Swami Vivekanand College of Engineering,

07

SWAMI VIVEKANAND COLLEGE OF ENGINEERING INDORE

CLASS WORK / SESSIONAL WORK

ASSIGNMENT / EXPERIMENT No

SUBMITTED ON .... MARKS OR GRADE OBTAINED ....

NAME KRISH SONI ROLL NO 0822CS241109

CLASS CS-II 2nd SEM DEPARTMENT COMPUTER SCIENCE

SUBJECT Engineering Physics (LAB) CODE NO BT-201

Signature of Student Krish

Signature of Professor

EXPERIMENT No:- 02

AIM:- To study the effect of temperature on the reverse saturation current in junction diode and hence to determine the forbidden energy gap.

Requirements:- E&E Make Training Module Type: EE-55 with thermometer and its instructions manual.

THEORY:- A p-type semiconductor in contact with an n-type semiconductor constitutes a p-n junction diode. Before the two semiconductors are brought together, each one is in equilibrium i.e. the holes and electron concentrations are constant and uniform throughout each semiconductor. Just after contact, majority holes from the P type diffuse into the n-type.

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The holes and the electrons recombine when they meet. However, this flow of majority carriers eventually stops because of the formation of a thin layer in which holes and electrons recombine, leaving a row of negative ions on the p-type and a row of positive ions on the n-type material side. The layer in which electron-hole recombination occurs is called the depletion layer. The formation of charges on either side of the Layer constitutes a potential barrier which prevents further flow of charges. This potential barrier is 0.2V for Ge and 0.6V for Si. It is the formation externally applied voltage. The barrier voltage can be neutralised by applying a voltage of appropriate polarity. The junction conducts heavily in the forward bias condition reverse bias condition. Here, we are using reverse bias condition as shown in fig. 1.1

The relation between the diode current and the voltage V is given by,

$$I = I_S\left(\exp(qV/kT) - 1\right) \quad \text{—— (1)}$$

Where, q is electronic charge
K is Boltzmann constant
T is absolute temperature

Under the reverse bias condition the reverse saturation current I_s Is increases as the temperature increase. The temperature dependance of I_s is determined by n_i which is given by,

$$n_i^2 = KT^3 \, ex(-E_g/KT) \quad \text{—} \ (2)$$

Where, K is constant

E_g is the width of energy gap at absolute zero

However E_g may be assumed to be practically constant. The reverse saturation current may be represented by the relationship,

$$I_s = CT^3 \exp(-E_g/KT) \quad \text{—} \ (3)$$

$$\log_e I_s = \log_e (CT^3) - (E_g/K).1/T \quad \text{—} \ (4)$$

In the operating range of the diode, the temperature dependance of I_s is determind by second term of the equation (4). Hence, a plot of $\log_{10} I_s$ v/s $10^3/T$ is approximately linear

EQUIPMENT :-

(1) Ge diode

(3) 3V DC Power supply

(4) Thermometer.

Procedure :-

(1) Switch ON the mains supply
(2) Switch ON the oven. Heat the diode up to 67°C
(4) Switch off the oven. Wait till temp. starts decreasing. Now measure the temperature (i.e. from 65°C) and Corresponding Current in the microammeter. Take the current reading for falling temperature.
(5) Plot graph $\log_{10} I_s$ as a function of $10^3/T$. Evalute the the forbidden energy gap of Ge which is
(3) Keep the thermometer in the hole provided for it.

$$\frac{\text{Slope of graph } \log_{10} I_s \text{ V } 10^3/T}{5.036}$$

Do not heat diode above 67°C

Observation :-

S.NO.	Current	Temp.	Temp.	$10^3/T$	$\log_{10} I_s$
1.	35.2	55	328	3.04	1.54
2.	18.2	50	323	3.09	1.26
3.	09.1	45	318	3.14	0.95
4.	05.4	40	313	3.19	0.73

Conclusion :- The slope of the graph is determine and energy band gap of germanium diode is thus calculated.

