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Experiment :- 1

» AIM :-

To measure the maxwell bridge

(i) Inductance of a coil
(ii) Q factor of the coil using Maxwell's bridge

» APPARATUS :-

S.No.	apparatus	Range	Quantity
1	Maxwell bridge kit	-	1
2	Inductive coil	-	1
3	Headphone	-	1

» THEORY :-

In the bridge an inductance is measured by comparison with a standard variable capacitance.

Under balanced condition

$$(R_1 + j\omega L_1)\left[\frac{R_4}{1 + j\omega C_4 R_4}\right] = R_2 R_3$$

$$R_1 R_4 + j\omega R_1 R_4 = R_2 R_3 + j\omega R_2 R_3 C_4 R_4$$

Comparing the real and imaginary parts.

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$R_1 = \frac{R_2 R_3}{R}$ and $L_1 = R_2 R_3 C_4$

The expression for Q factor of the coil is $Q = \frac{\omega L_1}{R_1} = \omega C_4 R_4$

PROCEDURE :-

- Connection to be made as per the circuit daigram.
- The balance Condition is obtained by adjusting capictance.
- The balance Condition is cheket with a help of headphone.
- All the value in the bridge are noted down.

L_1 = Unknow inductance
R_1 = effetive resistance of inductor
C_4 = variable standard capictor
$R_2 R_3 R_4$ = Know non-inductive resistance.

* Tabulation :-

Maxwell bridge mathod.

S.R Num	Given Inductance	Capacitance	Resistance	Resi....	L=PRC
Unit	Henry	µF	KΩ (Rm)	KΩ (R2)	mH
1	600	0.6	1000	1000	600
2	520	0.5	1000	1000	500
3	550	0.6	1000	1000	600

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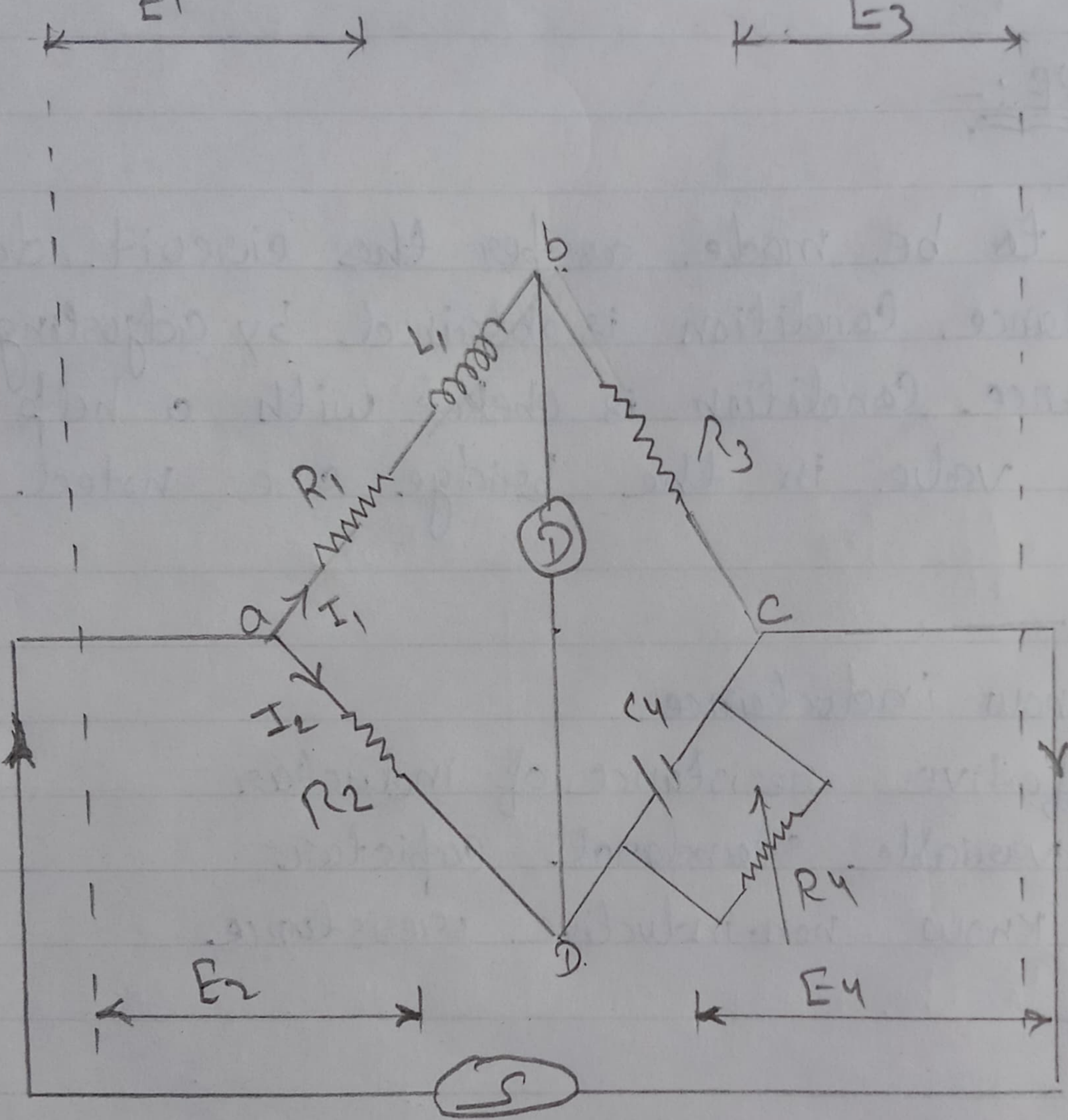


