Name.....
Class/Sec.....Roll No.....
Object.....

* Electric Protective Devices *

1. Miniature Circuit Breaker (MCB) :-

→ Construction :-

(i) External Casing :- External casing holds all the internal components firm and protects them from dust. It is made of insulating material such as plastic or ceramics.

(ii) Contacts :- An MCB consists of a pair of contact per phase. One of them is a fixed contact and the other is movable. The movable contact is attached to the external knob. It enables the opening and closing of the breaker.

(iii) Knob :- External knobs are present to manually turn ON and OFF the devices.

(iv) Mechanical latch :- An latch arrangement is made inside MCBs to hold the contacts under spring tension at the ON position.

(v) Bimetallic Strip :- The bimetallic strip offers delayed overload protection by sensing the prolonged flow of current greater than its rated current

(vi) Solenoid :- Solenoid offers instantaneous

protection against short circuits by releasing the mechanical latch. Solenoid gets activated when the current through the coil exceeds a particular value, normally more than 3 times its rated current. The solenoid is not activated by overloads

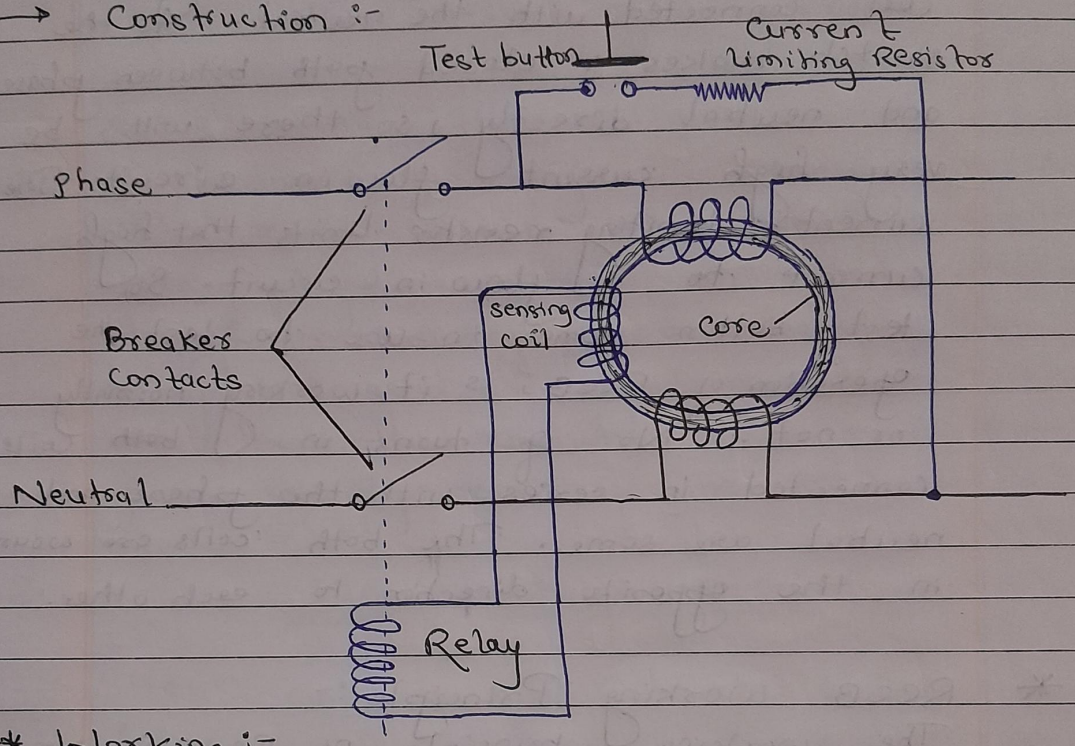
(vii) Arc Chutes :- Arc chutes are used for splitting and quenching arcs. This enables arc extinction during short circuits and on-load opening of the breakers.

* Function of MCB :-
(i) Switching (ii) Overcurrent protection
(iii) Short circuit protection (iv) Arc Quenching

* Working of MCB :- In case of overloads, a current more than the rated current is driven through the contact and the bimetallic strip. As the current flows through the bimetallic strip, time depends on the amount of current flowing through the strip. The higher the current faster will be the deflection of the bimetallic strip. During short circuits, a transient current flowing through the solenoid forces the plunger towards the latch. This action instantaneously releases mechanical latch and opens the contact immediately.

2. Residual Current Circuit Breaker

→ Construction :-



* Working :-

The main element of the RCCB is the Core consisting of three coils. One coil is to be connected in series with the phase, another coil is to be connected in series with the neutral. And the sensing coil is connected to the relay. The relay used in the RCCB is a current sensing relay. The main function of the relay is to actuate or send the signal to the circuit breakers contacts when a leakage current arises in the circuit

→ RCCB has a Test button series with a current limiting resistor. The function of

this switch is when it is pressed the current will flow through the coil connected with the neutral. As the switch makes a closed path between phase and neutral directly, so there will be very high current flow in circuit. The current limiting resistor limits that high current to flow in circuit. So, test button comes in use to test the operation of RCCB, is it working normally or not. No. of turns in both coils connected in series with the phase and neutral are same. The both coils are wound in the opposite direction to each other.

