Experiment 4:

To Determine the Dielectric constant of a solid Glass by using RLC Circuit.

Appasatus:

Audio oscillator, Parallel plate capacitor, Inductor, resistance box, milliämeter glass slab.

Theory:-

We will discuss different topics about this experiment.

Circuit:

RLC circuit is used for this experiment where "R" is the resistance, "L" is the inductor and C is the capacitor.

Circuit Description:

The Parallel plate capacitor is connected in series with inductor, resistance box and milliammeter. An audio oscillator is also connected in series with capacitor which is used as Ac generator. The behaviour of all these devices is different for voltage and current for each other.

Circuit components

The circuit components are as follows
(i) Inductor (ii) Resistance
(iii) Capacitor (iv) Ammeter

Inductor:

It is a basic component commonly used in electronic circuit. It is a coil connected on coil of some suitable material. The inductor is of two types

→ Self Inductance
→ Mutual Inductance

Self Inductance:

The ability of an inductor to induct emf itself when the coil current is changed is called self inductance.

Mutual Inductance:

The phenomenon in which changing current in one coil induce emf in another coil is called mutual inductance.

Explanation:

When two coils are placed to close to each other that expanding and collapsing magnetic [illegible] of one coil like

with the other an induced emf is produced in other coil. These two coil are said to be mutually induced (M)

FARADAY'S law:

Faraday's law for induced voltage states that

Induced voltage or emf is directly proportional to the rate of change of magnetic flux.

$$emf = \frac{N d\Phi}{dt}$$

Capacitor:

Capacitor is the device which has the ability to store electric charge.

(i) It blocks the passage of DC and passes AC.

(ii) It opposes any change of voltage in the circuit in which it is connected

(iii) It has ability to store charge.

Capacitance:

The ability of capacitor to

Store energy is called capacitance. In a parallel plate capacitor consisting of two plates each of Area 'A' seperated by distance 'd' have the capacitance.

$$C = \frac{\varepsilon A}{d}$$

Where "ε" Is the permitivity of dielectric

Unit

Unit of capacitance is Farad

Factors effecting Capacitance:

Following are the three factors that effects the capacitance

i) Plate area
ii) Plate Spacing
iii) Dielectric material

Plate Area:

Greater plate Area gives greate capacitance and vice versa. It happens because large plate will collect more charge for the applied voltage than a smaller voltage.

Plate Spacing:

All the factors being

equal plate spacing effect capacitance. Similarly less spacing gives and large capacitance and vice versa. It is so because less spacing results in a greater field force which cause more charge to store on a plate.

Dielectric Material:

Greater permitivity of dielectric material gives large capacitance and vice versa.

A dielectric is some non conducting material which stops the charge flow when electric field is not applied to plates

Dielectric Constant:

The ratio of capacitance of parallel plate capacitor with an insulating substance or medium b/w them"

It is denoted by ε_r

$$\varepsilon_r = \frac{C_{med}}{C_{vac}}$$