



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

LABORATORY WORK SHEET

Date: 19/08/2022

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Exp No: 10 Experiment Name: ENERGY BAND GAP OF SEMICONDUCTOR

DAY TO DAY EVALUATION:

	Preparation	Algorithm	Source Code	Program Execution	Viva	Total
		Performance in the Lab	Calculations and Graphs	Results and Error Analysis		
Max. Marks	4	4	4	4	4	20
Obtained	4	4	4	4	4	20

Signature of Lab I/C

START WRITING FROM HERE:

AIM: To determine the energy band gap of a given semiconductor using a diode in reverse bias.

APPARATUS:

- P-N diode
- Power supply
- Voltmeter
- Microammeter
- Thermometer

FORMULA:

Energy band gap of semiconductor

$$E_g = \text{Slope} \times 2 \times 1.38 \times 10^{-23} \text{ Joule}$$

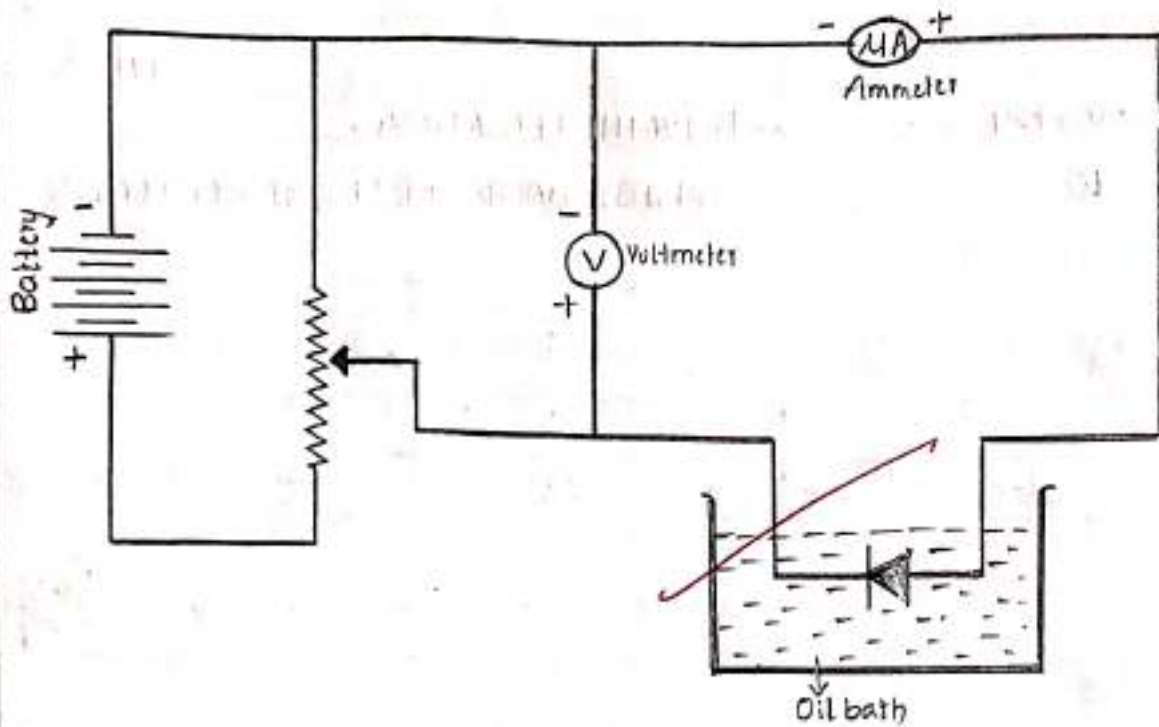
$$E_g = \text{Slope} \times 1.725 \times 10^{-4} \text{ eV}$$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\ln I_s}{1/T}$$

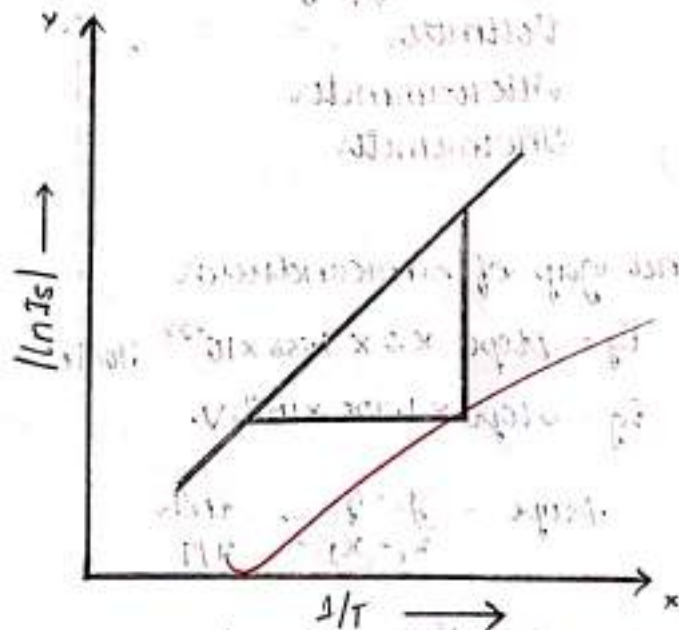
I_s = Reverse saturation current.

T = Absolute temperature.

