SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF BIOMEDICAL ENGINEERING

COURSE NAME: 23EET103/ ELECTRIC CIRCUITS AND ELECTRON DEVICES

I YEAR / II SEMESTER

Unit III – ELECTRICAL WIRING AND SAFETY

Topic : Grounding

GROUNDING

- Grounding (in US) or Earthing (in UK) is a process of connecting electrical systems, appliances and metal enclosure to ground.
- Ground refers to the physical connection to Earth which acts as a reference point and also a return path for current.
- The main purpose of grounding is to provide a low resistance path for electricity to flow.
- Grounding can implement the connection to ground with the help of a grounding electrode.

GROUNDING

- A typical grounding system consists of two parts. In the first part, all the individual branch circuits consist of a wire (ground wire) that we connect to the metal frame of outlet boxes, appliances, tools, etc. All the ground wires from individual branch circuits reach the main circuit breaker panel and connect to the ground bus.
- The second part of the grounding system consists of a large copper wire (known as grounding electrode conductor) that is connected to a ground rod buried in earth.

TYPES OF GROUNDING

- **Low Voltage Systems (**the supply to residential and small industrial users, the grounding arrangement can be TN, TT or IT)

  Here, the first letter indicates the connection between transformer and earth (T – direct connection to earth and I – No connection with earth). The second letter indicates the connection between the electrical equipment at the consumer and earth (T – Local earth connection and N – electricity supplier provides the earth connection)

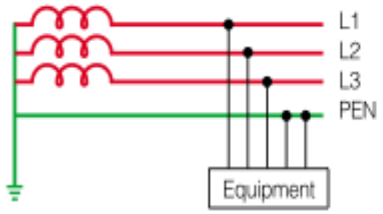
- **High Voltage Systems** (Power generation stations, Substations etc. form the high voltage network that are quite different from the low voltage distribution transformers and consumers)

TYPES OF LOW VOLTAGE GROUNDING

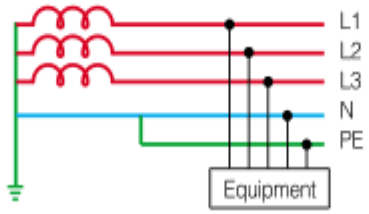
- **TN Grounding**
- In TN earthing system, the star point of the transformer (neutral) is connected to earth and at the consumer side, the ground wire of electrical appliances is connected with this connection.
- TN-S: The ground and neutral conductors are separate and are connected at the transformer.
- TN-C: Ground and neutral conductors are the same.
- TN-C-S: Separate ground and neutral conductors but only near the consumer side.
- **TT Grounding**
- In this type of grounding, the grounding at the transformer and at the consumer are independent i.e., the star point (neutral) at the transformer is connected to earth and a local ground electrode acts as a grounding point at the consumer. These two points have no connection.
- **IT Grounding**
- In IT grounding, there is no grounding at the transformer but there is a local grounding using a ground electrode at the consumer.