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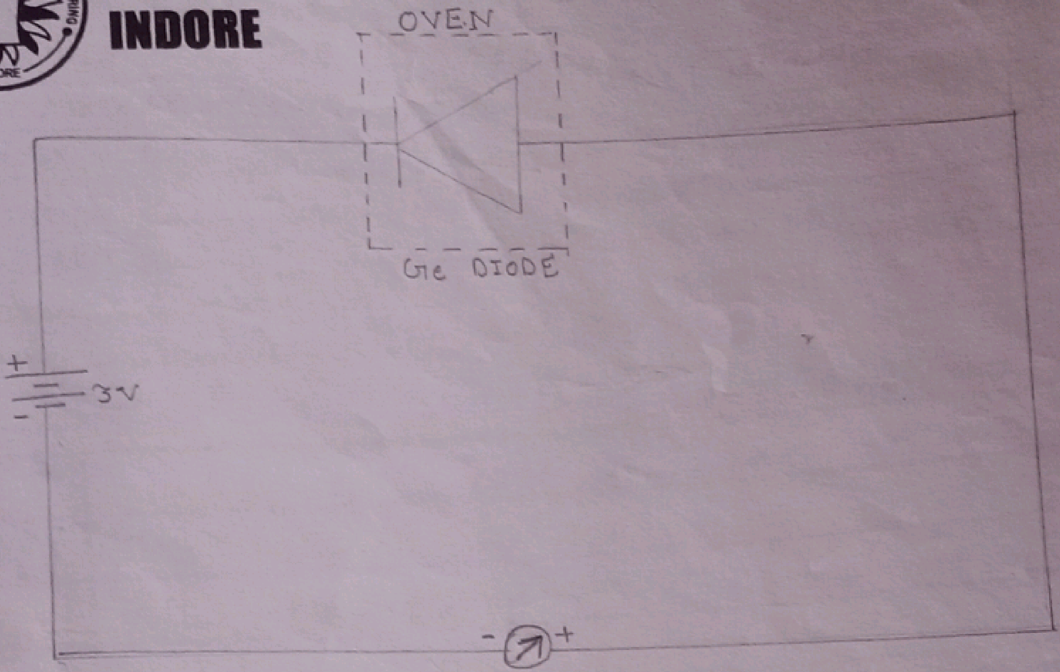
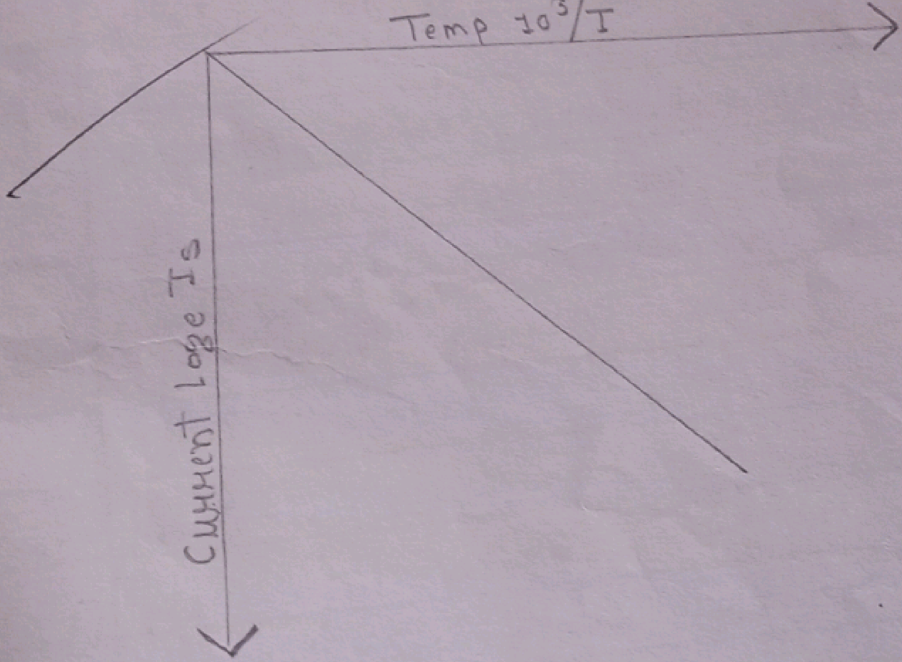