MAXWELL'S INDUCTANCE C...... BRIDGE

» MODEL Calcution

$P = 1000\,\Omega$

$R = 1000\,\Omega$

$C = 0.655 \times 10^{-6}$ mf

$L = PRC$

$= 1000 \times 1000 \times 0.6 \times 10^{-6}$

$= 0.6$

$= 600$ mH

» RESULT:-

Thus the inductance of the given coil is found by maxwel bridge.

Experiment :- 02

AIM :-

To meesure unknow value of low resistance by balancing the kelvin's double bridge.

APPARATUS REQUIRED

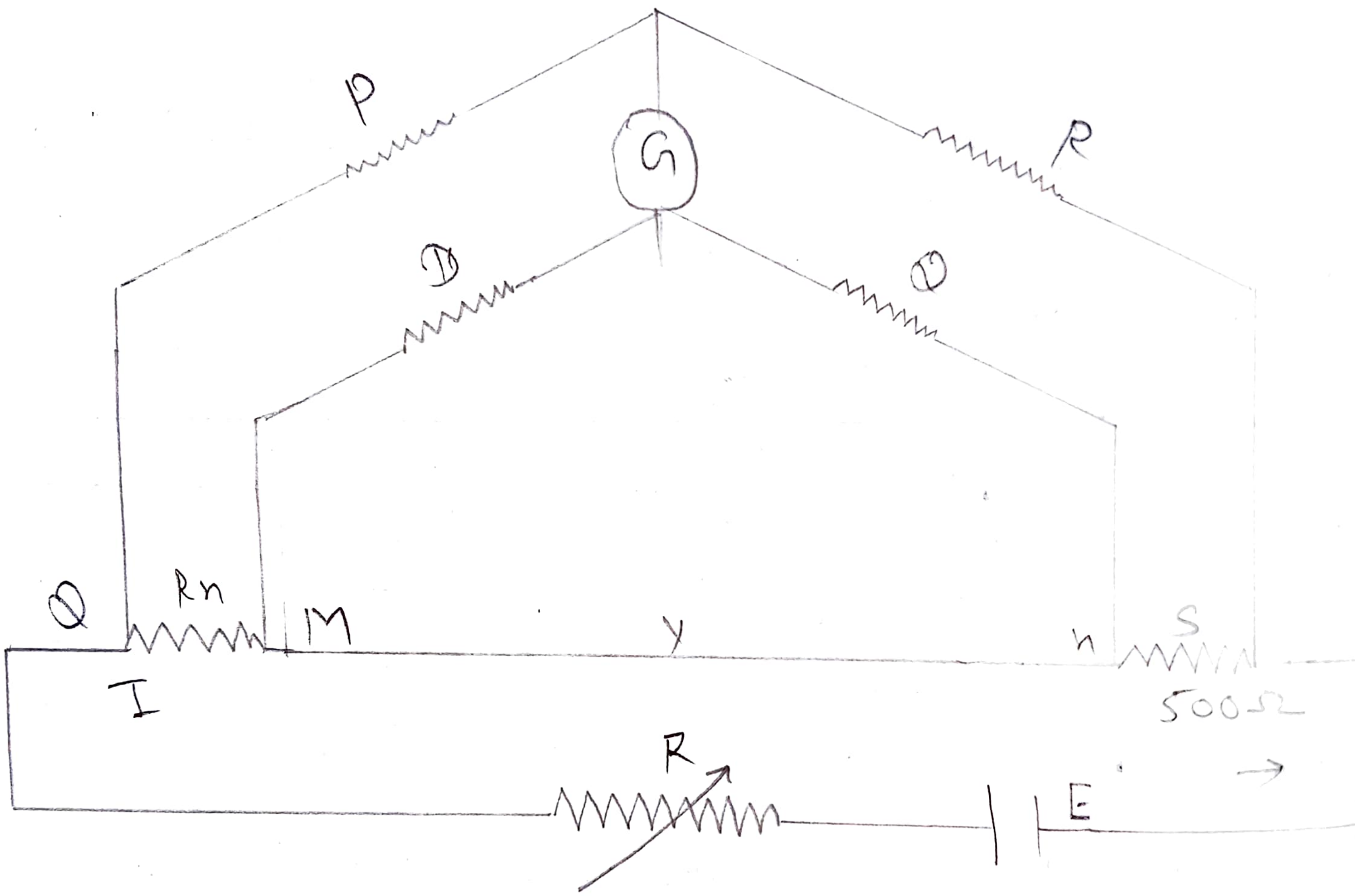
S.No	Apparatus	Range	Quanitity
1	Kelvin's double bridge	-	1
2.	Galvanometer	-	1
3.	Patch cards	-	3
4.	Unknown resistance	-	1

