



## Pedagogical Teaching Aids

Sem: V

Sub Name : Electromagnetic Waves

Sub. Code:18EC55

As Electromagnetics is one of the core critical course of Electronics and Communication Engineering. The course has to be learnt in three dimensional co-ordinate systems namely 1. Rectangular co-ordinate System 2. Cylindrical co-ordinate System 3. Spherical co-ordinate System.

### 1. Rectangular Co-ordinate System

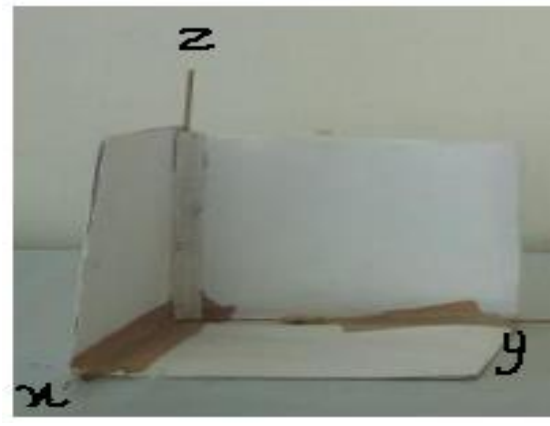


Fig.1: Rectangular Co-ordinate System

**Description :** Rectangular co-ordinate system has x, y and z as it's vertices Usually x- direction is considered to in a direction coming out from the board y is assumed from left to right direction and z is upward movement to convince the co-ordinate system and constant planes a model with card sheet and paper prepared as depicted in Fig. 1.

### 2. Cylindrical Co-ordinate System

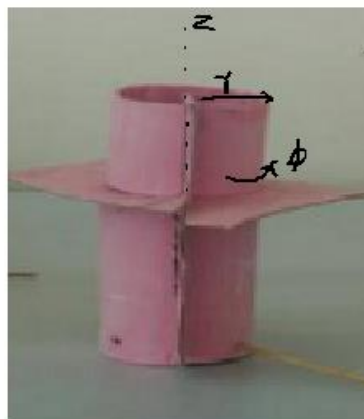
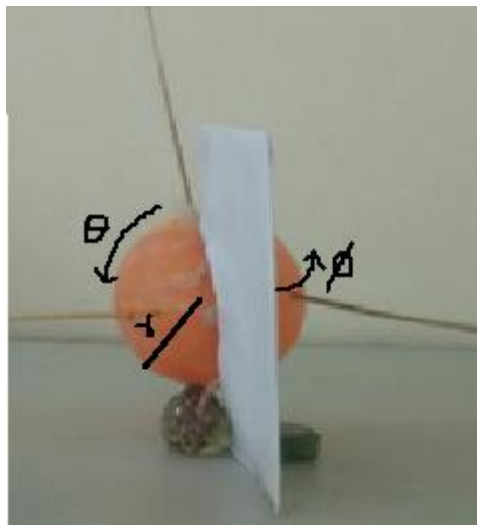


Fig.2: Cylindrical Co-ordinate System



**Description :** Cylindrical co-ordinate system has  $r$ ,  $\theta$  and  $z$  as it's vertices,  $z$ - direction is same as considered in rectangular co-ordinate system. The  $r$  direction is along the radius of the cylinder and  $\theta$  is an angle defines the circularity of the cylinder, varies from 0 degrees to 360 degrees for the complete cylinder. To convince the vertices and constant planes of this co-ordinate system a model with card sheet and paper prepared as depicted in Fig. 2.

### 3. Spherical Co-ordinates System



**Fig.3: Spherical Co-ordinate System**

**Description :** Spherical co-ordinate system has  $r$ ,  $\theta$  and  $\phi$  as it's vertices,  $z$ . The  $r$  direction is along radius of the sphere. The  $\theta$ - direction is top- down movement the sphere, which is measured from  $z$ -direction and it's an angle. For the complete sphere  $\theta$  runs from 0 degrees to 180 degrees. Movement in  $\theta$  -direction depends on  $r$ . i.e ( $rd\theta$ ). The  $\phi$  is an angle varies from 0 degrees to 360 degrees to make the complete sphere. To convince the vertices and constant planes of this co-ordinate system a model with card sheet, ball and paper prepared as depicted in Fig. 3.

**Outcome :** As per the oral feedback by students these models truly help in conveying the various co-ordinate systems thoroughly. hence help in better understanding of the course.

