EXPERIMENT NO 4

Statement:

Determine the capacitance of different metal sphere. by conduction method.

- Conductor balls (d = 2cm, 4cm, 12cm).
- High value resistor.
- High voltage supply unit v = 0 – 10 kV.
- Auxiliary capacitance
- Universal measuring amplifier
- Multirange meter
- Screened cable
- Adapter, BNC socket
- Connector

Procedure:

1- The circuit diagram and experimental require to determine the capacitance of
2- spherical conductors is given.
Spherical conductors is held on an insulated barrel base. It is connected to positive terminal and high voltage power supply.

3- After charging this sphere for short time power supply is disconnected.

4- To ensure the charges on the test sphere for short time (ten seconds), power supply is disconnected. The charged sphere is shortly brought into contact.

5- The charge is ~~(connect)~~ converted into voltage by electrometer of measuring amplifier using high resistance input and is measured from volt-meter.

6- The capacitance of test sphere is determined from the voltage and charge values using formula:

$$C_s = \frac{C_a U_1}{U_2}$$

where C_s = capacitance of the conductivity sphere, C_a = Capacitance of auxiliary capacitor (220 nF),

U_1 = measured voltage

U_2 = Applied voltage

7- Number of observations are taken, for each test sphere by varing the applied voltage. Mean value of capacitance should be determined for each sphere and compared

$C_{theoretical} = 4(3.14)(8.85\times10^{-12})(0.0\ldots$
$= 1.11\ pF$

Applied Voltage U_2	Measured Voltage U_1	Capacitance C_s (pF)
0.5	0.07	1.4×10^{-12}
1	0.17	1.7×10^{-12}
1.5	0.20	1.3×10^{-12}
2	0.23	1.15×10^{-12}
2.5	0.34	1.36×10^{-12}
3	0.43	1.43×10^{-12}
3.5	0.46	1.31×10^{-12}
4	0.53	1.32×10^{-12}
4.5	0.61	1.35×10^{-12}
5	0.63	1.26×10^{-12}

$\%\ error = \frac{theor - EXP}{theor}\times\frac{100}{100} = \frac{1.11\times10^{-12} - 1.35\times10^{-12}}{1.11\times10^{-12}}\times\frac{100}{100} = 2\ldots$

<u>For sphere r 2cm</u>

$C_{theo} = 4(3.14)(8.85\times10^{-12})(0.02) = 2.22\ PF$

Applied Voltage U_2	Measured Voltage U_1	Capacitance C_s (pF)
0.5	0.13	2.6×10^{-12}
1	0.26	2.6×10^{-12}
1.5	0.30	2×10^{-12}
2	0.42	2.1×10^{-12}
2.5	0.52	2.08×10^{-12}
3	0.63	2.1×10^{-12}
3.5	0.74	2.11×10^{-12}
4	0.91	2.27×10^{-12}
4.5	0.99	2.2×10^{-12}
5	1.06	2.12×10^{-12}

$\% \text{ error} = \frac{\text{Theoretical} - \text{Experimental}}{\text{Theoretical}} \times \frac{100}{100}$

$= \frac{2.2 \times 10^{-12} - 2.218 \times 10^{-12}}{2.22 \times 10^{-12}} \times \frac{100}{100} = 0.09\%$

For sphere = 6cm

Applied Voltage U_2	Measured Voltage U_1	Capacitance C_s (PF)
0.5	0.43	8.6×10^{-12}
1	0.77	7.7×10^{-12}
1.5	1.09	7.2×10^{-12}
2	1.42	7.1×10^{-12}
2.5	1.77	7.08×10^{-12}
3	2.19	7.3×10^{-12}
3.5	2.41	6.8×10^{-12}
4	2.81	7.02×10^{-12}
4.5	3.39	7.5×10^{-12}
5	3.60	7.2×10^{-12}