fig. I



SWAMI VIVEKANAND COLLEGE OF ENGINEERING INDORE

CLASS WORK
SESSIONAL WORK

ASSIGNMENT / EXPERIMENT	No 03

SUBMITTED ON .... MARKS OR GRADE OBTAINED ....

NAME KRISH SONI

CLASS CS-II 2nd SEM ROLL NO 0822CS241109

SUBJECT Engineering Physics (LAB) DEPARTMENT COMPUTER SCIENCE

CODE NO BT-201

Krish
Signature of Student

Signature of Professor

EXPERIMENT-03

Object:- To plot the characteristics of a zener Diode

Apparatus required:- Zener Diode Kit, patch chord.

THEORY:- In forward biasing the function of zener diode is just like the function of P-N diode, but it reverse biasing arrangement of zener Diode, there happens a certain voltage at which current flow increase suddenly. This definite positive voltage is known as zener voltage.

Procedure:-

(1) Make the electrical connections with forward biasing as shown in the figure.

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Adjust the power supply voltage and note the current. Increase the supply and measure the value of current.

(2) Make the electrical connections with reverse biasing as shown in the figure.

(3) Now adjust power supply at zero voltage and note the current with millimeter.

(4) Right from the negative voltage of zener diode increase this negative voltage with gradual steps and note the corresponding current value in millimeter or micrometer. Continue to take the readings till a stage comes when current changes suddenly and get its maximum value. In this position any further change in voltage will produce negligible effect on current value

Observation Table :-

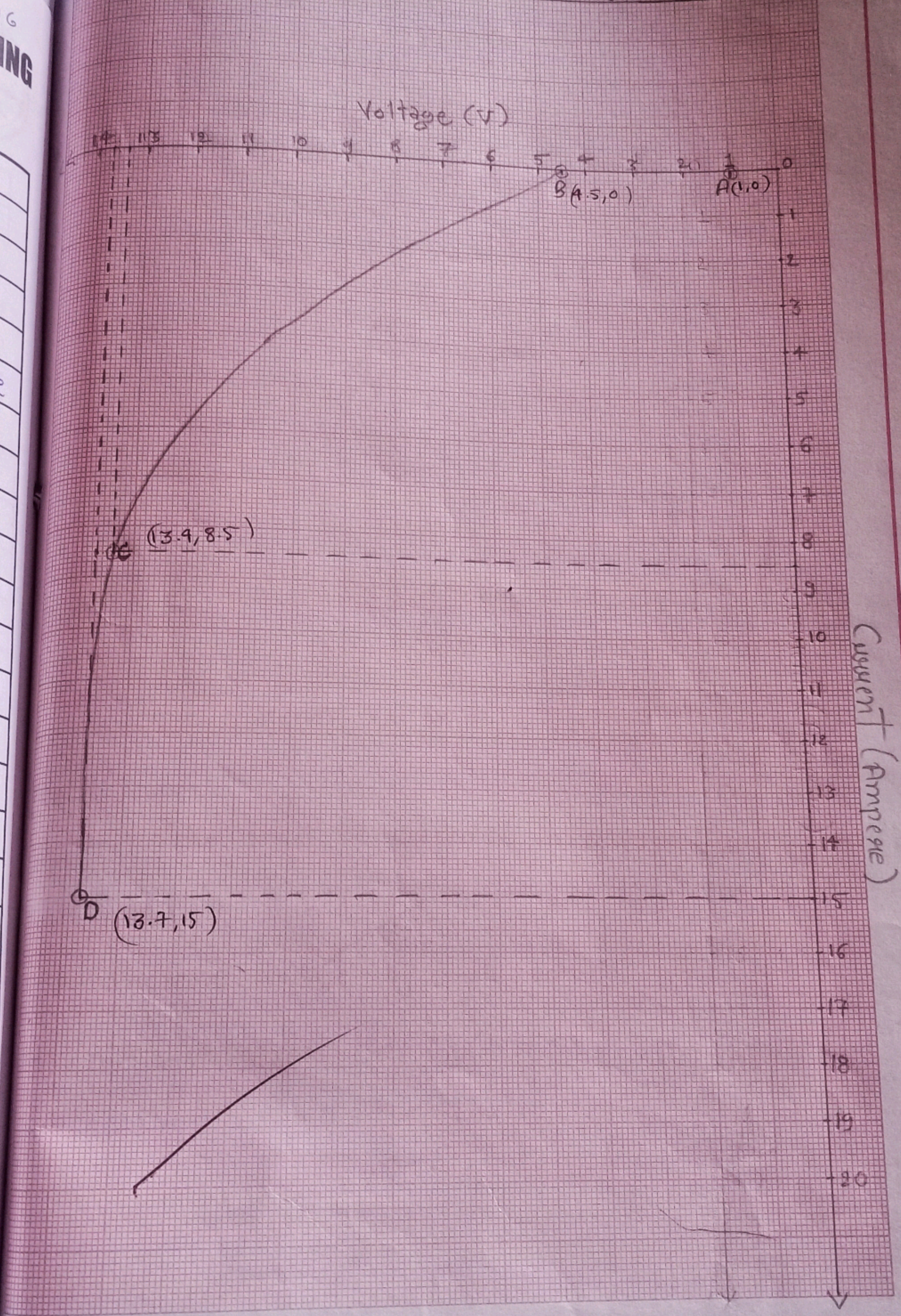
Reverse Bias :