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**Course Incharge**



## Pedagogical Teaching Aids

**Sem: III**

**Sub Name : Digital System Design**

**Sub. Code:18EC34**

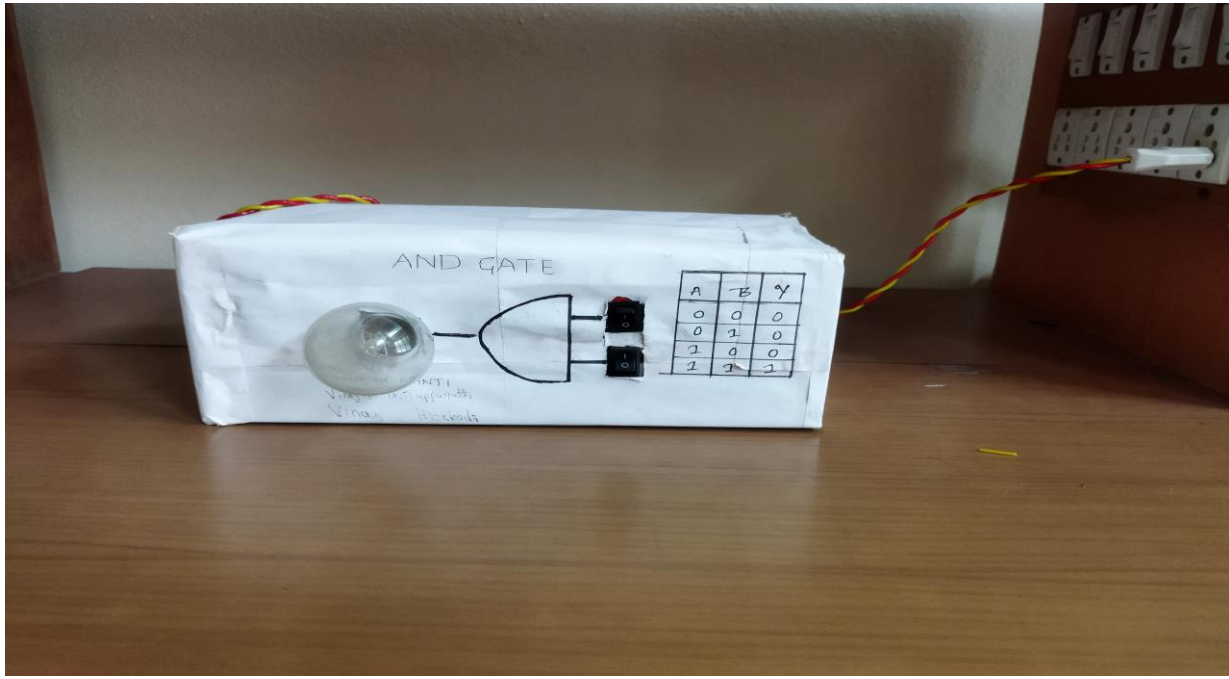
**Description :** An AND gate is a logic gate having two or more inputs and a single output. An AND gate operates on logical multiplication rules. In this gate, if either of the inputs is low (0), then the output is also low. If all of the inputs are high (1), then the output will also be high. An AND gate can have any number of inputs, although 2 input and 3 input AND gates are the most common.

In this model, inputs A & B are used as normal switches with low & high position and output Y is used as Bulb. If inputs AB is equal to 00, 01 & 10 respectively then output is equal to 0 (low) means bulb is OFF condition. If AB is equal to 11, then output becomes 1 (high) means bulb is ON condition.

