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Expt. No. 01 Page No. 01

Experiment 0.1

Aim of the Experiment:- To use a multi meter for measuring.

a. Resistance
b. Ac and DC Voltages
c. DC Current

Measurement of Resistance

* Procedure:-

Connet a black coloured that lead to the Common (-) Socket and red coloured text lead to the (+) Socket - Connet the metallic pin of the test lead with each other. If the pointer of the multimeter does not t and of zero ohm reading on the resistance scale. Adjest the zero ohm till the pointer is at zero.

Adjest the position of the range swrich to (Rx1) Connet the pins of two test leads to the ends of the unknows resistance and note the reading is to high.

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In such a case adjust the range and switch to Rx 10 position again adjust zero and not the reading as explained above. if the reading is still small adjust the range switch to Rx1000 position adjusting each time.

Measure three different values of resistance say R_1, R_2, R_3

Here, $R_1 = 10\ \Omega$, $R_2 = 50\ \Omega$, $R_3 = 100\ \Omega$

Apparatus Required:-

A multi-meter with a dry cell fitted inside it. Two knows resistance a DC source, AC mains Connecting wire.

* OBBERVATION:-

S.N	Resistance	Multimeter Reading	Multimeter Factor	Resistance
01	$R_1\ \Omega$	10.5	1	10.5
02	$R_2\ \Omega$	50.8	1	50.8
03	$R_3\ \Omega$	98.0	1	98.0

Thus the difference in Resistance are 0.5 Ω, 0.8 Ω and 2 Ω respectively.

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* PRECAUTIONS

① The function switch should be adjusted to the DC position.

② check the zero error of the multimeter before making and resistance related measurement.

① MEASUREMENT OF AC VOLTAGES

* PROCEDURE

i) Connect the black coloured lead to the common or (-) socket and red coloured lead to the Ac socket

If the AC voltage from the mains is to be measure set the range switch to 250 V Connect the two pins of the lead across the voltage to be measured and note the following reading Suitable scale.

Given, the voltage is 30V

* OBSERVATION

The measured potential difference = 2.80V
difference from the original = 0.2 V

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* PRECAUTION

i) For accurate measurement of voltage set the range switch at the appropriate range.

ii) Connect the black coloured text lead to common (-) socket.

iii) Connect the red coloured text lead to (+) socket for AC voltage.

Measured DC potential difference = 1.35 V
∴ Difference in DC potential = 0.15 volt.

(2) MEASUREMENT * OF DC * CURRENT

i) Set the position of the function switch to DC.

ii) Connect the black coloured text lead to common (-) socket and the red coloured text lead in (+) ve socket.

iii) If the ~~same~~ current reading is too small take it as the rough value and readjust the range switch to suitable current range again.

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* PRECAUTIONS :-

i) For measuring direct current set the function switch at 'DC position.

ii) For accurate measurement of current set the range switch of appropriate.

iii) Connect the black coloured text lead to the Common (-) ve Socket.

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EXPERIMENT-02

* Aim of the Experiment :— To compare capacitances using de-Sauty's bridge.

* Apparatus Required :-

i) Two Capacitors
ii) Two Resistance boxes
iii) Head Phone
iv) Oscillater or Step-down transformer
v) Signal Generator.

* THEORY

The current diagram of de-Sauty's bridge is the same as that of DC-bridge provided the resistance of an arms are replaced by impedance of the arms.

If Z_1, Z_2, Z_3, Z_4 are impedance of the four arms of the bridge then the condition for balance is $\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$

In the present bridge $Z_1 = \frac{1}{\omega C_1}$, $Z_2 = R_1$, $Z_3 = \frac{1}{\omega C_2}$

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and $Z_4 = R_2$.

where ω is the cyclic frequency of S.M.f.

$$\frac{\frac{1}{\omega C_1}}{R_1} = \frac{\frac{1}{\omega C_2}}{R_2} \quad \text{Or} \quad \frac{C_1}{C_2} = \frac{R_1}{R_2}$$

In the condition for maximum ensativity is that the impedence of w the arms be almost the same.

* PROCEDURE

(i) Mark the Circuit as Shown in the figure.

(ii) Fix up R_1 at Same value consistent with maximum Sensitivity of the bridge and adjust R_2 for no sound in the headphone H. If no sound is obtained. Look for maximum Sound.

(iii) Fix up R_1 at Some other value and adjust R_2 for no Sound or minimum Sound in the headPhone Repeat Several time.

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* OBSERVATION

R_1	1	2	3	4	5
R_2	5	10	15	20	25
$\frac{P}{C_L} = R_1/R_2$	5/1	5	5	5	5

* RESULT :- The radio of capacitance is 5/1.

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Experiment - 3

* **Aim of Experiment :-** To verify the superposition and maximum power theorem.

* **Apparatus Required :-**

(i) A regular power supply
(ii) A resistance box
(iii) Fixed resistance
(iv) A DC voltmeter
(v) Connecting wires

* **Theory :-**

Maximum power theorem states that in a resistive circuit when the bond resistance is varied max^m power is absorbed by the load when the load resistance is equal to the source resistance.

In the circuit R_2 in known as resistance and R_2 is a variable load resistance.

In the experiment different values of R_1 are used and P is calculated from eq (1) by measuring V_2 for each value for R_1.

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A graph is plotted with R_1 in X- asix and pin y asix P is found to attain a maximum at $R_2 = R_3$

Hence P is maximum when $R_1 = R_3$ establised the maximum power transfer theorem.

* PROCEDURE :-

All Connections are made as per circuit fig A Fixed resistance of 30Ω is used for R_3. The resistance R_1 is supplied for a resistance Box.

