EXPERIMENT NO: 5

AIM: To Study Of Electrical Safety

THEORY:

ELECTRIC SHOCK:-

An electric shock can occur upon contact of a human's body with any source of voltage high enough to cause sufficient current through the muscles of hair. The minimum current a human can feel is thought to be about 1 mA. The effect of electric shock may be death –

1) Due to fibrillation of heart. i.e. damaging the heart to small pieces causing the stopping of breathing.
2) Due to stopping of breathing action caused by blockade in the nervous system causing respiration.
3) Due to local overheating or burning of the body.

The fibrillation of the heart is the most serious cause of death and there is no curve, although there is possibility of rescuing a man who has suffered by the latter two causes. The seriousness of the electric shock is dependent upon the following factors.
i) The Current Strength: It has been experienced that in alternating currents of low frequency the current between 1 mA and 8 mA are just bearable, but currents between 8 mA and 15 mA give a painful shock which sometimes contract muscles too. If the chest it may stop breathing and currents between 100mA and 200 mA may cause fibrillation of heart. Current beyond 200 mA will cause burn and if it passes through heart even, it will not cause fibrillation but may stop breathing temporarily.
Thus it is seen that it is the current which gives shock although it depends upon the voltage. The leakage current is given by I = E/R
Where E is the supply voltage and R is the body resistance.

The body resistance is different under different conditions when the body is dry, its resistance varies between 70 kΩ and 100 kΩ per sq. cm (the skin resistance is high while the internal resistance is low), but when the body is wet, its resistance reduces to between 700 Ω and 1 kΩ per sq. cm. The average effective resistance of the body may e taken as 50 kΩ when dry and 1 kΩ when wet. The high voltage causing currents beyond 200 mA punctures the outer skin causing burns. Table gives the results of shock under different conditions and under different voltage.

Condition of Body	Electric resistance of body in Ω	100 V		500V		10,000 V	
		Current A	Effect	Current A	Effect	Current A	Effect

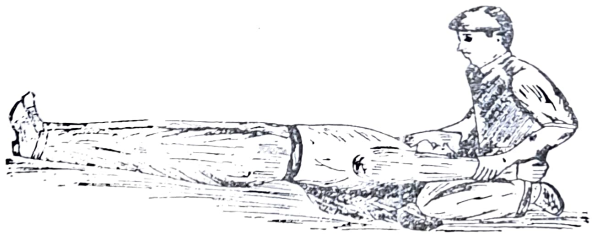


Fig. 5.2

If the operator has got burns only, the burns should be dresses properly; oil should never be used on the burns.

Precautions against Shock:

It is always necessary to observe the following precautions against shock, since prevention is better than cure.

- Try to avoid wok on live mains which should be switched off before working.
- If it is not possible to switch off the mains, be sure before working that your hands or feet are not wet and insulted with rubber shoes.
- In order to rescue a person who has got an electric shock if there is no other insulator available for rescuing, use your feet rather than hands, wearing the rubber shoes or PVC shoes.
- When working on high voltages, be sure that the floor is not conductor. Concrete floors are dangerously conductive.
- When working on high voltage, try to keep your left hand in pocket i.e. avoid your left hand to get in contact with any live conductor or metallic causing of an apparatus or metal pole or cross arms.
- Do not work in such place where your head is liable to touch the live mains before making the circuit dead.

CONCLUSION: In, this experiment, I learnt about electric safety. when, a person got current, then what prodgies do; I learnt from this experiment. I learnt many technique about electric safety.

EXPERIMENT NO: 6

AIM: To Study The Model Of Dancing Ring Based On Electromagnetic Induction.

THEORY:

The model is operated by single phase ac supply. First the supply switch is switched 'ON'. Now when the push button is pressed, the coil (material: copper) will provide path for the current to flow. This coil surrounds an iron core. So according to principle of electromagnetic induction, this cylindrical iron core acts as an electromagnet. It will be magnetized due to the flow of current in the coil. The iron core is placed inside a hollow wooden cylinder and is thereby extended above the actual coil coverage. A wooden stand is used in which the coil surrounds the actual iron core. The disc has to be passed over this cylindrical extension or iron core and placed on the tabular top of wooden stand.