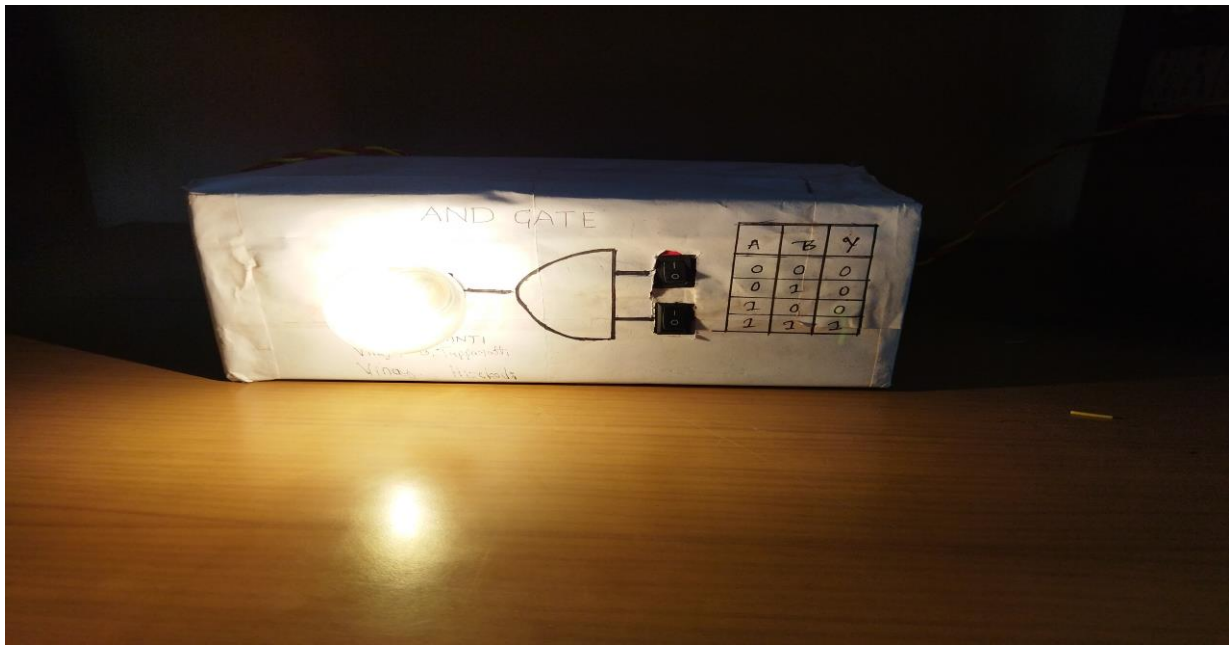
The AND gate is used for data transmission control in digital electronics. AND gate allows or disallows the transmission of data through a channel. AND Gates are used in digital measuring instruments. AND gates are also used in alarm circuits.

A	B	Y = AB
0	0	0
0	1	0
1	0	0
1	1	1

**Table 1 : Truth Table of AND Gate**



**Fig.1: When inputs AB = 00,01 & 10, Outputs =0 (Bulb is OFF Condition)**



**Fig.2: When inputs AB = 11, Output =1 (Bulb is ON Condition)**

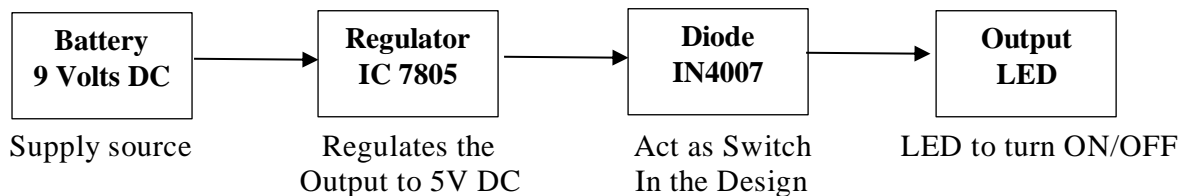
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### Diode As Switch

**Title: To switch ON/OFF an LED using diode in forward and reverse bias using battery cell.**

#### Block Diagram



**Description:** Above block diagram shows how the diode act as switch, here 9 Volts battery act as supply source to the circuit. Output of 9 V battery is given to the input of fixed voltage regulator IC 7805. IC 7805 regulates the incoming DC 9V to output 5 V DC then this voltage is applied to diode IN4007. When the diode is forward biased it act as closed switch and current will flow through the diode and output LED become ON. When the diode is reverse biased it acts as open switch hence there is not current flows through diode circuit and LED become OFF.

