NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

Electrical and Electronic Measurements and Instrument

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DEPARTMENT OF ELECTRICAL ENGINEERING

AIM : To design a **Maxwell's inductor capacitance** bridge.

OBJECTIVE : To determine the value of R_1 and R_3 for unknown inductor

APPARATUS REQUIRED:

SL NO	APPARATUS	SPECIFICATION	QUANTITY
1	FUNCTION GENERATOR	0-20,5A 50Hz	1
2	MULTIMETER	DIGITAL	1
3	RESISTANCE	R_2=50Ω,R_4=790Ω	2
4	CAPACITOR	$33\mu F$	1
5	DOT BOARD	-	1
6	POTENTIOMETER	1K	2

THEORY:

The Maxwell's inductor capacitance bridge use in AC circuits for determining wide range of measurement of inductor at audio frequencies. A **Maxwell Inductance Capacitance Bridge** (known as a Maxwell Bridge) is a modified version of a Wheatstone bridge which is used to measure the self-inductance of a circuit. A Maxwell bridge uses the null deflection method (also known as the "bridge method") to calculate an unknown inductance in a circuit. When the calibrated components are a parallel capacitor and resistor, the bridge is known as a Maxwell-Wien bridge.

The working principle is that the positive phase angle of an inductive impedance can be compensated by the negative phase angle of a capacitive impedance when put in the opposite arm and the circuit is at resonance (i.e., no potential difference across the detector and hence no current flowing through it). The unknown inductance then becomes known in terms of this capacitances.

At balance condition,

$$(\boldsymbol{R_1} + \boldsymbol{jwl_1})\left(\frac{\boldsymbol{R_4}}{\boldsymbol{1} + \boldsymbol{j\omega C_4 R_4}}\right)\boldsymbol{R_4} = \boldsymbol{R_2}.\boldsymbol{R_3}$$

On equating the real part,

$$\boldsymbol{R_1} = \boldsymbol{R_2}\frac{\boldsymbol{R_3}}{\boldsymbol{R_4}}$$

On comparing the imaginary part,

$$L_1=R_2*R_3*C_4$$

Now, the **Quality factor** is given by,

$$\boldsymbol{Q} = \frac{\boldsymbol{wl_1}}{\boldsymbol{R_1}} = \boldsymbol{wC_4R_4}$$

PROCEDURE:

1. First we connect the circuit as shown in figure.
2. Second we did adjust the potentiometers used for the circuit.
3. Third then also we did adjust to show null.
4. Fourth then we calculate the value of R_1 , Frequency and R_3.
5. Fifth we did write the observation table.

CALCULATION:

C=$33\mu F$

R_2=50Ω

R_4=790Ω

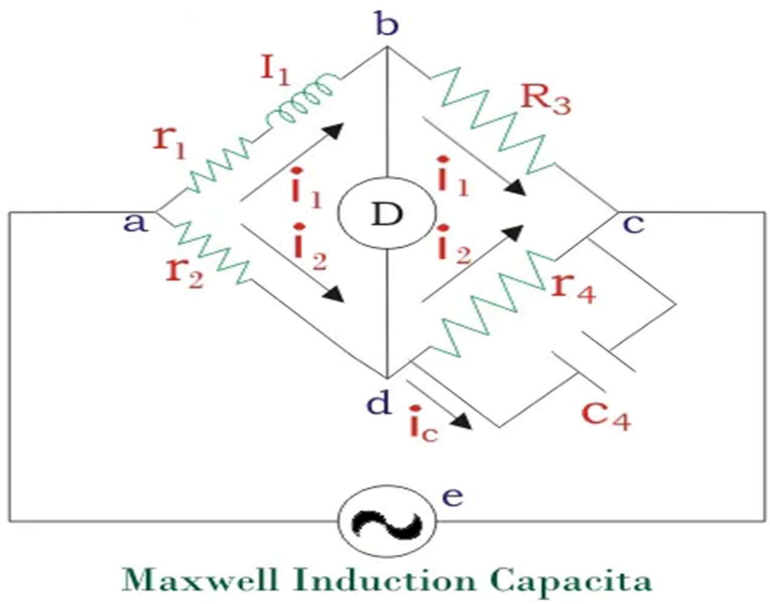
Calculated value:

Consider, **L**=$1H$

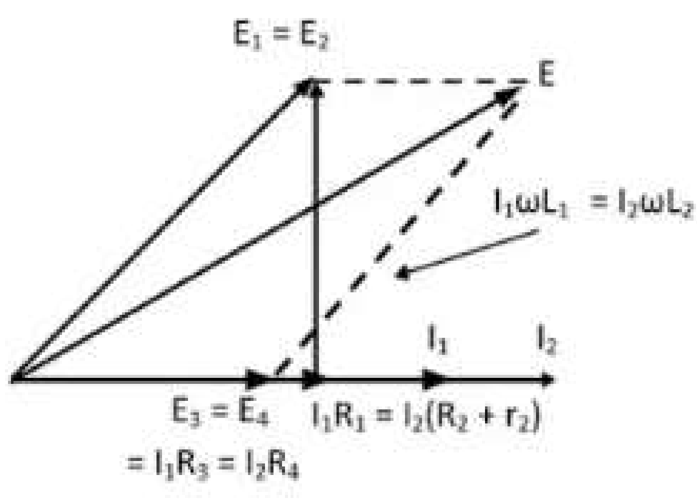
R_3=$\frac{L}{R_2 * C_4} = \frac{1}{33\mu f * 50\Omega}$=**606Ω.**

R_1=$\frac{R_2 * \mathbf{R3}}{\mathbf{R4}} = \frac{50\Omega * 606}{790\Omega}$=**38.35Ω.**

CIRCUIT DIAGRAM :



PHASOR DIAGRAM:



MEASURED VALUE :

R_1= 38 Ω

R_3= 605 Ω

OBSEVATION TABLE :

R_1		R_3		R_2	R_4
Calculated	Measured	Calculated	Measured		
38.35Ω	38Ω	606Ω	605Ω	50Ω	790Ω

PRECAUTIONS:

1. The circuit should not be connected for long time.
2. The reading should be taken carefully.
3. Need to be precise during taking null value.