ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

UNIT 3

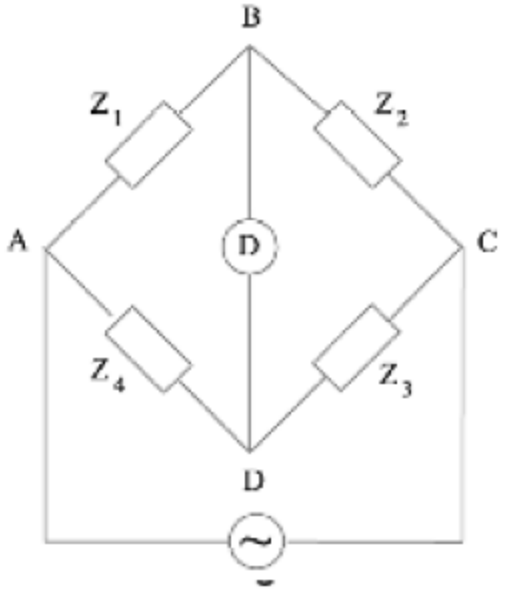
Measurement of Parameters

MEASUREMENT OF HIGH RESISTANCES

- Very high resistances of the order of mega-ohms can be measured by using an instrument called MEGGER, also called as the insulation resistance tester.
- It is used as a high resistance measuring meter as also a tester for testing the earth resistances.

Measurement Of Inductance & Capacitance With The Help Of AC Bridges

- Alternating Current bridges are widely used for measurement of inductance, capacitance, storage factor, loss factor etc.
- A.C bridge circuits also find application in providing phase shift, feedback paths for oscillators and amplifiers, filte ble signals and measuring frequ s.



- Balancing Condition

$$\mathbf{Z_1 / Z_2 = Z_4 / Z_3} \quad \text{or} \quad \mathbf{Z_1 Z_3 = Z_2 Z_4}$$

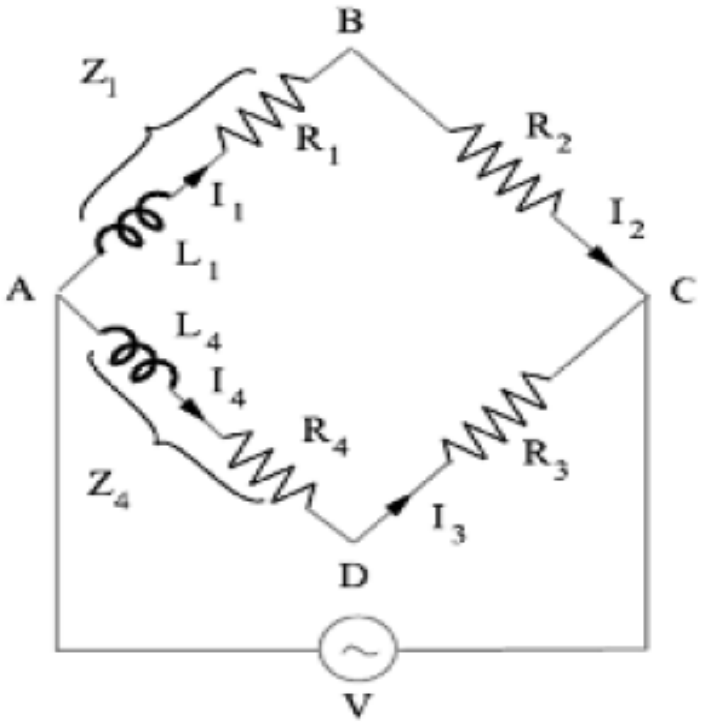
$$Z_1\angle\phi_1 . Z_3\angle\phi_3 = Z_2\angle\phi_2 . Z_4\angle\phi_4 \text{ or } Z_1 Z_3\angle\phi_1 + \phi_3 = Z_2 Z_4\angle\phi_2 + \phi_4$$

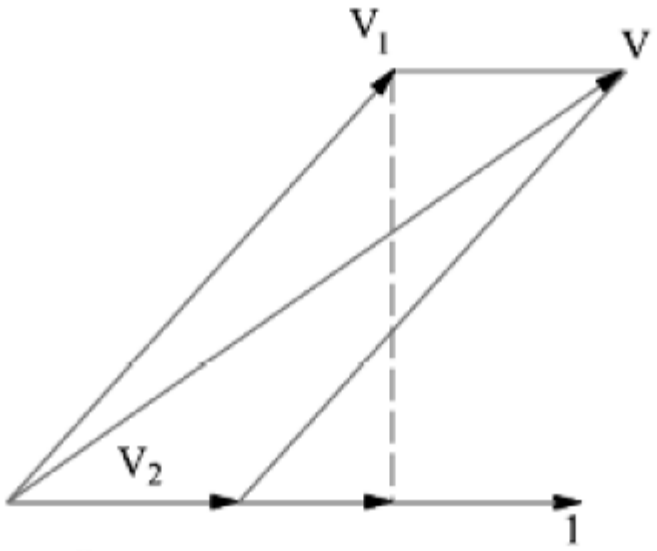
$Z_1 Z_3 = Z_2 Z_4$ ... for magnitude balance

$\phi_1 + \phi_3 = \phi_2 + \phi_4$ ... for phase angle balance

Maxwell Bridge

- The Maxwell bridge measures an unknown inductance in terms of a known capacitance.
- The maxwell bridge is limited to the measurement of medium-*Q coils (1<Q<10).*





$I_2 R_2 = I_3 R_3 ; I_1 R_1 = I_4 R_4$

The balance condition is that $Z_1 Z_3 = Z_2 Z_4$

$\therefore \quad (R_1 + j\omega L_1) R_3 = (R_4 + j\omega L_4) R_2$

Equating the real and imaginary parts on both sides, we have

$R_1 R_3 = R_2 R_4$ or $R_1 / R_4 = R_2 / R_3$ *

(*i.e.* products of the resistances of opposite arms are equal).

and $\omega L_1 R_3 = \omega L_4 R_2$ or $L_1 = L_4 \dfrac{R_2}{R_3}$