TYPES OF LOW VOLTAGE GROUNDING

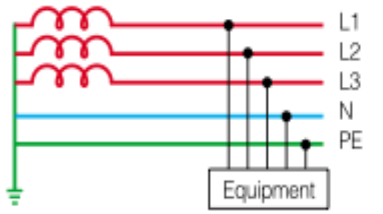
TNC system
230/400 V



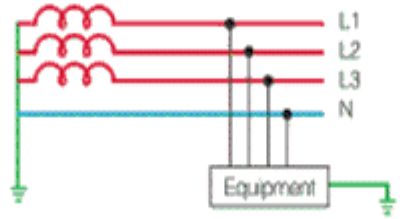
TNC-S system
230/400 V



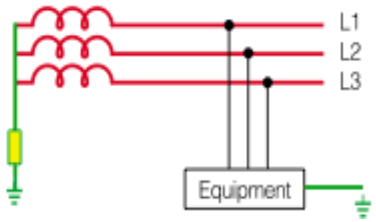
TNS system
230/400 V



TT system
230/400 V



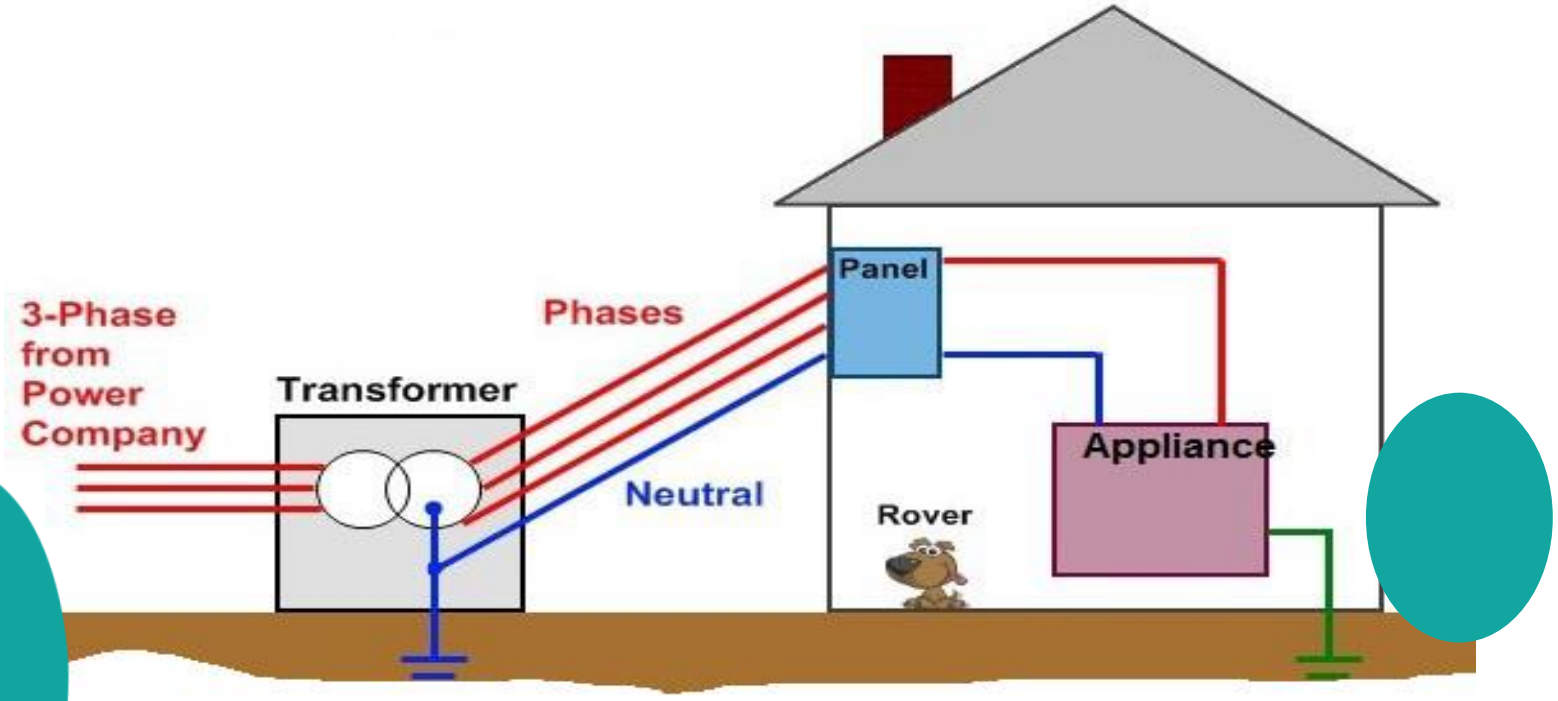
IT system
230/400/600 V



- ✓‘T’ - Direct connection to earth
- ✓‘I’ – Isolated
- ✓‘N’ – Neutral
- ✓‘S’ – Separate
- ✓‘C’ – Combined
- ✓ ‘PEN’ – Protective Earth + Neutral

