N C H	ECE-C (AP LAB)		
TUE					ECE-D (AP LAB)		
WED					ECE-B (AP LAB)		
THU							
FRI							
SAT					CE&ME (EP LAB)		

HOD

PRINCIPAL