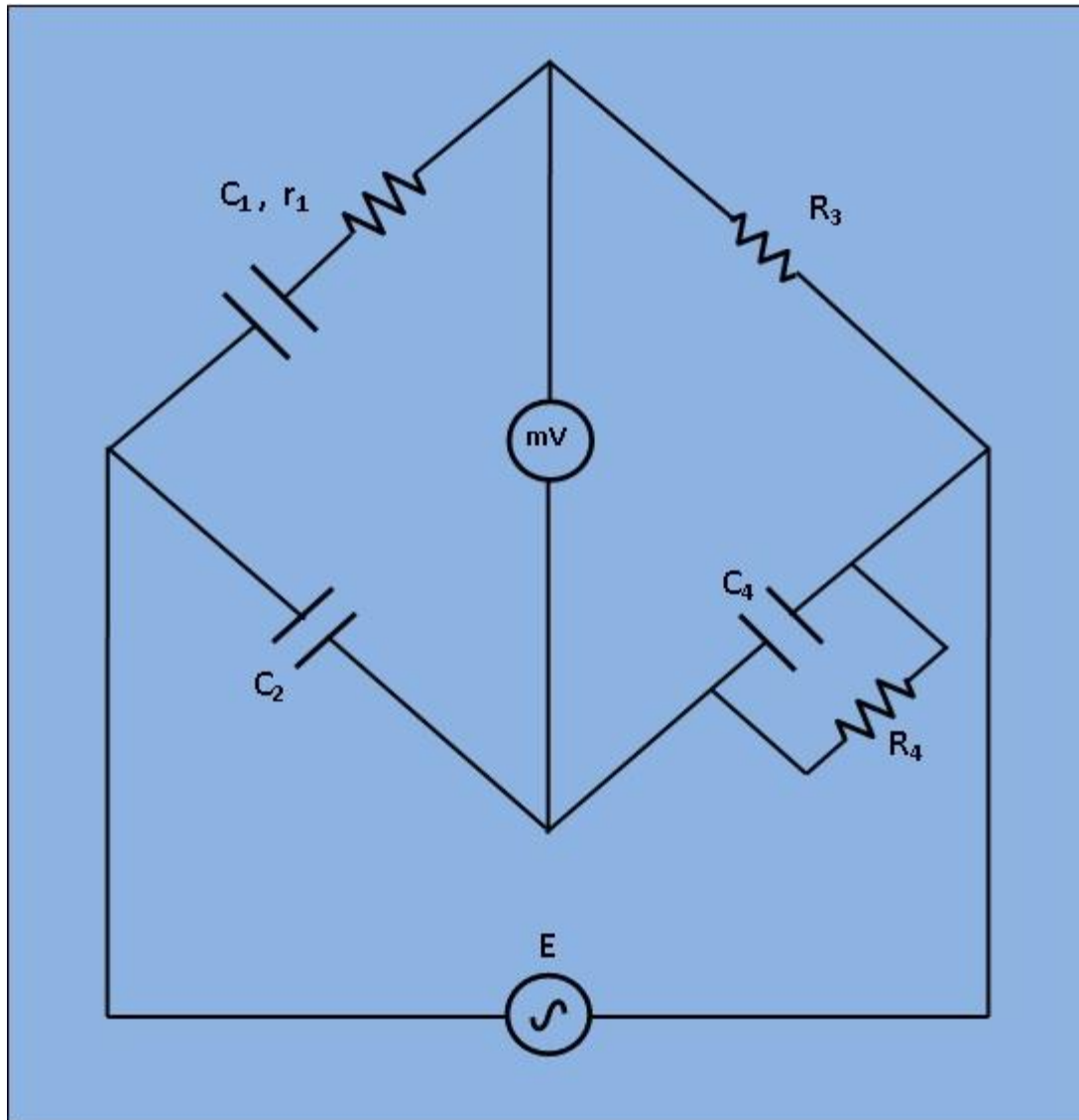


## EXPERIMENT-6

### Measurement of Capacitance by Schering Bridge

**AIM:** 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,

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