THEORY:-

It is modification of wheatstone bridge. In the fig. Pend Q are the first set of ratio arms. P and Q are the second set of ratio use connected the Galvanometer. The ratio $\frac{P}{Q}$ is made equal to $\frac{P}{Q}$. Under balanced conditions there is no current through the galvanometer.

$$E_{ab} - E_{and}$$

$$E_{ab} = \frac{P}{P+Q} E_{ac} \text{ and}$$



KELVIN'S DOUBLE BRIDGE

$$E_{ac} = \left[IR_x + S + \frac{(p+q)r}{(p+q+r)} \right]$$

and

$$E_{and} = \left[IR_n + \frac{pr}{(p+q+r)} \right]$$

when $E_{ab} = E_{and}$

$$R_x = \frac{R \times S}{Q} + \frac{qr}{p+q+r} \left[\frac{P}{Q} - \frac{p}{q} \right]$$

If $\frac{P}{Q} = \frac{p}{q}$ then $\boxed{R_n = \frac{P.S}{Q}}$

> **Formula used :-** unknown resistance of kelvin's double bridge

$$R = PS/Q \text{ in ohms}$$

>>> PROCEDURE :-

- The trainer is energized and the power supply +5v is checked.
- A Galvanometer is connected externally to the trainer.
- The unknown resistance 'R' is connected in the trainer.
- The value of $P/Q = p/q = 0.1$ ratio
- The value of S is adjusted for proper balance and the value of "S" is noted and "R" is calculated from the formula.
- Unknowns resistance $= R = \frac{PS}{Q}$ in Ω

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Tabulation

S.No.	P	Q	S	Measured value $R = PS/Q$	Set value R_n
Unit	Ω	KΩ	KΩ	ohms	ohms
1	1	1	10	10	10
2	1	1	10	90	100

P, Q :- First set of ratio arm
p, q :- Second set of ratio arm
R_n = Unknown resistance
S : Standard resistance
R : Resistance of conecting lead
G : Galvanometer
E : Internal battery

Model Calculation

$$R = \frac{P \times S}{Q} = \frac{1000 \times 10}{1000} = 10 \text{ ohms}$$

Result :-

The unknown value of resistance is founded out using Kelvin's bridge.