Insert a resistance $R_1 = 5\Omega$ and measure the voltage V_1 across it by DC voltmeter.

Increase a resistance R_1 to 10, 15, 20 ..... 50Ω for each R_1 Measure V_1

Now decrease R_1 from 50Ω to 5Ω in previous values and for each R_1 find V_1 Thus for each R_1 find V_1 thus for each R_1 two values of V_1 are obtained.

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A graph is plotted P versus R_1 and from the graph. the value of R_1 at P is maximum this value is found to be R_0 this verifying maximum power transfer theorem.

* OBSERVATION :-

R_1 in Ohm	Load Voltage R_1 inc	V_1 in volt R_1 dec.	Mean V_1 volt	$P=\left(\frac{V_1}{R_1}\right)^2$
5	1·35	1·28	1·31	0·34
10	2·30	2·32	2·31	0·53
15	3·12	3·10	3·11	0·64
20	3·72	3·61	3·66	0·66
25	4·77	4·18	4·22	0·71
30	4·795	4·86	7·70	0·79
35	5·149	5·08	5·11	0·74
40	5·49	5·38	5·43	0·73
45	5·80	5·75	5·77	0·71
50	6·09	6·08	6·03	0·66

* RESULT :-

The Relation $R_1 = R_3$ proves the maximum power Transfer theorem.

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Expt. No. 03 Page No. 12

Experiment :- 04

* Aim of Experiment:-

a) To plot a graph between current and frequency in a series L·C·R Circuit and to find resonant frequency.

b) To find the quality

* Apparatus Required:-

An audio Frequency oscillater (Range 10 HC to 10 KH2) an including coil, a capacitor a non-induction resistance box a cathode ray escillascope (C.R.O) a multimeter connecting wire etc.

* Theary:-

When an alternating E.M.f. is injected into L.C.R Series Circuit the current is generally small for all frequency excepts a particular frequency.

$$n = \frac{1}{2\pi\sqrt{2C}}$$

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The greater the reduction in the value of current for a smaller off tuning of the circuit The greater is the sharpness of resonance.

It is measured by reciprocal the width of the curves corresponding to half the mean square current at resonance. The sharpness of resonance is given by:-

$$\text{Sharpness} = \frac{n_0}{n_2 - n_1}$$

At resonance there is voltage amplification across in induction, the electrical current at any frequency is given by

$$I = \frac{V}{\sqrt{R^2 + \left(\omega_c + \frac{1}{\omega c}\right)^2}}$$

Where V: is the applied voltage abrrously accurs when

$$\omega_r C - \frac{1}{\omega_r C} = 0$$

$$\Rightarrow \omega_r L = \frac{L}{\omega_r^2}$$

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$$\Rightarrow \omega_r^2 = \frac{1}{LC}$$

$$\Rightarrow \omega_r = \sqrt{\frac{1}{LC}}$$

$$\Rightarrow n_0 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

and resonant current $I_r = \frac{V}{R}$

The radio of the voltage across L or C to the applied voltage is

$$\frac{V_2}{V} = \frac{I_r \omega_r L}{I_r R} = \frac{\omega_r L}{R}$$

This is called the quality factor (Q-value) of circuit and it represents how many times the voltage across L or C is increased as resonance.

It can be shown easily that a factor also represents the sharpness of resonance.

$$\text{Sharpness of resonance} = \frac{n_0}{n_2 - n_1} = Q_L = \frac{\omega_r L}{R}$$

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* PROCEDURE :-

i) Make the circuit shown in the figure.

ii) From the given value of L and C calculate the resonant frequency of the circuit by the relation

$$\nu_r = \frac{1}{2\pi\sqrt{\frac{1}{LC}}}$$

iii) Adjust the output voltage of oscillator and the resistance R to get max^m current with in the range of the MA the value of output of the oscillator R must be kept constant through out the experiment.

iv) Thus the greater the resistance the less is the sharpness of resonance.

* OBSERVATION :-

Resistance $R = 100\ \Omega$
Inductance $L = 100\ mH = 0.1\ H$
Capacitance $C = 0.1\ \mu f = 10^{-7}\ F$

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Frequency	$Z = R^2 + (\omega_1 - 1/\omega^2)^2$	Voltage $Z = V/I$
1000	969	2.87
1100	769	2.34
1200	581	2.36
1300	480	2.28
1400	276	2.25
1500	155	2.24
1600	100	2.29
1700	164	2.22
1800	265	2.22

* CALCULATIONS

Current of resistance from graph = 0.002234
= 0.0223 mA

Calculated value of current = $\frac{V}{R} = \frac{2.35}{100}$
= 0.0235 A

Difference = 0.002 A
Resonant frequency n_0 = 1600 Hz
Calculated value of n_r = 1592 Hz

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* Quality Factor

Maximum value of current at resonance

$I_r = 22.3\ mA$

Corresponding Frequency $n_x = 1600\ Hz$

$$\frac{I_r}{V_2} = \frac{22.3}{1.42} = 15.76\ mA$$

Corresponding value of Frequency

below $n_r, n_1 = 1510\ Hz$

$n_r, n_2 = 1680\ Hz$

Bandwidth (B) $n_2 - n_1 = 170\ Hz$

Quality factor $Q = \frac{n_r}{n_2 - n_1} = \frac{1600}{170} = 9.41$

* PROCEDURE

① The value of induction L and capacitance C should be properly selected so that natural frequency of the circuit lies between 1000 Hz and 2000 Hz.

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ii) Adjust the frequency of the AC oscillator when the maximum in LCR circuit goes maximum current.

The value of Output voltage of oscillator and resistor R Must be kept constant throughout the experiment.