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

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

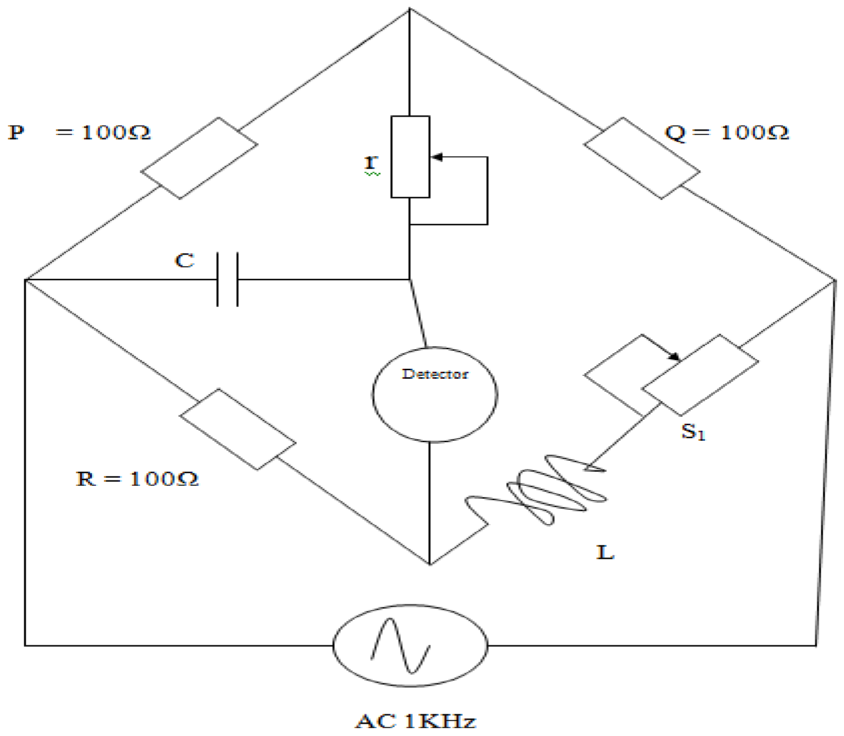


Fig: Anderson Bridge

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 .R/P

TABLE:-

OBS NO	P	Q	R	C	r	L Given	L Measured **L = [r(R+P)+PQ] C .R/P**	% Error **[(L_{meas}-L_{true})] /L_{true}]*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 adiagram 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

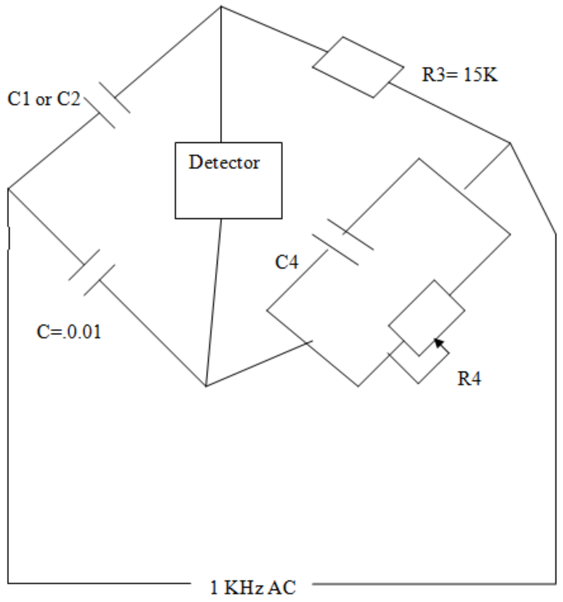


Fig: Schering Bridge

PROCEDURE:-

i) Connect the circuit as per the circuit diagram.
ii) Select the unknown capacitance (say C_1= 0.01 µf) from capacitance bank.
iii) Connect the CRO channel across the bridge marked as detector.
iv) Now adjust the potentiometerR_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 µf & follow same procedure.

TABLE:-

Given, f = 1 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 µf)	15000		0.01	$C_1 = CR_4/ R_3$	$(C_{1m}-C_{1t})/C_{1t}]*100$

2	**C_2 (0.001 µf)**	15000		**0.01**	**$C_2 = CR_4/ R_3$**	**$(C_{2m}-C_{2t})/C_{2t}]*100$**

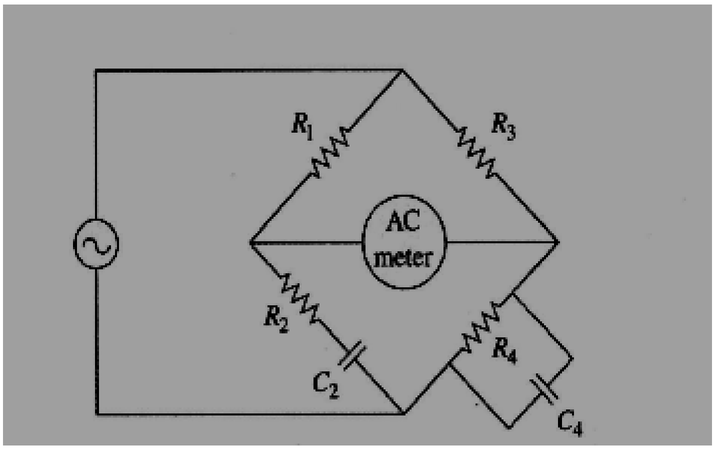
Wien's Bridge

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 $f = 1/2\pi\sqrt{R_1R_2}C$

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 , $f = 1/2\pi\sqrt{R_1R_2}C$
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
						$(f_m-f_t)/f_t]*100$

Suggested Reading:

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