R = 10 ohms

Experiment :- 3

AIM:-

To calibrite use give ammeter by using potentiometer

APPARATUS:-

Potentiometer 10 wires, battery eliminatus (0-5V, 500mA) battery eliminator (0-5 V, 2A), Danial cell ar dry cell. two way key and connecting wires.

THEORY:-

The Connecting are self-explanarary. In this circuit experiment the same current as simultaneously measured with the given instrument as potentiometer and a given ammter. Hence the error in the given instrument as det. Let l_1 be the balancing length of potentiometer wire. when emf 'E' of a Danial cell in balanced it. then we have

$$\mathcal{E} = l_1 n$$

where 'n' is the potentail gradient along the potentiometer wire $\therefore$ $n = \frac{\mathcal{E}}{l_1}$ ---- (1)

Let L_2 be the balancing length of potentiometer wire were potential difference V_2 accross Resistance R bet. M and N in balanced on it There we have $V_2 = n l_2$ ---- (2)

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from (1) & (2) we have $V_2 = En(I_2/I_1)$

$i_2 = V_2$ --- (3)

Subtracting value of V_2 from (3) in (2)

$i_2 = En\left(\frac{l_2}{l_1}\right)$ ---- (4)

here

i_2: current as measured by potentiometer when
R = 1 Ω
i = current as measured by ammeter
E = emf of std. cell / daniell dry cell
l_1 = balancing length for stand cell
l_2 = balancing length of 1 Ω resistance.
Error = $(i_1 - i_2)$

If the reading of a given ammeter for the same current in i_1 the error is the reading of the instrument will be $(i_1 - i_2)$. with help of the battery eliminator B_2 current can be viewed in the circuit and the ammeter can be calibrated for its full range. A graph can then be prepared between reading and the corresponding

» OBERVATION :—

emf of the standard cell = 1.08V
1.5 for dry cell

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S.No	Balancing length of stell (l_1)	Balancing length across 1Ω resis... (l_2)	P.D across resistance $V_2 = E(l_2/l_1)$	Actual i's curr. amper. ($i_2 = V_2$)	observed ammeter ($i_2 = V_2$)	Error ($i_1 - i_2$) Amp.
1	1000	34	0.098	0.098	0.1	0.002
2	1000	67	0.194	0.194	0.2	0.006
3	1000	100	0.290	0.290	0.3	0.10
4	1000	189.8	0.347	0.347	0.4	
5	1000	163.3	0.473	0.473	0.5	
6	1000	192.4	0.557	0.557	0.6	
7	1000	221.5	0.642	0.642	0.7	
8	1000	254	0.763	0.763	0.8	0.064
9	1000	288.8	0.837	0.837	0.9	0.063
10	1000	316.8	0.918	0.918	1.0	0.23
11	1000	345	1.000	1.000	1.1	0.100
12	1000	386	1.119	1.119	1.2	0.081
13	1000	407	1.180	1.180	1.3	0.120
14	1000	438	1.270	1.270	1.4	0.130
15	1000	472.5	1.370	1.370	1.5	0.130
16	1000	506.5	1.468	1.468	1.6	0.132
17	1000	543.9	1.577	1.577	1.7	0.123
18	1000	570.1	1.653	1.653	1.8	0.147
19	1000	601.3	1.743	1.743	1.9	0.157
20	1000	642	1.861	1.861	2.0	0.139
21	1000	673.5	1.953	2.953	2.1	147
22	1000	700	2.03	2.03	2.2	170
23	1000	737.4	2.138	2.138	2.3	0.17
24	1000	769.2	2.230	2.230	2.4	0.18

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24	1000	827.5	2.399	2.399	2.4	0.201
25	1000	863.3	2.503	2.503	2.5	0.200
26	1000	898.4	2.605	2.604	2.6	0.200
27	1000	922.3	2.674	2.605	2.7	0.197
28	1000	958.2	2.650	2.677	2.8	0.198
29	1000	946.2	2.666	2.688	2.9	0.226
30	1000	958.2	2.775	2.774	3.0	0.272

» Calculation:-

(1) $i_1 = 0.998$ Amp
$(i_1 - i_2) = 0.002$ Amp

(2) $i_2 = 0.194$ Amp
$(i_1 - i_2) = 0.006$ Amp

(3) $i_2 = 958.2$

$(i_1 - i_2) = 0.222$

Experiment : 04

AIM :-

To mesure low resistance by Crompton Potentiometer.