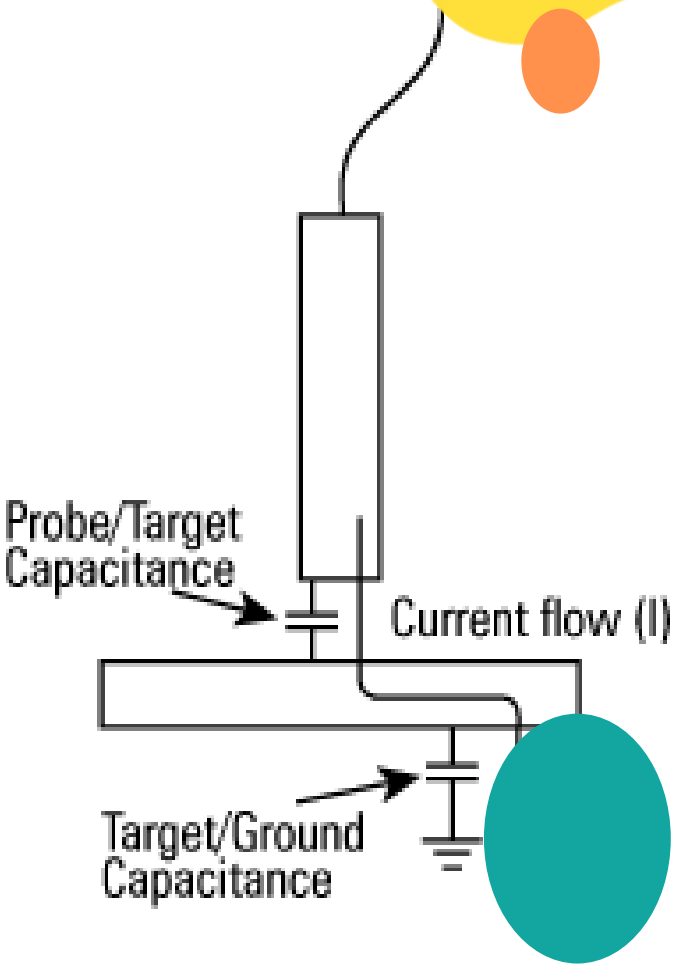
TYPES OF HIGH VOLTAGE GROUNDING

- These three systems are:
  - ➢ Ungrounded Systems
  - ➢ Resistance Grounded Systems
  - ➢ Solidly Grounded Systems



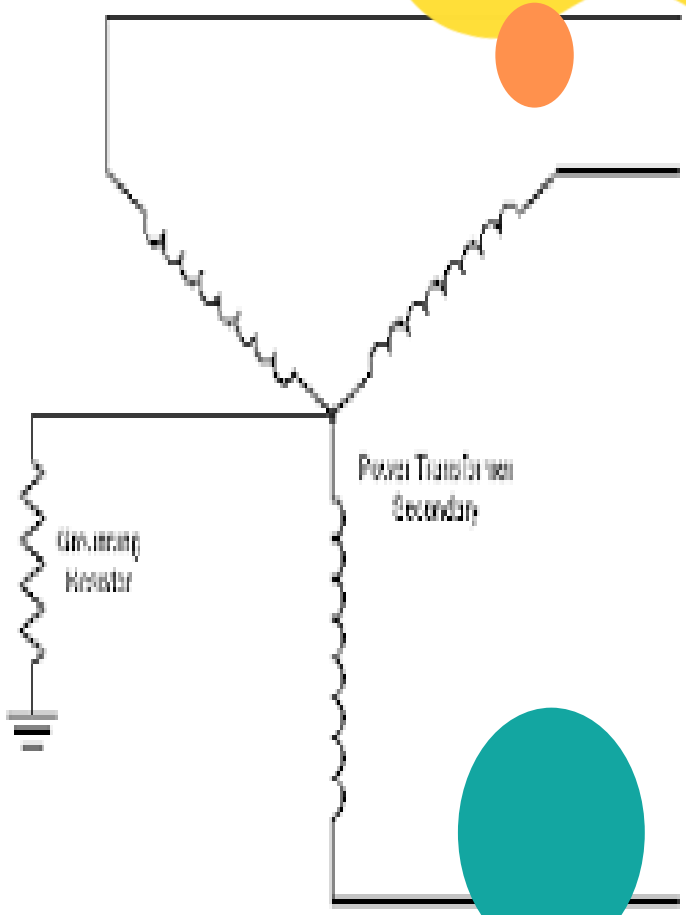
UNGROUNDED SYSTEM

- An ungrounded system isn't really ungrounded. Electrically, system is connected to ground through the capacitance between the lines and the earth, that it's a capacitance grounded system.
- It ungrounded because of convention, and because there isn't a direct physical connection between any of the power lines and the ground.



RESISTANCE GROUNDING SYSTEM

- Resistance grounding is when a connection between neutral line and the ground through a resistor. This resistor is used to limit the fault current through your neutral line:
- if voltage doesn't change, then current is dependent on the size of the resistor according to Ohm's law (V=IR).



