Practical No.15 Use of earth tester for measurement of earthing resistance of a installed earthing of laboratory.

I Practical Significance:

Earthing System or Grounding System is an electrical network work as a safety measure to protect human life as well as equipment. The main objective of the Earth testing is to measure the value of earth resistance and compare and maintain it with recommended value of earth system resistance.

II Industry/ Employer Expected Outcomes(s):

Use earth tester for measurement of earthing resistance.

III Course Level Learning Outcomes(s):

Use Electrical safety devices in electrical circuit.

IV Laboratory Learning Outcomes(s):

Measurement of earth resistance.

V Relevant Affective Domain related outcome(s):

Follow safety electrical rules for safe practices.

VI Minimum Theoretical Background:

The instrument used for measuring the resistance of the earth is known as earth tester. All the equipment of the power system is connected to the earth through the earth electrode. The earth protects the equipment and personnel from the fault current. The resistance of the earth is very low. The fault current through the earth electrode passes to the earth. Thus, protect system from damage. As per Indian standard as well as international standard (IEEE and IEC), earthing resistance should not be more than following recommended value for various installations:

1. Household-5 Ohm
2. Power station-0.5 Ohm
3. Major substations- 1 Ohm
4. Minor substation-2 Ohm

Earth tester is a special type of megger used for measurement of earth resistance having additional constructional features of rotating current reverser and rectifier. It has four terminals namely P1, P2 and C1, C2. Two terminals PI and C1 are shorted to form a common point to be connected to the earth electrode. P1, P2. The other two terminals P2 and C2 are connected to auxiliary electrodes P and C respectively.

IX Precautions to be followed:

1. Read carefully the instructions of the manufacturer.
2. All connection should be tight.
3. Select the proper range of tester.
4. Handle rotation should be as per instruction given on instruments.

X Procedure:

1. Connect the earth tester and connecting cables.
2. Drive the current electrode at a distance of 30 meters from the main electrode.
3. Drive the potential electrode midway between the main and current electrodes.
4. Short the terminal C1 and P1, of the earth tester (if four terminals) and connect the terminals to the main electrode.
5. Connect the terminal P2 and C2 of the earth tester to the potential electrode and current electrodes respectively.
6. Rotate the earth tester at its rated speed.
7. Measure the resistance of the earth electrode directly in the tester and enter the value in observation table.
8. Repeat the measurement by shifting the auxiliary electrode position as state in Nos. 2 to 4 of observation table.
9. Calculate average value of earth resistance.
10. If the value is found more than 5 Ohm, pour water in funnel of earth electrode a measure the earth resistance.

XI Resources Used (Student should the required resources):

Sr. No.	Name of resources	Broad Specification	Quantity
1	Earth tester with -	Analog type	1 set.
2	Hammer ball pen	1 kg	1 No.
3	Combination plier	200 mm	1 No.
4	Screw driver	300 mm	1 No.

XII Actual Procedure followed:

1. Connect the earth tester & connecting cables.
2. Drive the current electrode at a distance of 30 meters from the main electrode.
3. Drive the potential electrode midway between the main & current electrodes.
5. Connect the terminal P2 & C2 of the earth.

testor to the potential electrode & current electrodes respectively.
6. Rotate the earth testor at its rated speed.

XIII Observations and Calculations:

S.N.	Position of electrode	Earth resistance	Average Earth resistance
1	Current electrode 30m, Potential electrode 15m(from the main electrode)	420	
2	Current electrode 40m, Potential electrode 20m(from the main electrode)	318	269.8
3	Current electrode 36m, Potential electrode 18m(from the main electrode)	230	
4	Current electrode 24m,Potential electrode 12m (from the main electrode)		

XIV Results:

Hence we have studied in this practical to use of earth testor for measurement of earthing resistance of a installed earthing of laboratories.

XV Interpretation of results (Giving meaning to the results):

to use of earth testor for measurement of earthing resistance of a installed earthing of laboratories

XVI Conclusions and Recommendations:

we have studied to use of earth testor for measurement of earthing resistance of a installed earthing of laboratories

XVII Practical Related Questions:

1. State the methods of reducing resistance of the earth electrode.
2. What will happen, if two earth electrodes are joined together?
3. What will be the effect of change in the speed of rotation of earth tester?
4. State the causes of higher value of earth resistance.
5. State the operating principle of earth tester.

[Space for answers]

Q.1. to reduce the resistance of an earth electrode increase the electrodes length and diameter use multiple electrodes treat the soil around the electrode to improve conductivity or use electrolytic grounding electrodes.

Q.2. Joining two earth electrodes together ideally through binding conductor creates a single more robust grounding system.

Q.3. A change in the earth's rotational speed would have significant consequences including shorter days and nights altered gravitational effects and nights potential disruptions to weather patterns and ocean currents.

Q.4. higher earth resistance values are primarily caused by soil resistivity shallow electrode depth poor electrical contact inadequate grounding conductor and corrosion of electrode material

Q.5. An earth tester or earth resistance meter operates on the principle of ohm's law ($V = IR$).