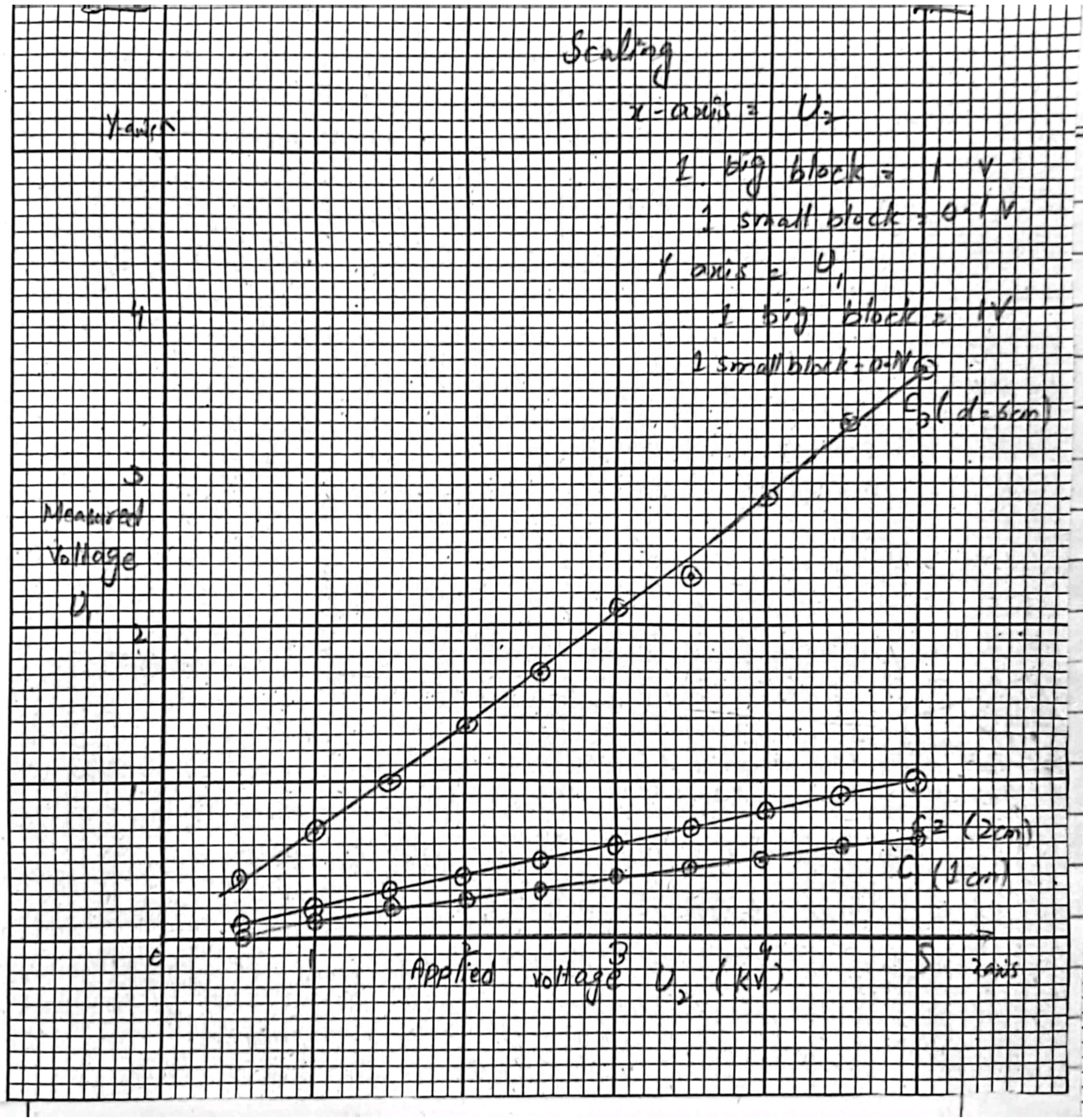
$C_{theoretical} = 4(3.14)(8.85 \times 10^{-12})(0.06)$

$= 6.66 \times 10^{-12} F$

$\% \text{ error} = \frac{\text{Theor} - \text{Exp}}{\text{Theor}} \times \frac{100}{100}$

$= \frac{6.66 \times 10^{-12} - 7.35 \times 10^{-12}}{6.66 \times 10^{-12}} \times \frac{100}{100}$

$= 10.3\%$


Scaling
x-axis = U_2
1 big block = 1 V
1 small block = 0.1 V
Y axis = U_1
1 big block = 1V
1 small block = 0.1V
Y-axis
Measured Voltage U_1
4
3
2
1
0
1
2
3
4
5
Applied voltage U_2 (kV)
x axis
C_3 (d=6cm)
C_2 (2cm)
C_1 (1cm)