ADVANTAGES OF RESISTANCE GROUNDING

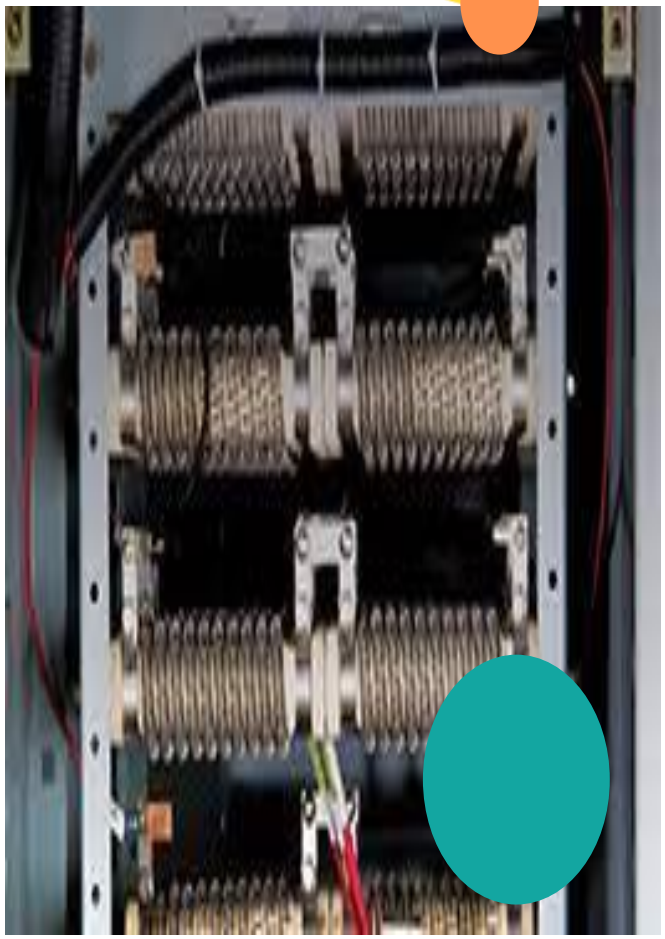
- Because the current in the neutral is controlled instead of negligible, system over voltages are also controlled.
- This reduced current and reduced overvoltage means reduced heat, which keeps the wear and tear of electrical system to a minimum.
- This is especially important for keeping motors safe, since the reduced current will not damage the magnetic iron of the motor (which is costly to repair). The reduced currents also reduce the risk of shock and arc flash/blast hazards.

TYPES OF RESISTIVE GROUNDING

- There are two types of Resistive Grounding
  - ➢ High Resistance Grounding
  - ➢ Low Resistive Grounding

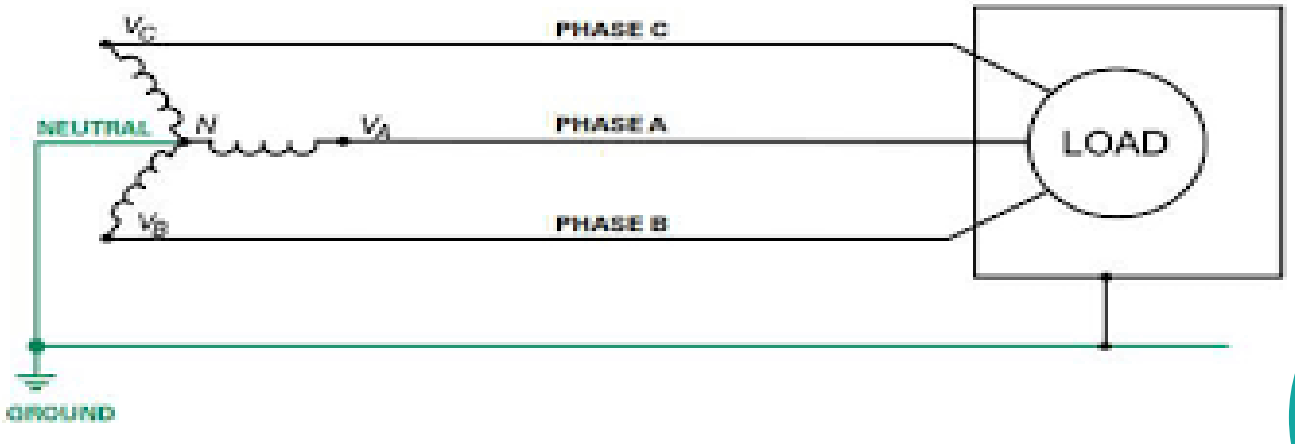
HIGH RESISTIVE GROUNDING

- High resistance grounding is typically used to limit ground fault current to < 10 amps.
- The low ground-fault current also means that, just like an ungrounded system, It can continue to operate the system on a single line-to-ground fault. The low current will typically not trip your protective devices during a single line-to-ground fault.



LOW RESISTIVE GROUNDING

- Low resistance grounding typically limits grou[illegible]ult current to between 100 and 1000 amps.
- Low resistance grounding also reduces overvoltage, and is used in medium voltage systems of 15kV or less, typically where big generators/motors are used.



SOLID GROUNDING

- Solid grounding is connect, without any sort of resistance in the way. The ground is typically connected to the system at a neutral point, like the neutral terminal of a generator or transformer.
- Solid grounding has two main uses:

➢ In systems with voltages of 600V or less, solid grounding can be used if it is not necessary to maintain operation of a faulted circuit.

➢ In systems with voltages of 15kV or greater, solid grounding can be used if high ground fault currents are desirable of any reason, such as quick ground fault detection

Thank You