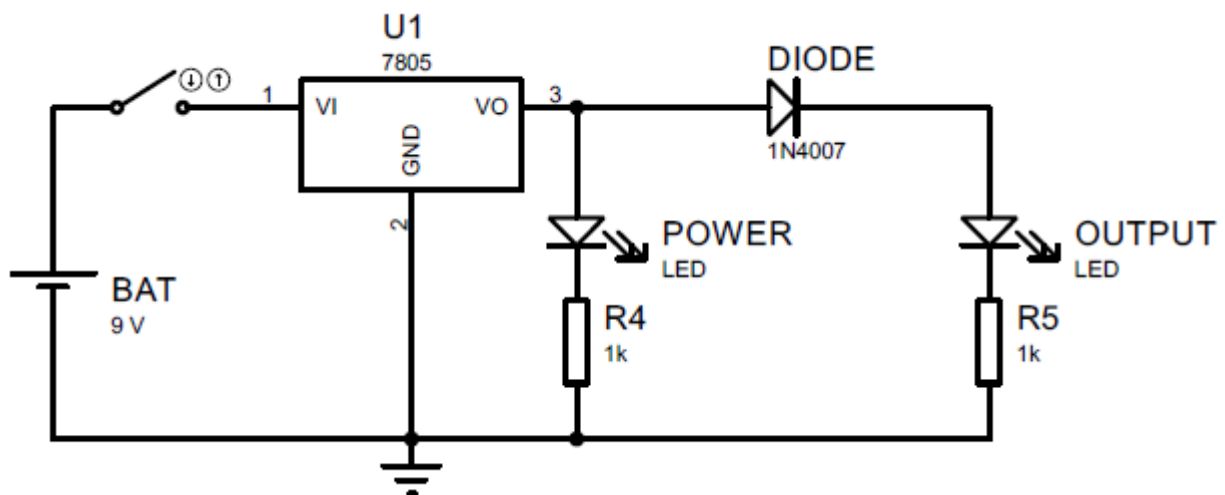


Fig1. Circuit diagram of a diode as a switch.

