

National Institute of Technology, Durgapur
Department of Electrical Engineering

Experiment No: 8

Title: Measurement of Unknown Inductance , Capacitance & its dissipation factor and frequency by AC Bridge

Objectives:

- i> To measure the unknown self - inductance of a given coil by Anderson's bridge method.
- ii> To measure unknown capacitance and dissipation factor using Schering bridge
- iii> To measure the frequency upto 2 KHz range by Wien's Bridge

Anderson Bridge

Apparatus Required:

Sr No	Instrument Name	Specification	Quantity	Makers Name

THEORY: Anderson's bridge is the most accurate bridge used for the measurement of self – inductance over a wide range of values, from a few micro-Henries to several Henries. In this method the unknown self-inductance is measured in terms of known capacitance and resistances, by comparison. It is a modification of Maxwell's L – C bridge. In this bridge, double balance is obtained by the variation of resistances only, the value of capacitance being fixed.

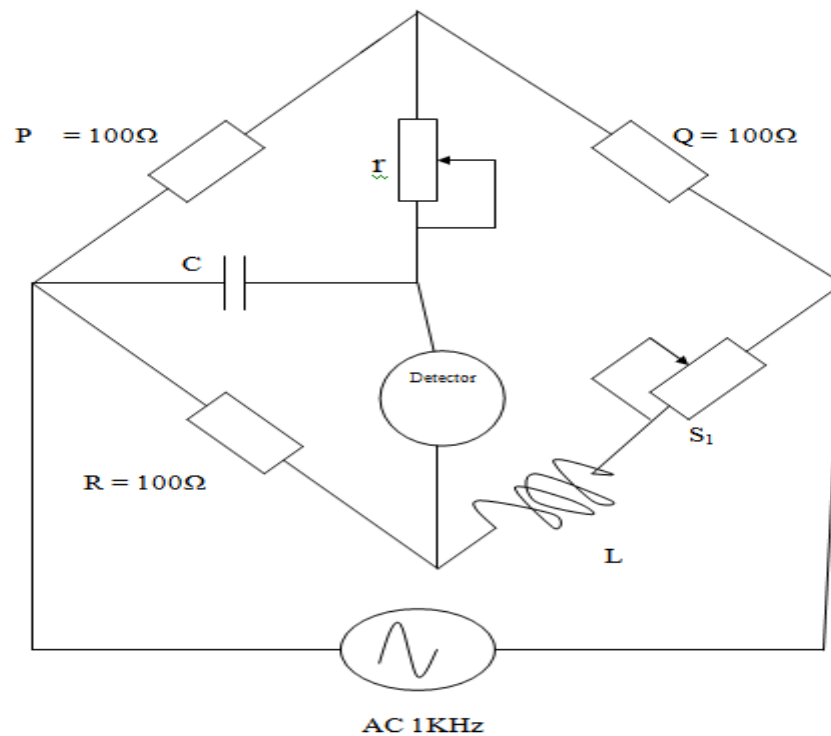


Fig: Anderson Bridge

PROCEDURE:-

(AC BALANCE)

- i) Connect ac 1khz source instead of dc 5v source & Keep unchanged the circuit diagram of DC balance.
- ii) Connect any one capacitor & potentiometer, r as per the diagram of AC balance.
- iii) Connect head phone as an ac detector as per the diagram.
(CRO can be used as an ac detector for better accuracy).
- iv) Switch on the system.
- v) vary the potentiometer r till the sound intensity of the head phone goes minimum (null point).
- vi) After getting null point switch off the system.
- vii) Disconnect the potentiometer r & measure the resistance of r.
- viii) Now calculate the inductor using following formula

$$L = [r(R+P)+PQ] C \cdot R/P$$

TABLE:-

OBS NO	P	Q	R	C	r	L Given	L Measured $L = \frac{[r(R+P)+PQ]}{R/P} C$	% Error $\frac{[L_{meas}-L_{true}]}{L_{true}} \times 100$

Schering Bridge

Apparatus Required:

Sr No	Instrument Name	Specification	Quantity	Makers Name

THEORY:

A Schering Bridge is a bridge circuit used for measuring an unknown electrical capacitance and its dissipation factor. The dissipation factor of a capacitor is the ratio of its resistance to its capacitive reactance. The Schering Bridge is basically a four-arm alternating-current (AC) bridge circuit whose measurement depends on balancing the loads on its arms. Figure below shows a diagram of the Schering Bridge.