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

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

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

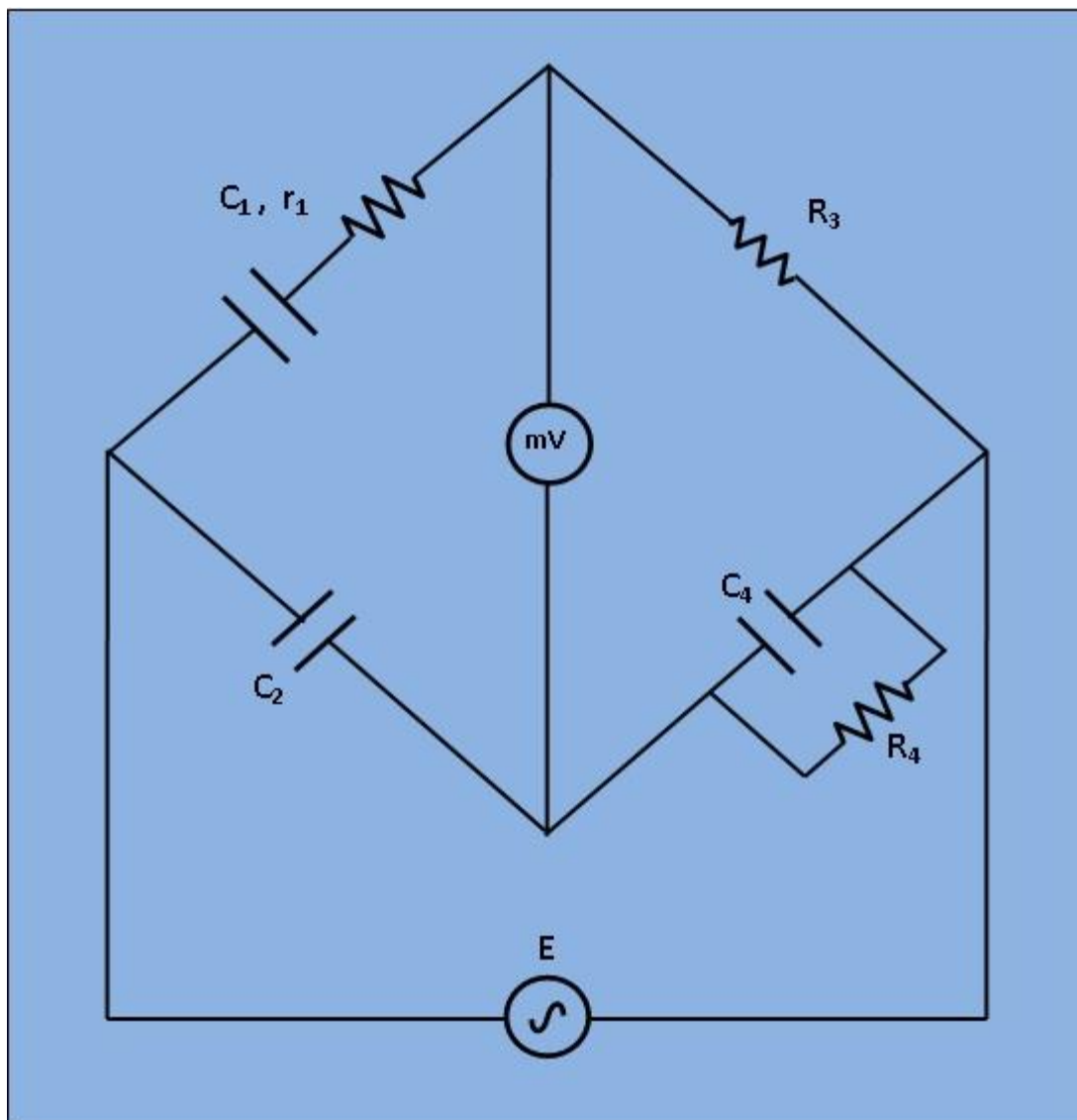
$$C_1 = R_4 * \frac{C_2}{R_3} \dots\dots (4)$$

