

## EXPERIMENT # 11

### TO MEASURE THE UNKNOWN INDUCTANCE BY MAXWELL INDUCTANCE BRIDGE

#### OBJECTIVE:

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#### THEORY:

A **Maxwell Inductance Bridge** is a modification to a Wheatstone bridge used to measure an unknown inductance (usually of low Q value) in terms of calibrated resistance.

In the two arms, there are two pure resistances so that for balance relations, the phase balance depends on the remaining two arms. If a coil of unknown impedance  $Z_1$  is placed in one arm, then its positive phase angle  $\phi_1$  can be compensated in a way that known impedance with an equal positive phase angle may be used in either of the adjacent arms remaining two arms have zero phase angles (being pure resistances). Such a network is known as Maxwell's A.C Bridge or L1/L4 Bridge. Thus, inductive impedance may be measured in terms of another inductive impedance (of equal time constant) in either adjacent arm.

As shown in circuit diagram;

$$Z_1 = R_1 + jX_1 = R_1 + j\omega L_1 \dots \text{unknown}; Z_4 = R_4 + jX_4 = R_4 + j\omega L_4 \dots \text{known}$$

$$R_2, R_3 = \text{known pure resistances}; D = \text{detector}$$

The inductance  $L_4$  is a variable self-inductance of constant resistance, its inductance being of the same order as  $L_1$ . The bridge is balanced by varying  $L_4$  and one of the resistances  $R_2$  or  $R_3$

To find the resistance;

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

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

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

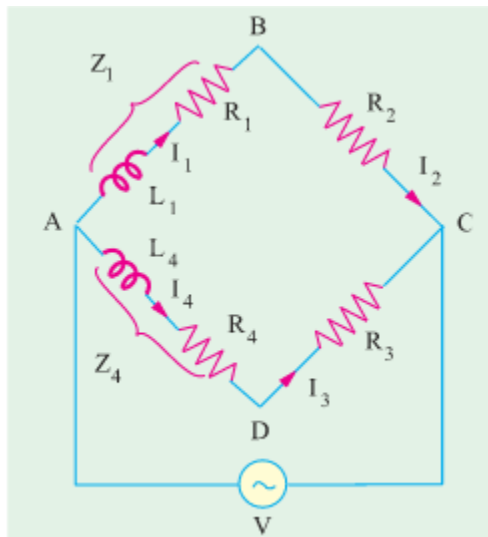
$$R_1 R_3 = R_2 R_4 \text{ or } R_1 / R_4 = R_2 / R_3$$

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

To find inductance;

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

**CIRCUIT DIAGRAM:**



**MAXWELL INDUCTANCE BRIDGE**

**APPARATUS:**

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**PROCEDURE:**

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**OBSERVATIONS AND CALCULATIONS:**

L <sub>4</sub>	R <sub>2</sub>	R <sub>3</sub>	L <sub>1</sub>

Table 11.1

**CONCLUSION:**

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