Aim:- To study dielectric constant & determination of curie Temp.

Observations:-

Barium Titrate ($BaTiO_3$).

Diameter = 11.16 mm.

Thickness = 1.32 mm.

Area = 97.77 mm^2

$\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.

or $\varepsilon_0 = 8.85 \times 10^{-6}$ nF/mm

$$C_0 = \frac{\varepsilon_0 A}{t} = \frac{8.85 \times 10^{-6} \times 97.77}{1.32}$$

$$\boxed{C_0 = 655.5 \times 10^{-3} \text{ PF}} = 655.5 \times 10^{-6} \text{ nF}$$

S.No.	Temp (°C)	Capacitance (nF)	Dielectric Constant $\left(\varepsilon = \frac{C}{C_0}\right) \times 10^3$
1.	35	1.13	1.725
2.	40	1.14	1.740
3.	45	1.13	1.725
4.	50	1.12	1.709
5.	55	1.12	1.709
6.	60	1.13	1.725
7.	65	1.14	1.740
8.	70	1.15	1.756
9.	75	1.17	1.786
10.	80	1.19	1.817
11.	85	1.21	1.847
12.	90	1.25	1.908
13.	95	1.29	1.969
14.	100	1.34	2.046
15.	105	1.43	2.183
16.	110	1.49	2.275

Date 13/08/19

Expt. No. 3 Dielectric Constant Page No.

Aim:- To study the variation of dielectric constant with temp & determination of Curie Temp. of $BaTiO_3$

Apparatus Required:- Dielectric constant set up model DEC-600 # 71, probe arrangement, with thermometer, sensor, sample, aluminium foil, high temperature oven.

Theory - The dielectric constant of a dielectric material can be defined as the ratio of the capacitance using the material as the dielectric in a capacitor to the capacitance using a vacuum as the dielectric. Typical value of ε for dielectric are for vacuum = 1, dry air > 1.0059, Glass = 3.8 - 14.5. Dielectric constant (ε) is given by $\varepsilon = \frac{C}{C_0}$

where, $C_0 = \frac{\varepsilon_0 A}{t}$

where, C = Capacitance using the material as dielectric in the capacitor.

C_0 = capacitance using vacuum as the dielectric

ε_0 = Permitivity of free space ($8.85 \times 10^{-12} J^2/m$)