As the iron core is magnetized, the flux is surrounding the iron core. This flux will interact with the circular ring placed on the top of the stand and surrounding the iron core. Hence emf is induced in the ring, which provides a closed path. So due to the interaction of flux with current carrying disc, the disc will experience a force. This force lifts up the disc from top of the stand. If we release the push button, the disc will come back. This can be repeated to see the electromagnetic force.

The same procedure is repeated by the disc no.2. Which is having a thin air gap slit in it as shown in fig. It is observed that it does not lift up , i.e. there is no electromagnetic force on the ring. The reason is that it does not provide closed path for the current to flow. So there is no interaction of flux with the current carrying disc, because current is not flowing in the disc, and hence there is no force.

When this disc no.2 is placed on disc no.1 and both are placed on the top of stand, the disc no.2 is lifted because the disc no.1 is having electromagnetic force. So it lifts up the disc no.2 which lies above it.

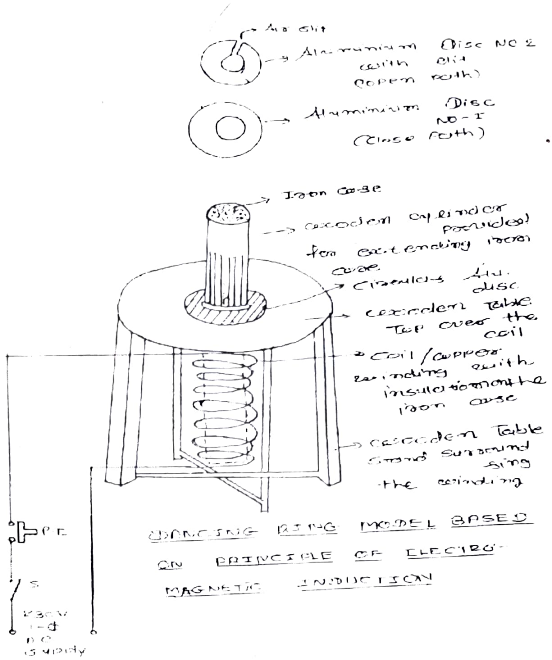


Fig. 6.1 Model of Dancing Ring

CONCLUSION: In this experiment I learnt about dancing ring model, and how it's work. In this experiment I learnt how that model works on electro megnetic induction. In lab we do this experiment with various type of ring, like Aluminium, Aurem, Al + Au, etc.

17/11/2022

28/12

EXPERIMENT NO: 7

AIM: Introduction to basic electronics components and its testing: Resistors, Inductors, Capacitor, Diode, BJT.

THEORY:

Electronic circuits are made up of several components. Generally, there are five basic components of which three are passive components and two are active components. Passive components are those components which do not require external energy source for its operation.

The passive components are:

1. Resistors
2. Capacitors
3. Inductors

Resistors:

The flow of charge or current through any material, encounters an opposing force similar in many respects to mechanical friction. This opposing force is called the resistance of the material. It is measured in *ohms*. Its symbol is Ω (omega). The circuit symbol for resistance is R. In electronic circuits resistance is deliberately introduced. The device or component to do this is called a Resistor.

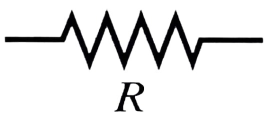
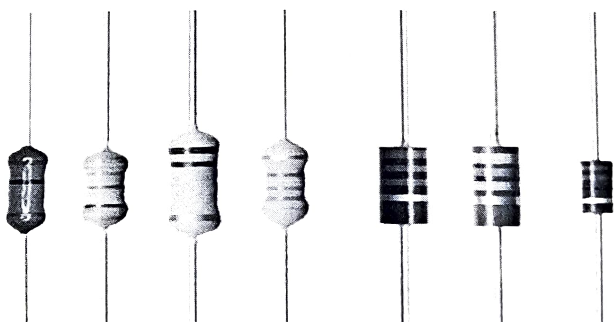