CIRCUIT DIAGRAM :



MODEL GRAPH :



OBSERVATION TABLE:

TEMPERATURE		$1/T$ ($\times 10^{-3}$)	REVERSE BIAS CURRENT (I_s)	$\ln I_s$
$^{\circ}\text{C}$	K			
90	363	2.75	55	4.00
85	358	2.79	50	3.91
80	353	2.83	45	3.80
75	348	2.87	40	3.68
70	343	2.92	43	3.76
65	338	2.96	35	3.55
60	333	3.00	32	3.46
55	328	3.05	30	3.40
50	323	3.10	28	3.33
45	318	3.14	26	3.25
40	313	3.19	24	3.17

RESULT:

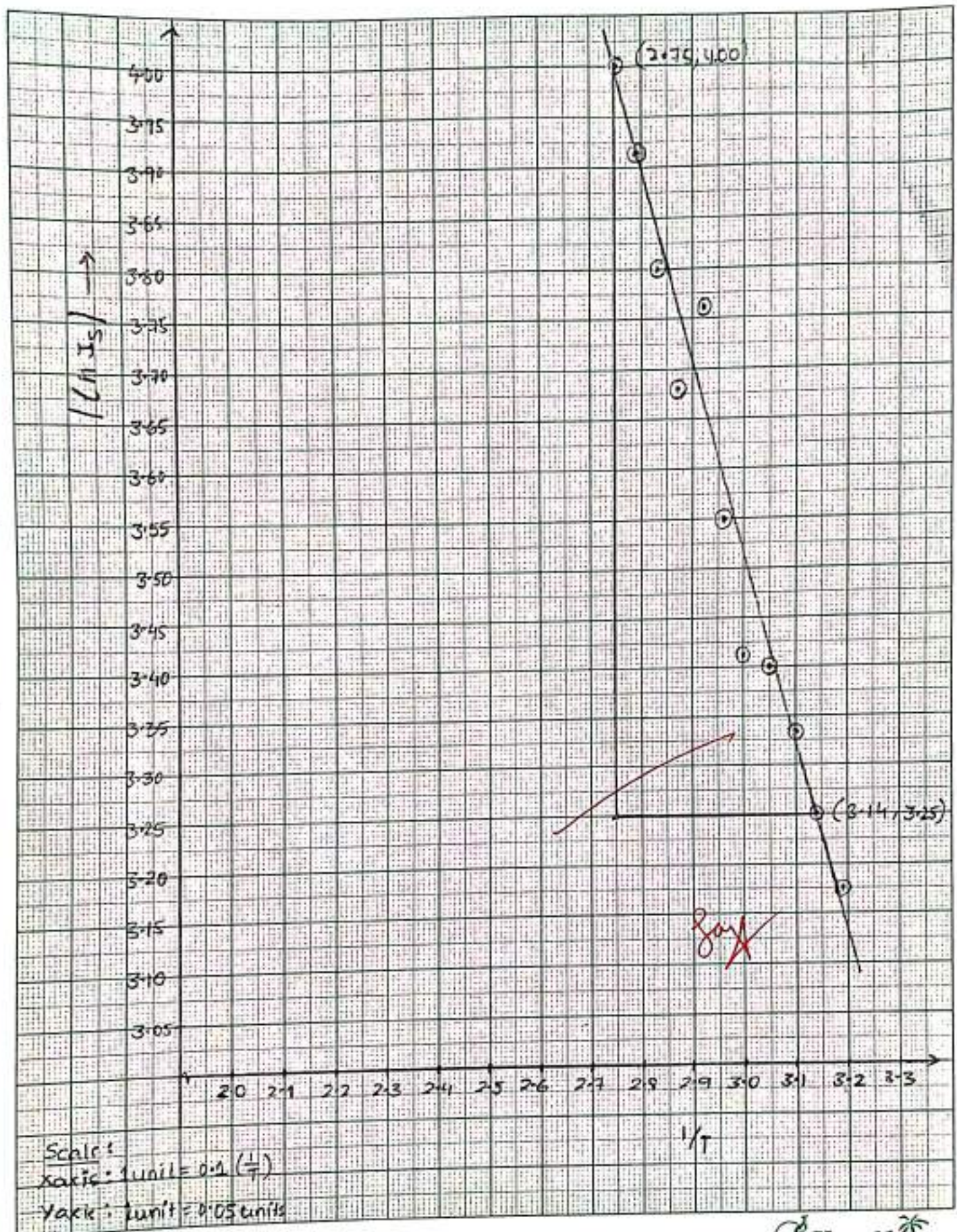
The energy band gap of a given semiconductor is

$$E_g = \text{slope} \times 2 \times (1.38 \times 10^{-23}) \text{ J}$$

$$E_g = (-1.92) \times 2 \times 1.38 \times 10^{-23} \text{ J}$$

$$|E_g| = 5.299 \times 10^{-23} \text{ J}$$

$$|E_g| = 3.32 \times 10^{-4} \text{ eV}$$



VIVA VOCE :

1. Define energy gap?

The difference of energy between the bottom of the conduction band and the top of the valence band of the electrons in a crystalline solid.

2. How pn junction is formed?

The pn junction is created by the method of doping. The p-side; positive side of the semiconductor has an excess of holes and the n-side; negative side has an excess of electrons.

3. What are intrinsic and extrinsic semiconductor?

Intrinsic semiconductor are solely reliant on temperature while extrinsic semiconductor are affected by temp. and the number of contaminants present.

4. Discuss forward and reverse biasing of diode.

Forward biasing occurs when the voltage across a diode permits the natural flow of current where as reverse biasing denotes a voltage across the diode in the opposite direction.

5. Explain depletion layer in pn junction.

Depletion layer is a region in p-n junction diode where no mobile charge carriers are present. Depletion layer acts like a barrier that opposes the flow of electrons from n-side and holes from p-side.

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