

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	$R_2=50\Omega, R_4=790\Omega$	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,

$$(R_1 + j\omega l_1) \left(\frac{R_4}{1 + j\omega C_4 R_4} \right) R_4 = R_2 \cdot R_3$$

On equating the real part,

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

On comparing the imaginary part,

$$L_1 = R_2 \cdot R_3 \cdot C_4$$

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

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

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:

$$C=33\mu F$$

$$R_2=50\Omega$$

$$R_4=790\Omega$$

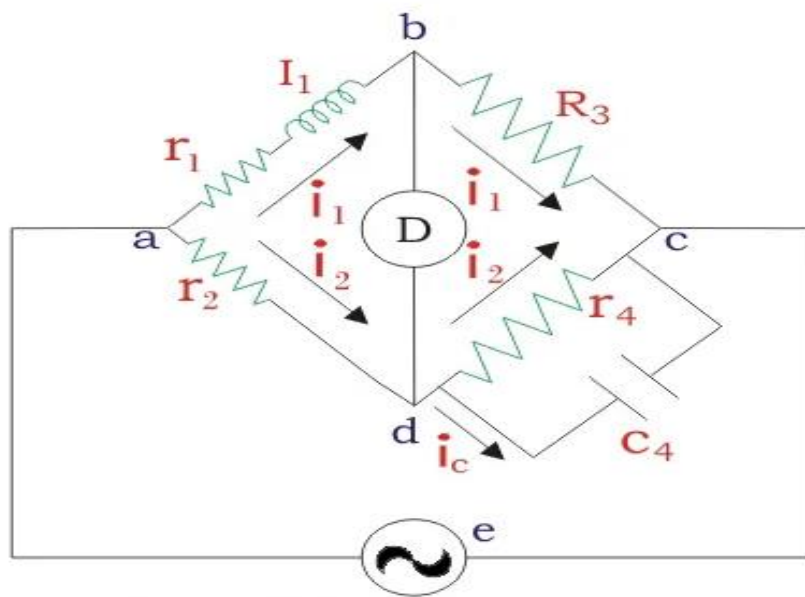
Calculated value:

Consider, $L=1H$

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

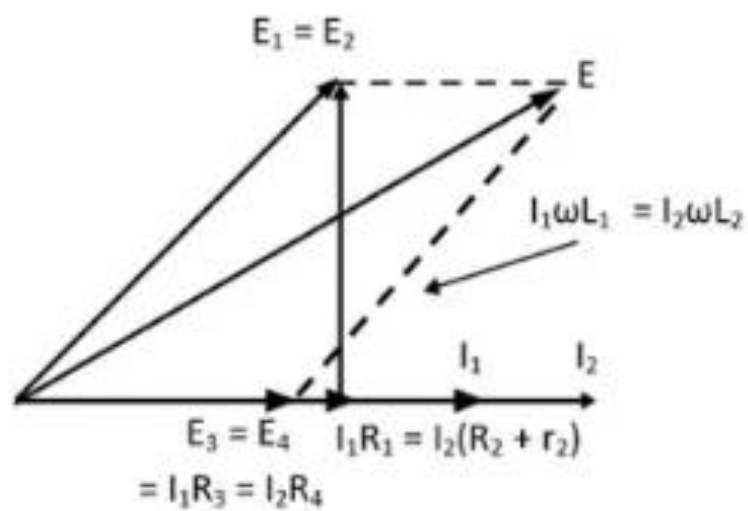
$$R_1 = \frac{R_2 * R_3}{R_4} = \frac{50\Omega * 606\Omega}{790\Omega} = 38.35\Omega.$$

CIRCUIT DIAGRAM :



Maxwell Induction Capacita

PHASOR DIAGRAM:



MEASURED VALUE :

$$R_1 = 38 \, \Omega$$

$$R_3 = 605 \, \Omega$$

OBSEVATION TABLE :

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

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.