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B.Sc(Hons) part-II
paper-IV

# Principle of A.C Bridge.

A.C bridges are the generalised form of Wheatstone's bridge in which there are complex currents and impedances. The detector is a head phone or vibration galvanometer, which is used to defect the null point. The head phone indicates minimum Sound at balance.

Kirchoff's laws in generalised complex form are used in the analysis of A.C network. These laws are—

(i) First law:— The algebric sum of all the complex currents meeting at a junction is zero.

$$\therefore \Sigma I = 0$$

(ii) In any closed mesh the algebric sum of the products of complex currents and complex impedances around any closed path is equal to the algebric sum of the complex e.m.f. in that mesh.

$$\therefore \Sigma ZI = \Sigma E$$

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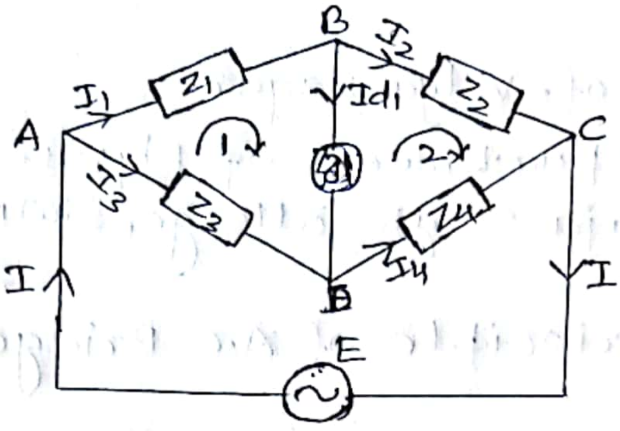
Balance Conditions:- Let us Consider a wheatstone bridge ABCD whose arms Contain Complex impedances $Z_1, Z_2, Z_3$ and $Z_4$ as shown in figure. Between B and D, an A.c detector D of Complex impedance $Z_d$ is connected.




Let us suppose that at any instant, the Complex Currents in various arms are $I_1$, $I_2$, $I_3$, and $I_4$ respectively, as shown in the figure.

Applying Kirchoff's Second law in meshes (1) and (2)

$$Z_1 I_1 + Z_d I_d - Z_3 I_3 = 0 \quad \text{———} (1)$$

$$\text{and } Z_2 I_2 - Z_4 I_4 - Z_d I_d = 0 \quad \text{———} (2)$$

When the bridge is balanced, there is no flow of current from B to D or D to B.

$$\therefore I_d = 0$$

$\therefore$ from equation (1) and (2) we get

$$Z_1 I_1 = Z_3 I_3 \quad \text{———} (3)$$

$$\text{and } Z_4 I_4 = Z_2 I_2 \quad \text{———} (4)$$

When $I_d = 0$ at B or D, then $I_1 = I_2$ and $I_3 = I_4$

$$\therefore \frac{Z_1}{Z_2} = \frac{Z_3}{Z_4} \quad \text{———} (5)$$

- This is the general Condition of balance for A.C. bridges. When real and imaginary part of both sides of equation are separately equated, we obtain two Condition of balance.

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