Figure 7.1 Fixed Resistor

Figure 7.2 Variable Resistor



size increse then Power incraese

Less power rating more

Figure 7.3 Carbon Molded Resistors

Resistor Specifications

Current control device

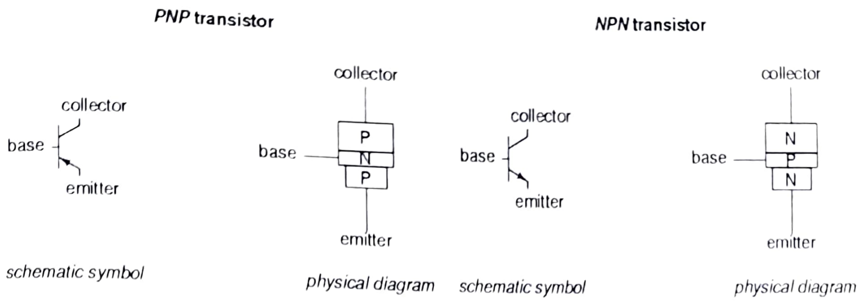
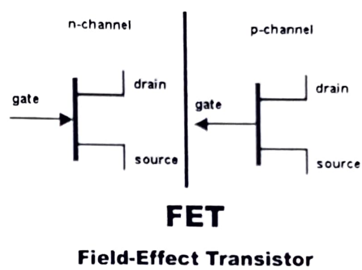


Figure 7.12 Transistor

FIELD EFFECT TRANSISTORS (FET)

It is used as amplifier and oscillator. The symbol of n-channel and p-channel FET is shown below.



voltage control device

Figure 7.13 Field Effect Transistor

CONCLUSION:

→ In this experiment, I learnt various type of Junction diode. Like that P-N Junction Diode, Zener Diode, Tunnel diode, Varactor Diode, Light Emitting Diode (LED), Photodiode, Schottky diode, FET, Bipolar Junction Transistor etc. Also learnt V-I characteristics of all diodes, I learnt resistance, capacitor, and Inductors.

EXPERIMENT NO: 8

AIM: Introduction to testing and Measurement Instruments: Power Supply, Function Generator, Oscilloscope

DIGITAL MULTIMETER

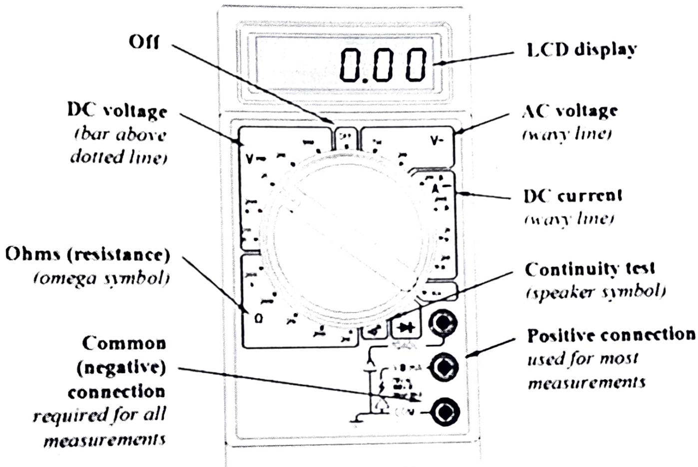


Figure 8.1 Digital Multimeter

- USE: Multimeters can be used as an ammeter, a voltmeter, an ohmmeter; by operating a multi-position knob on the meter. They can measure DC as well as AC. There are also special functions in a multimeter like 'Detecting a Short Circuit', testing transistors and some have additional features for measuring capacitance & frequency.
- All digital meters contain a battery to power the display so they use virtually no power from the circuit under test. They have a digital display as shown. There DC voltage ranges have a very high resistance (usually called input impedance) of 1M or more, usually 10 M, and they are very unlikely to affect the circuit under test. Here we will have discussion on digital multimeter (as they are commonly used). There are three sockets of wire, the black lead is always connected into the socket marked COM, short form for COMMON. The red lead is connected into the socket labeled V mA. The 10A socket is very rarely used.
- Measuring resistance with a multimeter To measure the resistance of a component it must not be connected in a circuit. If you try to measure resistance of components in a circuit you will obtain false readings (even if the supply is disconnected) and you may damage the multimeter. The techniques used for each type of meter are very different so they are treated separately:

Measuring resistance with a DIGITAL multimeter.