Least Count of ammeter (mA) =

Least Count of Voltmeter (V) =

S.NO.	Voltmeter (V)	Current (mA)
1	1V	0 mA
2.	4.5 V	0 mA
3.	13.4V	8.5 A
4.	13.7 V	15 A (Breakdown)

Scale :-
X-axis = 1cm = 1V
Y-axis = 1cm = 1A



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Circuit Diagram:-

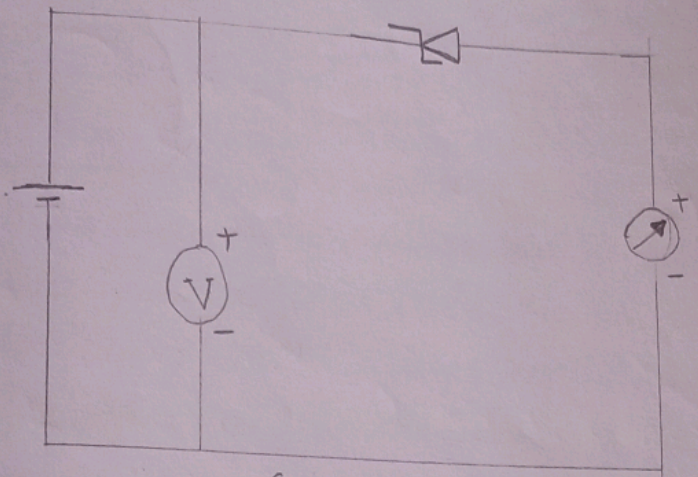

fig. Ckt diagram of zener Diode in Reverse Bias

RESULT:- Zener Voltage =

PRECAUTIONS:-

1) zener Diode must be connected in reverse biased condition only.

2) Connection should be neat and tight

3) Increase voltage by small amounts.

4) Do not cross the limit of the meter scale and take readings within the limit.