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

Dissipation factor

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

### **Procedure:**



**Fig. 1. Circuit diagram 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. Vary 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 its internal resistance ( $r_1$ ).
- 6) Also observe the Dissipation factor of the unknown capacitor which is defined as

$$\omega * C * r \text{ Where, } \omega = 2\pi f$$

## Simulation:

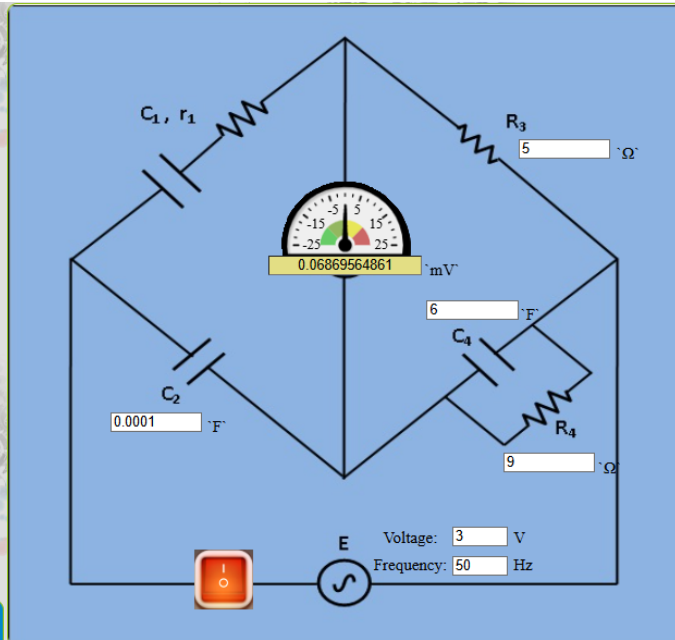
### Procedure:

1. Apply Supply voltage (3V) from the signal generator with arbitrary frequency.
2. Set the unknown Capacitance value from 'Set Capacitor Value' tab by clicking on 'Set' button.
3. Then switch on the supply to get millivoltmeter deflection.
4. Choose the values of  $C_2$ ,  $C_4$ ,  $R_3$  and  $R_4$  from the capacitance and resistance box. Vary the values to some particular values to achieve "Null".
5. Observe the millivoltmeter pointer to achieve "Null" or closest to "Null".
6. If "Null" is achieved, switch to 'Measure Capacitor value' tab and click on 'Simulate'. Observe calculated values of unknown Capacitor ( $C_1$ ) and it's Internal Resistance ( $r_1$ ). Also observe the Dissipation factor of the unknown capacitor which is defined as  $\omega * C * r$ . Where,  $\omega = 2\pi f$ .

**N.B.:-**

Range of  $C_2$  and  $C_4 = 100 \text{ pF}$  to  $11.111 \text{ uF}$  (in steps of  $100 \text{ pF}$ ).

Range of  $R_3$  and  $R_4 = 1 \Omega$  to  $11111110 \Omega$  (in steps of  $1 \Omega$ )



Set Capacitor Value

Measure Capacitor Value

The current voltmeter reading is: 0.0686956486 mv. Now simulate to get:

Capacitor value (in uF): 180.00

Resistance value (in  $\Omega$ ): 3.0000e+5

Dissipation Factor: 16956

Simulate

### CONTROLS

R3 : 1 $\Omega$		11.11111 M $\Omega$
R4 : 1 $\Omega$		11.11111 M $\Omega$
C2 : 100 pF		11.111 uF
C4 : 100 pF		11.111 uF