- Typically function generators are only able to operate at relatively low frequencies, some only operating to frequencies of around 100kHz, although more costly models can operate at higher frequencies, up to 20 or 30MHz. Despite this the need for function generators is often, but not always in the lower frequency end of the frequency spectrum.

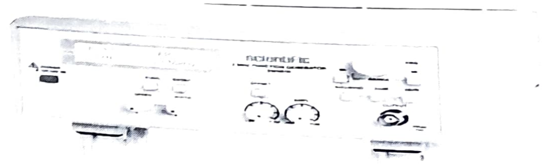


Figure 8.3 Function Generator

Function generator capabilities

Function generators are capable of producing a variety of repetitive waveforms, generally from the list below:
- **Sine wave:** A function generator will normally have the capability to produce a standard sine wave output. This is the standard waveform that oscillates between two levels with a standard sinusoidal shape
- **Square wave:** A square wave is normally relatively easy for a function generator to produce. It consists of a signal moving directly between high and low levels.
- **Pulse:** A pulse waveform is another type that can be produced by a function generator. It is effectively the same as a square wave, but with the mark space ratio very different to 1:1.
- **Triangular wave:** This form of signal produced by the function generator linearly moves between a high and low point.
- **Sawtooth wave:** Again, this is a triangular waveform, but with the rise edge of the waveform faster or slower than the fall, making a form of shape similar to a sawtooth.

Function generator controls

In addition to a selection of the basic waveforms that are available, other controls on the function generator may include:
- Frequency: As would be expected, this control alters the basic frequency at which the waveform repeats. It is independent of the waveform type.
- Waveform type: This enables the different basic waveform types to be selected: o Sine wave
    - o Square wave
    - o Triangular wave
- DC offset: This alters the average voltage of a signal relative to 0V or ground.
- Duty cycle: This control on the function generator changes the ratio of high voltage to low voltage time in a square wave signal, i.e. changing the waveform from a square wave with a 1:1 duty cycle to a pulse waveform, or a triangular waveform with equal rise and fall times to a sawtooth.

Function generators are normally very easy to operate. With modern processing technology often included this gives the possibility of many additional features including ease of operation, and remote control via one or more of the many standards available.

CONCLUSION: In this experiment, I learnt about Function Generator and Oscilloscope. How this device work.

EXPERIMENT NO: 9

AIM:
To measure and calculate L/R time constant for a given RL circuit.

APPARATUS:
Signal Generator, CRO, Resistor, Inductor, wires etc.

THEORY:
- When an inductor is kept in series with a resistance, the Kirchoff's voltage equation is given by

$$L\frac{di}{dt} + Ri = V(t)$$

The particular solution of this equation becomes

$$i(t) = \frac{V}{R}\left(1 - e^{-\frac{R}{L}t}\right) \qquad t \geq 0$$

$$= \frac{V}{R} \qquad t < 0$$

At $t = L/R$

$i(t) = (1 - 0.368)\, I_0$

$= 0.632\, I_0$

$= 63.2\%$ of I_0

Thus the time constant T= L/R has a great importance in electrical engineering.

CIRCUIT DIAGRAM:

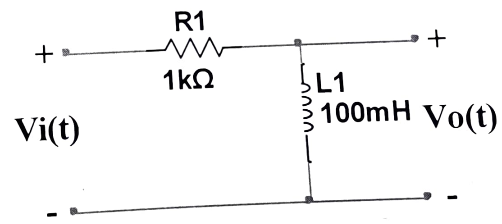


Figure 9.1

PROCEDURE:
1. Connect the circuit as per the circuit diagram in Figure 9.1.
2. With the help of a single generator, input a 5V peak to peak square wave Signal frequency of about 1 KHz.
3. Give an input of square wave and measure the output across the inductor and resistor as per the circuit.
4. Draw the graph for different frequency.