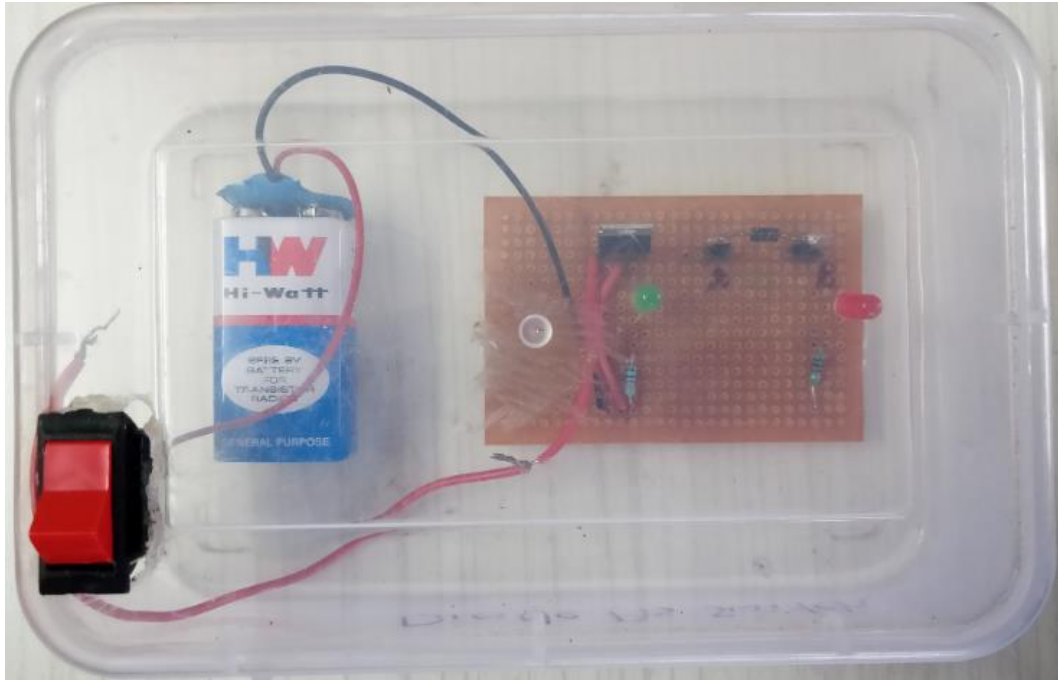


Fig2. Circuit Implementation

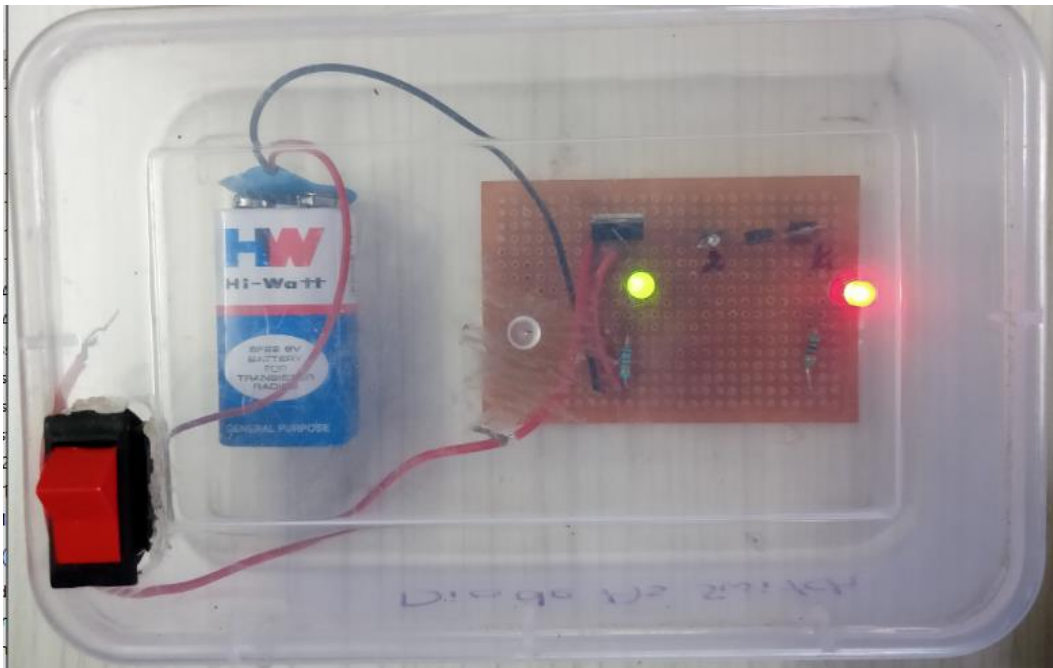


Fig3. Power ON and when diode is forward biased

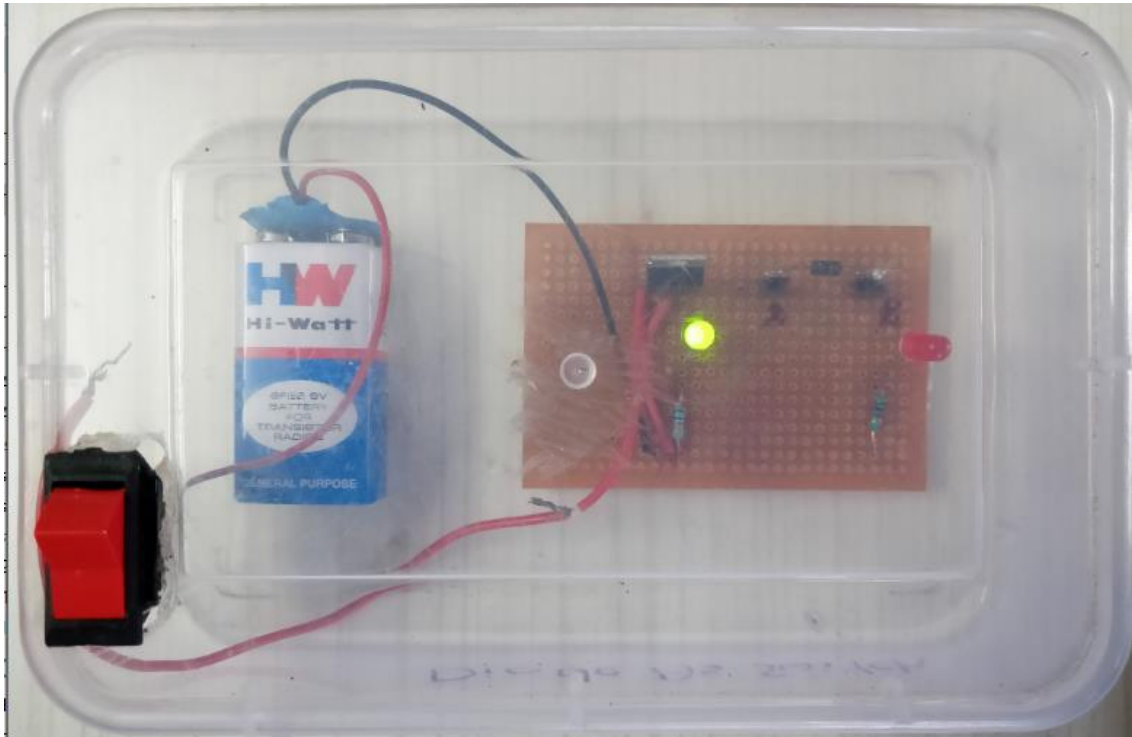


Fig4. Power ON and when diode is Reverse biased

Fig1. Shows the circuit used to show how diode used as switch and Fig2. Shows the implementation of the circuit used. Here switch is used to make circuit activate/deactivate and green color LED is used to indicate power is ON through IC 7805. When the output of IC 7805 is given to anode of the diode and cathode of the diode is connected to ground via output led and resistance 1k diode is forward biased and output LED (RED LED) is become ON as shown in the Fig3. When the output of IC 7805 is given to cathode of