A = Area of the plate / sample cross - section

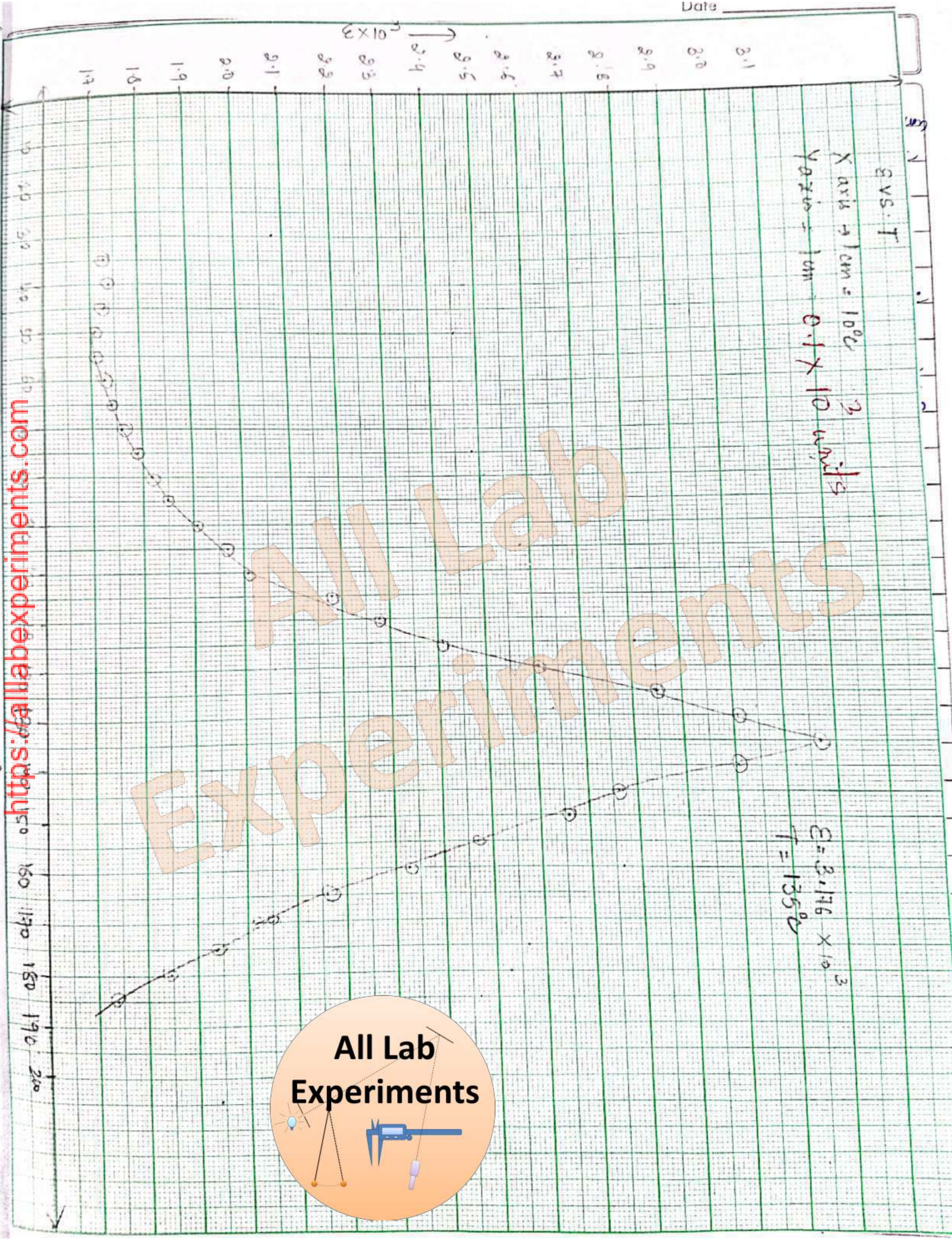
t = thickness of the sample.

Curie Temperature:- It is the temperature at which certain material lose their permanent magnetic properties, to the replaced by induced magnetism. The force of magnetism is determined by the magnetic moment, a dipole moment

Teacher's Signature

S.No	Temp(°C)	Capacitance (nF)	Dielectric constant ($\varepsilon = \frac{C}{C_0}$)
17.	115	1.58	2.412
18.	120	1.71	2.611
19.	125	1.87	2.855
20.	130	2.02	3.084.
21.	135	2.08	3.176
22.	140	1.98	3.023
23.	145	1.81	2.763
24.	150	1.74	2.656
25.	155	1.62	2.473
26.	160	1.52	2.321
27.	165	1.42	2.168
28.	170	1.35	2.061
29.	175	1.27	1.939
30.	180	1.21	1.847.
31.	185	1.14	1.740.
32.	190	1.09	1.664
33.	195	1.03	1.575
34.	200	0.99	1.511

Date


ε×10³
ε vs. T
X axis → 1cm = 10°C
Y axis → 1cm = 0.1 × 10³ units
ε = 3.176 × 10³
T = 135°C

within an atom which originated from the angular momentum of spin of electron material have different structure of intrinsic magnetic moments that depends on temperature the Curie temperature is the critical point at which a material intrinsic magnetic moments change direction.
Permanent magnetism is caused by the alignment of magnetic moments of induced magnetism is created when disorder magnetic moments are forced to align in an applied magnetic field. Higher temp. make magnets weak as spontaneous magnetism only occurs below the curie temperature can be calculated from the curie - weiss law which is derived from Curie's Law.

Result -
A graph of temperature vs dielectric constant of sample is shown.
From the graph, Curie Temp. $(T_c) = 135°C$.
and dielectric constant at T_c is 3.176×10^3.

Precautions -
The spring loaded probe should be allowed to rest on the sample very gently otherwise it may damage the conducting surface of the sample and even break the sample.