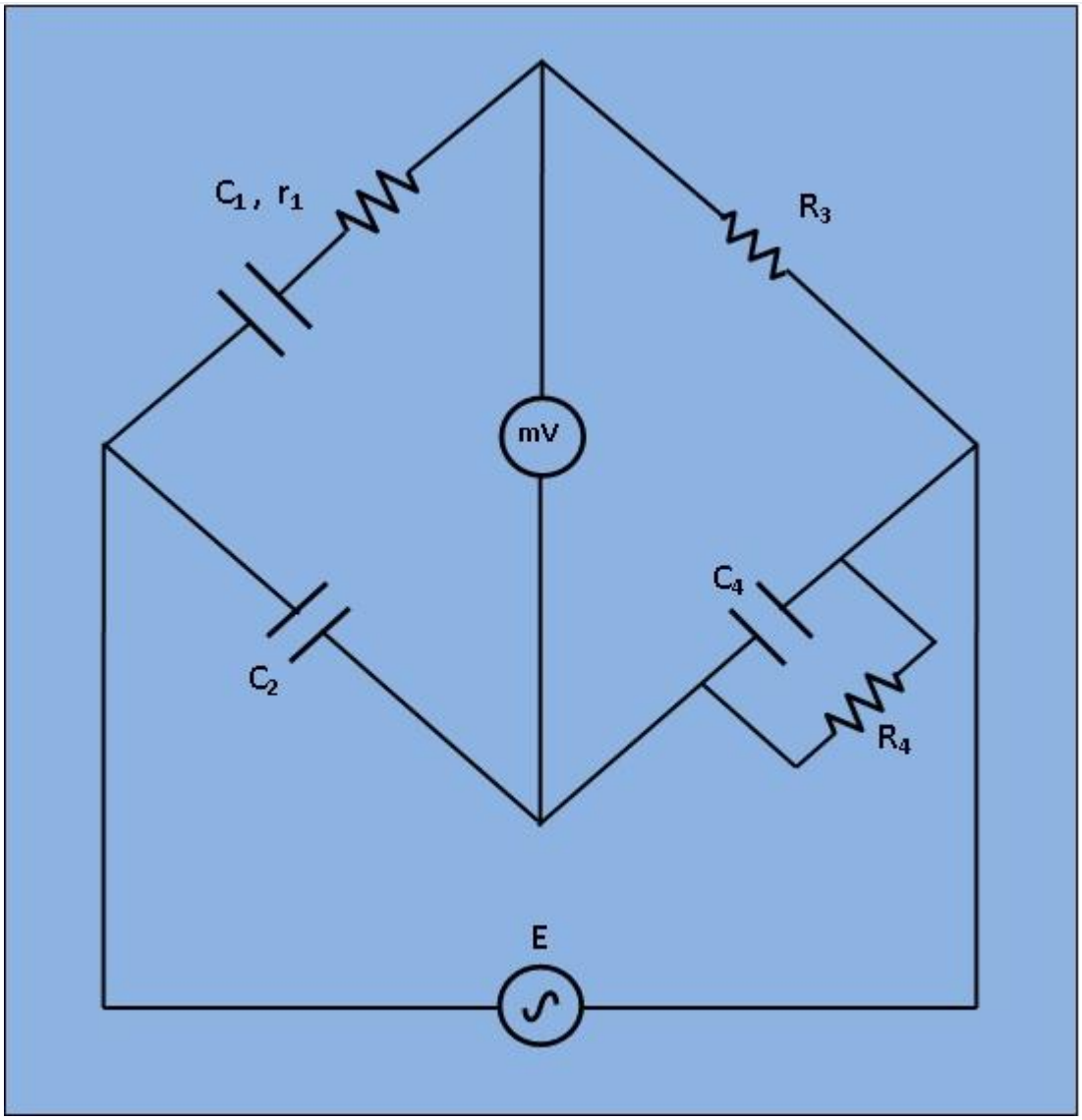
EXPERIMENT-6

Measurement of Capacitance by Schering Bridge

Objective

- To Determine the Capacitance of an unknown Capacitor.

Theory



- ***Fig 1: Circuit diagram for measurement of Capacitance by Schering Bridge***

- Let,
- C_1=capacitor whose capacitance is to be measured.
- r_1= a series resistance representing the loss in the capacitor C_1.
- C_2= a standard capacitor.
- R_3= a non inductive resistance.
- C_4= a variable capacitor.
- R_4= a variable non inductive resistance.
- At balance,

$$(r_1 + \frac{1}{j\omega C_1}) * (\frac{R_4}{j\omega C_4 R_4 + 1}) = \frac{R_3}{j\omega C_2} \ldots\ldots (1)$$

$$r_1 R_4 - \frac{jR_4}{\omega C_1} = -\frac{jR_3}{\omega C_2} + \frac{R_3 R_4 C_4}{C_2} \ldots\ldots (2)$$

Or Equating the real and imaginary terms in equa. (2), we obtain

$$r_1 = R_3 * \frac{C_4}{C_2} \ldots\ldots (3)$$

$$C_1 = R_4 * \frac{C_2}{R_3} \ldots\ldots (4)$$

And, Two independent balance equations (3) and (4) are obatined if C_4 and R_4 are chosen as the variable elements.