C_1 or C_2 is unknown capacitance, C is standard capacitance of value 0.01 micro-farad. $R_3 = 15k$ & R_4 variable resistance

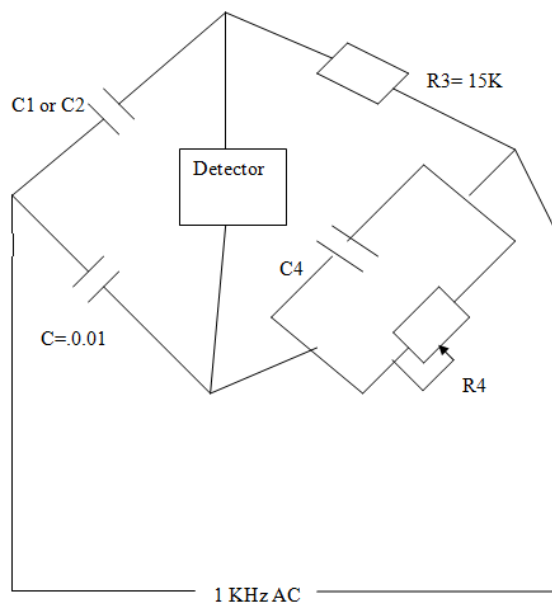


Fig: Schering Bridge

PROCEDURE:-

- i) Connect the circuit as per the circuit diagram.
- ii) Select the unknown capacitance (say $C_1 = 0.01 \mu\text{f}$) from capacitance bank.
- iii) Connect the CRO channel across the bridge marked as detector.
- iv) Now adjust the potentiometer R_4 & get the minimum amplitude at the CRO.
- v) Consider it as balanced condition.
- vi) Now measure R_4 using multimeter.
- vii) Calculate , capacitance $C_1 = CR_4/ R_3$
- viii) Verify the calculated value with unknown capacitance.
- ix) Now select unknown capacitance $C_2 = 0.001 \mu\text{f}$ & follow same procedure.

TABLE:-

Given, $f = 1 \text{ kHz}$

AT BALANCED

SL NO	Unknown capacitance	R_3	R_4	C	Calculated C_1, C_2	% Error C_1, C_2
1	$C_1 (0.01 \mu\text{f})$	15000		0.01	$C_1 = CR_4/ R_3$	$(C_{1m}-C_{1t})/C_{1t}] * 100$

2	C_2 (0.001 μ f)	15000		0.01	$C_2 = CR_4 / R_3$	$(C_{2m} - C_{2t}) / C_{2t} * 100$
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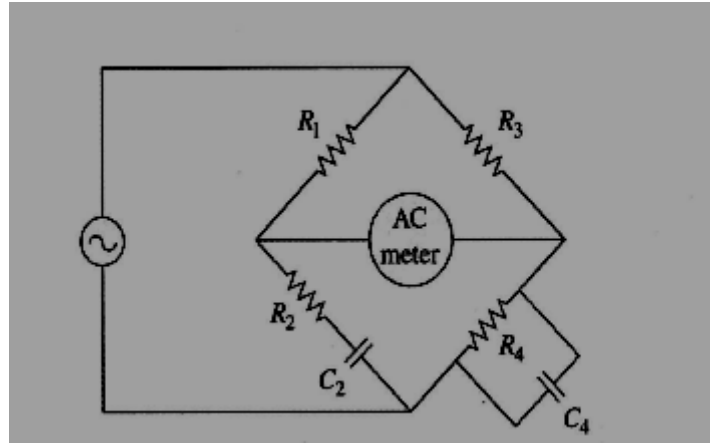
Wien's Bridge

Apparatus Required:

Sr No	Instrument Name	Specification	Quantity	Makers Name

THEORY:-

The Wien Bridge is primarily known as a frequency determining bridge and is describe here not only for its use as an ac bridge to measure frequency but also for its application in various others circuits. The Wien Bridge also finds applications in audio & high frequency application for frequency determining device.



WIEN Bridge Circuit

Balanced condition:

Frequency, $f = 1/2\pi\sqrt{R_1R_2C_1C_2}$

In this trainer kit $C_1 = C_2 = 0.01\mu f$, so $f = 1/2\pi\sqrt{R_1R_2C}$

PROCEDURE:-

- i) Connect the circuit as per the circuit diagram.
- ii) Connect the CRO channel across the bridge marked as detector.
- iii) Now adjust the dual potentiometer R_1 & R_2 & get the minimum amplitude at the CRO.
- iv) Consider it as balanced condition.
- v) Now measure R_1 & R_2 using multimeter.
- vi) Calculate ; frequency , $f = 1/2\pi\sqrt{R_1R_2C}$
- vii) Verify the calculated value with unknown frequency.

TABLE:-

SL NO	Known frequency in Hz	R ₁ In ohm	R ₂ In ohm	C In μf	Calculated $f = 1/2\pi C \sqrt{R_1R_2}$ in Hz	% Error
						$(f_m - f_t)/f_t * 100$

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Suggested Reading:

1. Electrical Measurement & Measuring Instrument by E.W.Golding