OBSERVATION TABLE:

Parameters	Theoretical	Practical
RL as Differentiator	2.23 mSec	2.2 mSec

RL CKT :-

R	L	V	V transiant	τ
1 KΩ	100mm	2V	1.276	2.2ms
0	100mm			
2KΩ	400mm	2V		

$$-\frac{L}{R} = \frac{-100\times10^{-3}}{10^{3}} = -10^{-4}$$

$$V_L = V[1-e^{-t/\tau}]$$

$$V_L = V[1-e^{-t/\tau}]$$

$$1.276 = 2[1-e^{-t/0.0022}]$$

$$\frac{1.276}{2} = 1-e^{-t/0.0022}$$

$$e^{-t/0.0022} = 1 - \frac{1.276}{2}$$

$$\boxed{t = 2.23\times10^{-3}\,sec}$$

CONCLUSION:

In this experiment, I learnt about how inductor works in RL circuit In lab, we performed this experiment and got some time value of Inductor's Charging and Inductor's discharging. In lab, we noticed how charging of Inductor occurs and after charging of Inductor, how much time was taken by Inductor for discharging.

EXPERIMENT NO: 10

AIM:
To measure and calculate RC time constant for a given RC circuit.

APPARATUS:
Signal Generator, CRO, Resistor, Capacitor, wires etc.

THEORY:

- When a Capacitor is kept in series with a resistance, the Kirchhoff's voltage equation is given by

$$V = \frac{1}{C}\int i(t)dt + Ri(t)$$

Thus the time constant of the circuit is given by T = RC.

The particular solution of the voltage v(t) for above equation is $v(t) = V0(1 - e^{-\frac{t}{RC}})$

At t = RC

$v(t) = (1 - 0.368)\ V_0$

$= 0.632\ V_0$

$= 63.2\%$ of V_0

Thus the time constant T= RC has a great importance in electrical engineering.

CIRCUIT DIAGRAM:

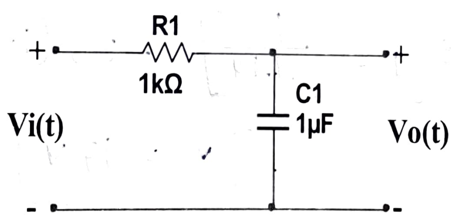


Figure10.1

PROCEDURE:

1. Connect the circuit as per the circuit diagram as shown in Figure 10.1
2. With the help of a single generator, input a 5V peak to peak square wave Signal frequency of about 1 KHz.
3. Give an input of square wave and measure the output across the capacitor and resistor as per the circuit.
4. Draw the graph for different frequency.

OBSERVATION TABLE:

Parameters	Theoretical	Practical
RC as Integrator		
RC as Differentiator		

Charging :-

volt	time
5	00 : 26 : 34
8	00 : 45 : 49
15	02 : 04 : 48
17	02 : 55 : 00

→ $V_s = V_o = 25V$

→ $C = 36\,\mu f$

→ R(DMM = $4.26\,M\Omega$
&
R DECADE)

→ 02 : 55 : 00 = 175 sec

$$V = V_o(1 - e^{-t/RC})$$

$$= 25(1 - e^{-175/4.26\times10^{6}\Omega\times36\times10^{-6}})$$

$$= 25(1 - e^{-175/153.36})$$

$$= 25(1 - e^{-1.14})$$

$$= 25\left[1 - \frac{1}{e^{1.14}}\right] = 25(1 - 0.32)V$$

$$\boxed{V = 17\,V}$$

CONCLUSION:

In this experiment, I learnt about Capacitor. And Also learnt about RC circuit. How RC circuit will be work, what is the role of capacitor in circuit. I learnt how capacitor work, how occurs charging and discharging in capacitor. In lab we perform this experiment and in experiment, I learnt resistance was something then How much time was taken by Capacitor to do charging and how much time was taken for discharging.