* RCCB Working Principle :-

The working principle of RCCB is very simple. When there is no fault in the circuit, the phase and neutral will carry an equal current. As the equal current flows in both phase and neutral coil, they will produce the same amount of magnetic flux and as they're wound in opposite direction, the resultant magnetic flux. As the flux is zero, there will be no current flow in sensing coil or the relay.

→ When Earth leakage or earth fault occurs, the current will start flowing from phase to the ground. So, as

unbalanced current starts flowing through the phase and neutral. As unbalanced current flows, the magnetic flux produced by the phase and neutral coil also be unequal So, a resultant flux will produce which cause to produce an emf in sensing coil. As the sensing coil is in a closed circuit with relay, a current will start flowing through the sensing coil and relay. The relay will send a signal to circuit breaker to break the contacts to disconnect the power supply or trip the RCCB.

3. MCB Changeover

→ It consists of Bi-stable Clip, large cable terminals, centre position OFF etc

Construction :-

The entire switching mechanism along with the fixed and moving contact assembly are housed in FR thermo plastic moulded case/cover, having high dielectric strength, excellent mechanical and thermal properties.

The switching mechanism is double break type. The contacts tips are made of Silver Cadmium oxide for long electrical life, sustained

current carrying capacity and they ensure temperature rise is within specified limits.

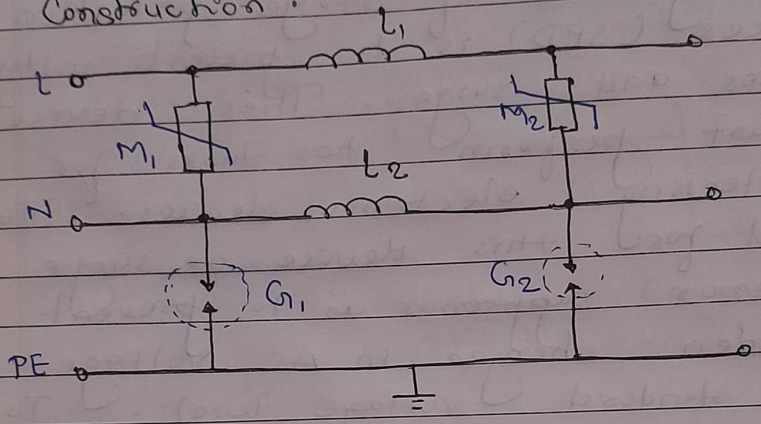
Working :- In an Emergency Power Supply System (EPSS), a transfer switch can change the flow of electrical energy from the primary source to an alternative backup source - such a generator - when a power failure occurs.

This device isolates the alternative power source from the main source for the duration of power failure or to prevent a possible overload.
When power is restored to main source the device can switch the flow of electric power back to the main source.

→ An automatic changeover switch has the ability to detect when a fault or restore occurs on the primary source and automatically switch between the two source as needed.
Transfer switch detects a power failure and automatically commands the generator to turn on.

4. Surge Protection Device

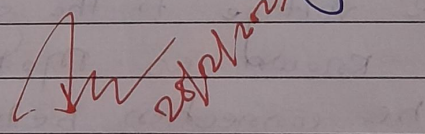
* Construction :-



The device passes the electrical current from the port to electronic devices. If any spikes or surge voltage occurs those can be forwarded to ground lines with help of MOV. It is a component in SPD's plays an important role while providing the surge voltage to the ground wire. MOV is known as Metal Oxide Varistor. It's the connection between the hot power line and the ground wireline. G1 and G2 are the gas discharge tubes. From fig, Common-mode surge voltage appears between L-PE and N-PE. And these can be limited by M1-G1 and M2-G2 and G1-G2. Differential surge voltage appeared between L-N and it is limited by M1-M2

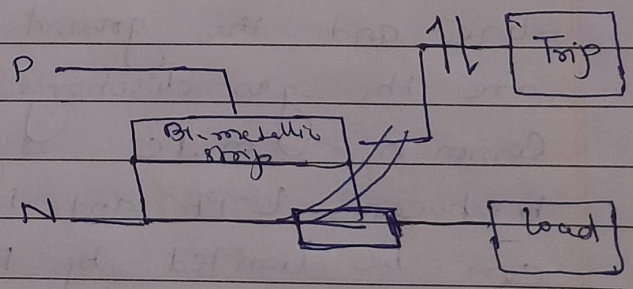
→ Working :-

The importance of surge protection devices (SPD) is to prevent voltage spikes and surges. This device must perform two tasks for protecting electronic devices. The need for this device or surge processor suppressor is to prevent sudden changes in AC voltages than the standard voltage level. To avoid the surge effect surge protection devices are useful. These devices forward the voltage from ports to the the devices through power lines. If the surge occurs this surge suppressor device pass extra voltage to the grounding wire.



MCB

i) Overloading :-



P → Bi-metallic contact - Bend - Trip down
→ No current flow through load