APPARATUS :-

Crompoton potentiometer. New tech type NTI 501, two battery eliminators, two rhostats, two one wey key, one Galvanometer, on known resistance of comparatively higher value and given small resistance.

THOERY :-

Let I current in passing though known resistance R of comparatively higher value R and small unknown resistance r. The balancing length corresponding to potential drop on R is l_1

$$\therefore IR = \phi l_1 \quad \ldots\ldots (1)$$

where G is potential gradient.

If balancing length corresponding to potential drop on $(R+r)$ resistance is l_2.

then $I(R+r) = G\,l_2$ ——— (2)

Putting the (2) (1) equation

$$\frac{R+r}{R} = \frac{l_2}{l_1}$$

or $1 + \frac{r}{R} = \frac{l_2}{l_1}$

or $\frac{r}{R} = \frac{l_2 - l_1}{l_1}$

or $r = \frac{l_2 - l_1}{l_1} R$ ——— (iii)

Putting the values of l_1, l_2 and R in the formule the unknown low resistance r is calculated.

>> PROCEDURE :—

(i) Complete the Connections as shown in fig (1).
(ii) Close the Keys K_1 and K_2 put plug in 'a' gap of way K.
(iii) Note down the balancing length l_1 for potential drop of R.
(iv) Mean value of small resistance r is calculated.
(v) Calculated the value of unknown small resistance using formula.

$$r = \frac{l_2 - l_1}{l_1} R$$

>> OBSERVATIONS :—

Sr. No.	Balance length l_1 for P.D of R Cm	Balancing length l_2 for P.D	$r = \frac{l_2 - l_1}{l_1} R$ (Ohms)
1			
2			
3			
4			

>> CALCULATIONS :—

Putting value of l_1, l_2 and R in the formula the value of unknown small resistance are is calcuted in each set of observation. Then mean value of r is determined.

>> RESULT :

The value of given small resistance as determined using crompton potentiometer is = ... Ohm.

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Experiment - 05

>> AIM:-

To measure the displacement using LVDT.