the diode and anode of the diode is connected ground through output LED. Diode is reverse biased and output LED will turn OFF as shown Fig4.

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## Pedagogical Teaching Aids

Sem: VI

Sub Name: Digital Switching System

Sub. Code:17EC654

Digital switching system is one of the communications subjects of Electronics and Communication Engineering. The course gives the switching system of the telecommunication. The basic system with relay is shown below

### 1. Relay switching System: On



Fig.1: Switching on



## 2. Relay switching System: Off

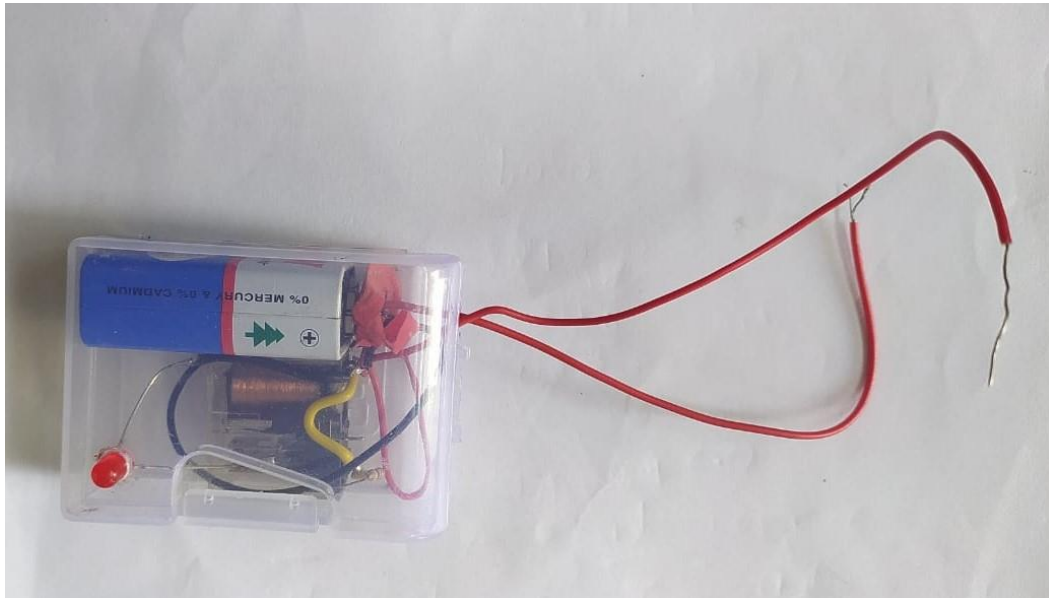



Fig.2: Switching off

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		<b>NBA</b>
		<b>Teaching Aids</b>
		<b>2021-22</b>