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CLASS WORK
SESSIONAL WORK

ASSINGMENT / EXPERIMENT No. 4

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

NAME Krish Soni

CLASS 1st Year 2nd sem ROLL NO. 0822CS241109

DEPARTMENT CSE {CS-II}

SUBJECT Eng. Physics CODE No. BT-201

Krish
Signature of Student

Signature of Professor

: EXPERIMENT NO: 4 :

OBJET:- To measure the numerical aperture of the ~~an~~ obtical fiber.

APPARATUS REQUIRED:- He-Ne laser, fiber optic chuck, optical fiber, screen, graph paper, measuring tape.

THEORY:- Numerical aperture (NA) is a basic descriptive characteristic of fibers. It can be thought of as representing the size or "degree or openness" of the input acceptance cone. Mathematically, numerical aperture is defined as the sine of half angle of the acceptance cone (sinθ) The light gathering Power or flux Carrying capacity of a fiber is numerically equal to the sequence of the aperture, which is the ratio between the area of a unit sphere with the acceptance

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cone and the area of the hemisphere (2π solid angle). A fiber with numerical aperture of 0.66 has 43% as much as flux carrying capacity as a fiber with a numerical aperture of 1.0 i.e.

$$0.66^2 1.00^2 = 0.43$$

Snell's law can be used to calculate the maximum angle with in which light will be accepted in to and conducted through a fiber

$$NA = \sin\theta_a = \sqrt{(n_1^2 - n_2^2)}$$

where $\sin\theta$ is numerical aperture.

n_1 and n_2 are the refractive indices of the core and the cladding respectively. The semi angle θ_a of the acceptance core for a step index fiber is determined by the critical angle $\theta_c = \sin^{-1}\sqrt{n_1^2 - n_2^2}$ for total internal reflection to take place at core cladding interface. For a ray with incident angle $\theta < \theta_a$, it undergoes total internal reflection at core cladding interface and is called the guided ray. For incident angle $\theta > \theta_a$ the ray undergoes only partial reflection at core cladding interface and is radiated out into the cladding.

A ray entering the fibre at an angle $\theta < \theta_a$ gets guided through the fiber, and comes out at angles $> \theta_a$ undergo partial reflections at the core cladding interface and eventually lose all their energy into the cladding.

In a short length of straight fiber, ideally a ray launched at angle θ, at the input end should come out at the output same angle θ from output end. It therefore the far field at the output end will also appear as a cone of semi-angle θ_a emerging from the fiber end. It is then simpler to make measurement on this far field to determine the NA of the fiber.

Procedure :-

1) Mount both the nods of the optical fiber on the fiber optic chucks.
2) Couple the light from the He-Ne laser source onto one of the fibre ends using a microscopic objective.
3) Place the screen at some distance from the output end (end other than at which light is coupled) of the fiber such that is

Perpendicular to the axis of the fiber.

(4) Now move the Screen towards or away the output ends of the optical fiber, Such that a circular spot is formed on the Screen.

(5) Measure the distance between the output end of the optical fiber and Screen, let this be L also measure the ~~distanc~~ diameter of the circular spot formed on the screen let it be D.

(6) Use the formula.

$$NA = \sin\theta_a = \sin \tan^{-1} D/2L$$

(7) Repeat the above procedure for different value of L & D and calculate the average value of NA

Observation Table:-

S.NO.	Diameter of the Spot D (D)	D/2	Distance b/w ~~fibre end and~~ Screen L	$\sin\theta$	θ
1	6.9	3.45	6.5	0.46	27
2	8.3	4.15	7.5	0.48	28
3	9.99	4.99	8.5	0.50	30
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Calculations:-

Mean Numerical Aperture (NA) = $\sin \tan^{-1} D/2l$

=

Acceptance angle (θ) = $\sin^{-1}$ NA =

Result:-

1) NA of the Given fiber =

2) Acceptance angle of the fibre =

Precautions:-

1) Light should fall on the fiber

2) Diameter of the spot should be measured accurately

3) Direct viewing of laser light should be avoided.

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