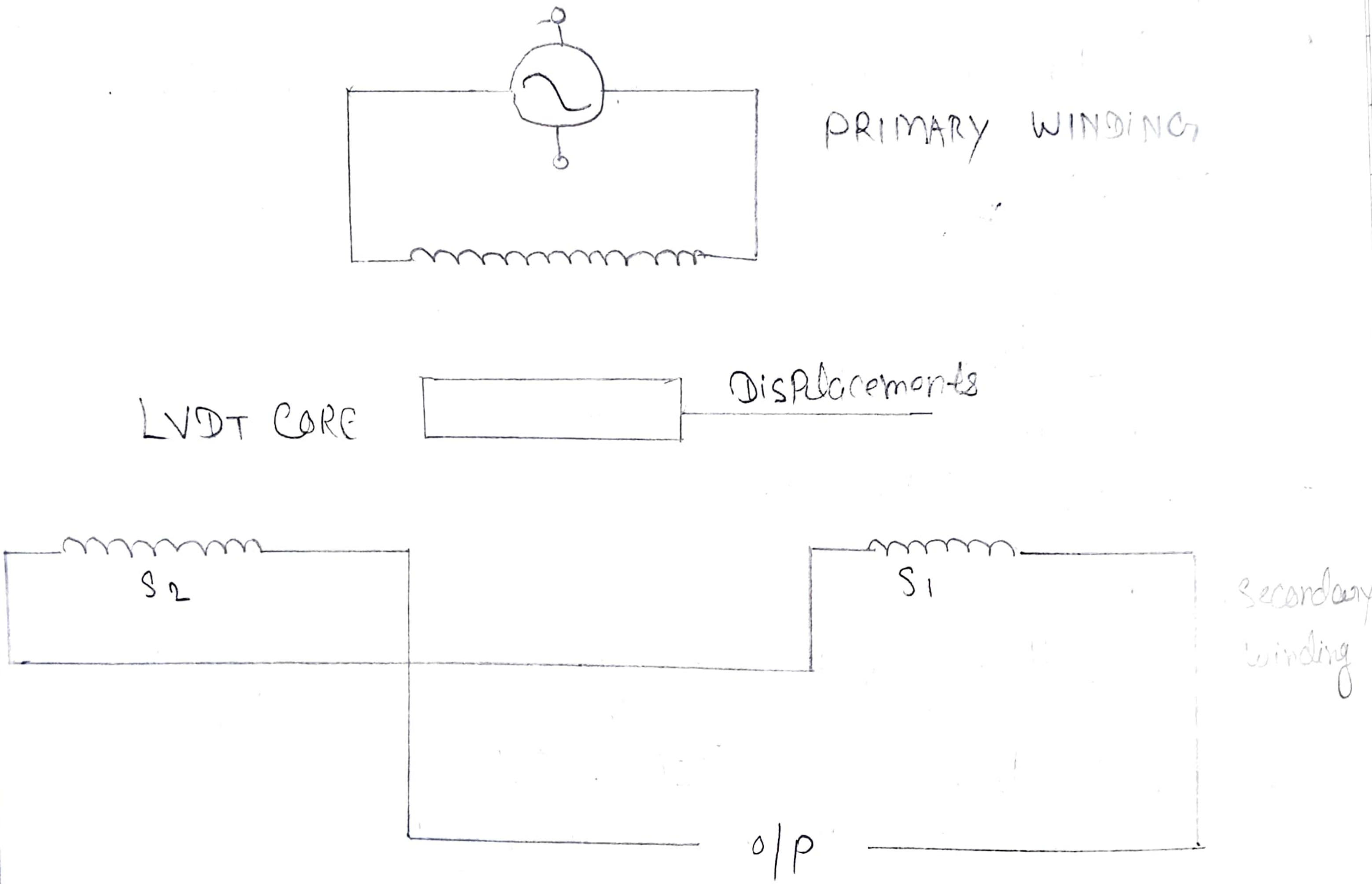
>> APPARATUS:-

(1) LVDT Setup
(2) Resistors - 4.7 KΩ - 3 10 KΩ
(3) Signal generators
(4) Digital multi-meter.

>> THEORY:-

The differential transformer is a passive inductive transformer also known as linear Variable Differential transformer (LVDT.) LVDT has a soft iron core which sides within the hollow transformer & therefore effects magnetics coupling between the primary and two secondries. The displacement to be measured is applied at its arm attached to soft iron core. When core is normal position (null). equal voltage are induced in the two second. The frequency of ac applied to the primary winding ranges from 50 Hz to 20 KHZ.

>> CIRCUIT DAIGRAM



PROCEDURE :-

1. Connection are made as per circuit daigram
2. Initially setup cure of LVDT at Center.
3. Minimize the residual valtage with external balance CKt.
4. Change the core displacement 1mm in one daireation and observe the crossponding out put valtge in DMM/CRO.
5. The Core is moved farwards in other direction and take the reading for various displacements in steps.

A measurement :-

Residual valtage - 3.2 mv
Minimum valtage - 0.7 mv

Colar Code :-

Red & green / shield : Primary
Yellow & green, centre black : Secondary

B Calibration :-

(a) Initially set the Care of an LVDT at a center position and observe the residual valtage at Null position.

(b) Now Rotate the 10Kohm pot and observe the valtage in DMM such that is should be lowest reading which is approximately (0.6mv to 1.3mv)

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S.NO	DISPLACEMENT (mm)	O/P VOLTAGE (mV)
1	0	0.7
2	1	9.1
3	2	17.9
4	3	26.3
5	4	35.4
6	5	44.6
7	6	33.7
8	7	63.3
9	8	72.8
10	9	81.8
11	10	91.0
12	1	8.3
13	2	16.9
14	3	23.5
15	4	34.4
16	5	42.8
17	6	52.4
18	7	62.48
19	8	71.5
20	9	80.5
21	10	90.2

Teacher's Signature:

» RESULT :-

Residual voltage = ______ mV

minimum voltage : ______ mV

Linear displacement range : ______ mm