## 3. Working of relay

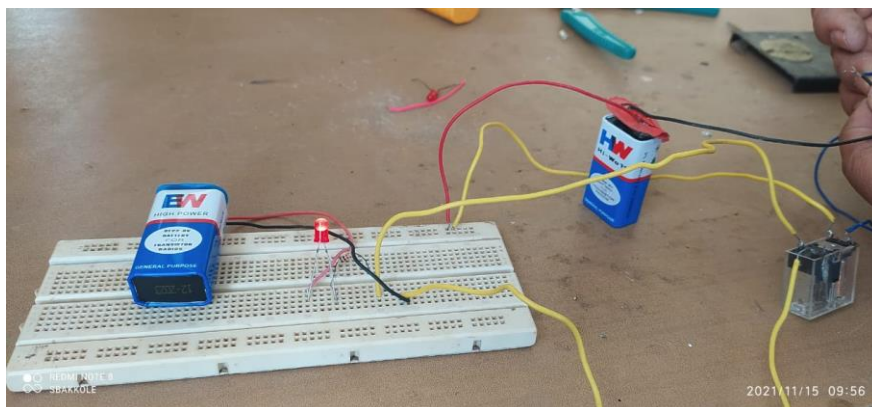


Fig.3: Working of relay

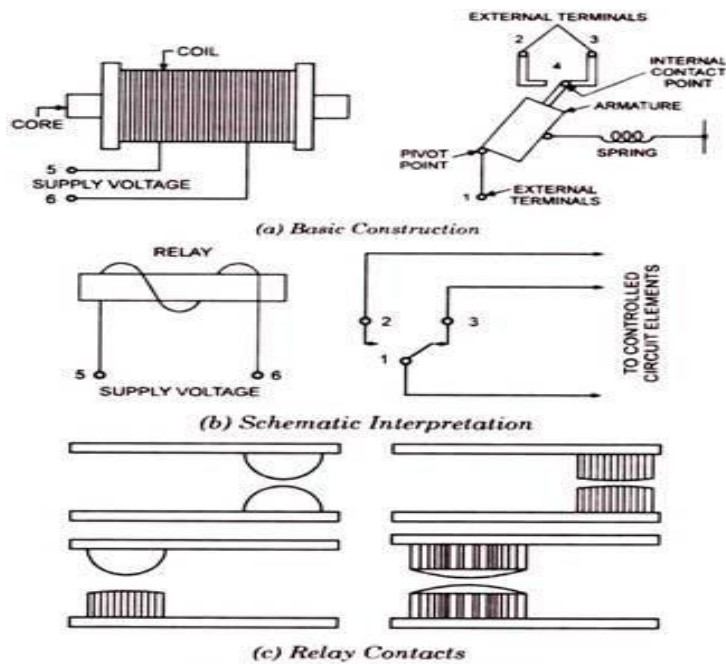
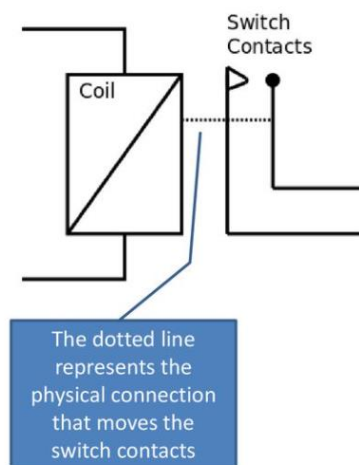


Fig. 2.25. Electromagnetic Relay



The dotted line represents the physical connection that moves the switch contacts

The Electromagnetic relay has three main parts:

- The electromagnetic coil. The coil typically has a resistance of several hundred ohms and only needs a few mA to work.
- The mechanical connection from the coil to the switch, this is called the armature
- The actual mechanical switch or switches – commonly DPDT.



An electromagnetic relay is a type of switch.

The 'relay' is controlled by a low power circuit such as a logic gate or comparator. This small electrical signal controls a mechanical switch.

The mechanical switch contacts can often carry large currents and cope with high voltages. The switch is part of an entirely separate circuit and controls output transducers such as heaters, motors and other high power devices.

Any external circuit connected between terminals 1 and 3 is in a closed position at this instant and the external circuit connected between terminals 1 and 2 is in an open position. When the voltage is applied to the coil, the relay is energized and the magnetic field set up around the coil makes the armature to be attracted toward it. Contact 4 breaks with terminal 3 but makes with terminal 2, and any external (controlled) circuit connected between terminals 1 and 2 is now completed. The relay remains in the position till the coil remains energized.

The schematic interpretation of this basic relay is illustrated in Fig. 2.25 (b). Terminals 2 and 3 are the fixed contacts, and terminal 1 is connected to the movable armature (in some relays the armature remains isolated from all contacts). The contacts of the basic relay act as single pole double throw (SPDT) switch. Although switch contacts are manually controlled, but relay contacts are remotely controlled.

#### Advantages of a relay:

- Can control both A.C. and D.C
- Control circuit and output circuit are electrically separate
- Can switch very large currents and voltages

#### Disadvantages of a relay:

- Slow compared to transistors (<50Hz)
- Noisy when switching
- Produces a large back e.m.f. which can damage other circuits
- Switch contacts wear out

**Outcome:** As per the feedback by students these models truly help in understanding of how switching is done in telecommunication and also learn the working of electromagnetic relay.

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