Dissipation factor

$$D_1 = \omega C_1 r_1 \ldots\ldots (5)$$

Procedure

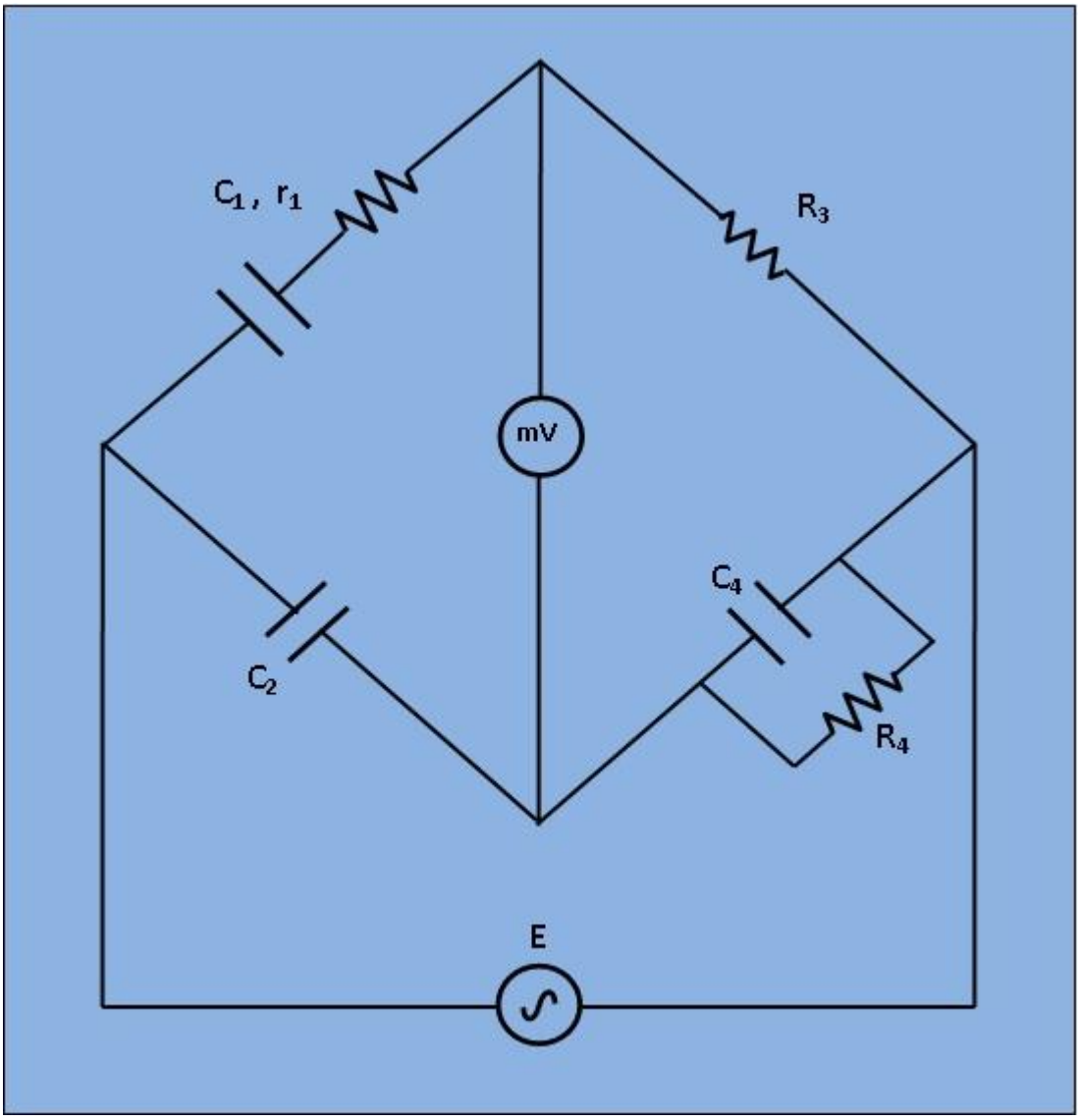


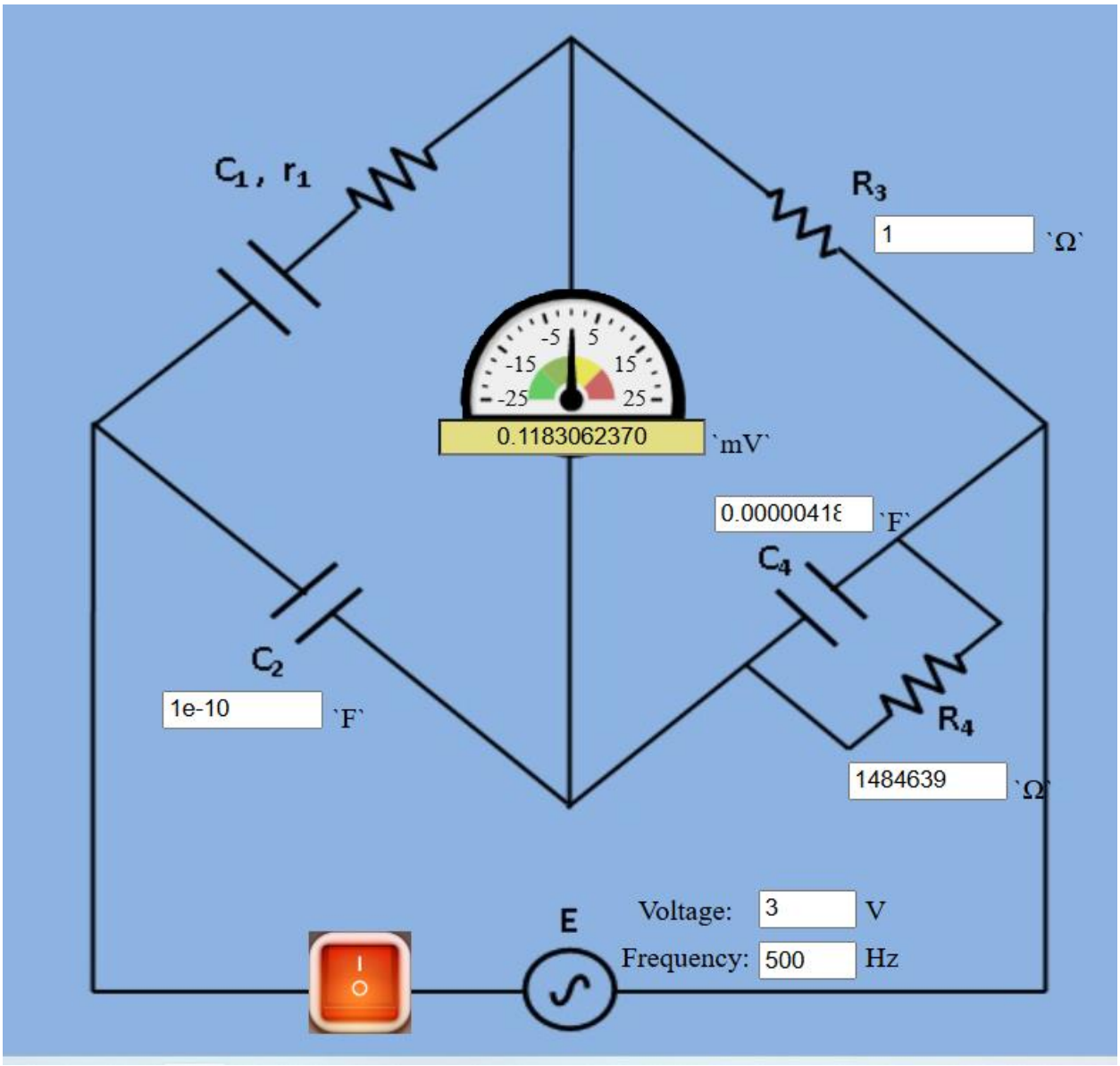
Fig. 1. Circuit digram of experimental set-up for Capacitance measurement by Schering Bridge.

1) Apply Supply voltage from the signal generator with arbitrary frequency. (V =3v). Also set the unknown Capacitance value from 'Set Capacitor Value' tab.

2) Then switch on the supply to get millivoltmeter deflection.
3) Choose the values of C_2, C_4, R_3 and R_4 from the capacitance and resistance box. Varry the values to some particular values to achieve "NULL".
4) Observe the millivoltmeter pointer to achieve "NULL".
5) If "NULL" is achieved, switch to 'Measure Capacitor Value' tab and click on 'Simulate'. Observe the calculated values of unknown capacitance (C_1) and it's internal resistance (r_1).
6) Also observe the Dissipation factor of the unknwown capacitor which is defined as

$$\omega * C * r \; Where, \omega = 2\pi f$$

Simulation :



The current voltmeter reading is: 0.118306237C mv. Now simulate to get:

Capacitor value (in uF): 148.46

Resistance value (in Ω): 41898

Dissipation Factor: 19532

Simulate

CONTROLS

R3 : 1 Ω — 11.11111 MΩ

R4 : 1 Ω — 11.11111 MΩ

C2 : 100 pF — 11.111uF

C4 : 100 pF — 11.111uF

Result:

Thus the measurement of capacitance by Schering Bridge is simulated and validated.