5.EXPLAIN THE FOLLOWING:

a. **Electrical method**
b. **Seismic method**

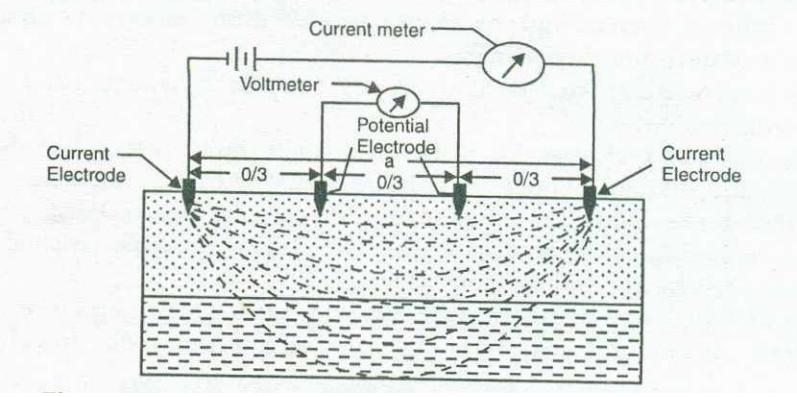
A. Electrical Methods

Principle.

- All electrical method are based on the fundamental fact that different materials of earth' s crust possess widely different electrical properties.
- Resistivity, electrochemical activity and dielectrical constant are some of these properties that are generally studied through these methods
- potential-drop methods: the natural potential may be due to electrochemical reactions between the solutions and the surrounding - subsurface rocks.
- These reactions are not always of the same order throughout the dimensions of the rock masses thereby creating a potential difference and conditions for flow of current from one end to the other end.
- Elongated ore bodies of magnetite and pyrite etc. are easily delineated by this method.
- Natural electrical potential is measured with the help of nonpolarising electrodes along definite directions and results are plotted in terms of potential gradient along horizontal distances which are then interpreted.

Potential Drop Methods.

- These include a variety of methods in which electrical current is artificially introduced from an external source at certain points and then its flow through subsurface materials recorded at different distances.
- In the Equipotential Method two primary electrodes are inserted into the ground, 6-7 meters apart from each other, across which current is introduced.
- The position of these primary electrodes remains fixed in the subsequent investigations.
- Potential between these primary electrodes is determined with the help of two search electrodes and points of equal potential found out along the entire region under investigations, which are jointed to get equipotential lines.



- Under normal conditions, that is, when the material below is of uniform nature, electrically c the ec lines would be regular in character.
- But in cases when the material w is not of uniform character (that is, it contains patches of high or low conductivity), equipotential lines would show clear

distortions or irregularities which would include probable location of rock masses of different characteritics.

- The Resistivity Method is similar to equipotential method but in this case it is the resistivity of the material of the subsurface which is determined and from which important interpretations are made
- Here also, a known current is introduced through two electrodes- current electrodes, which are inserted at some distances apart from each other.,

$$\rho = 2\pi \frac{d.v}{I}$$

Investigation.

- The depth of penetration of electrical current in these investigations is broadly equal to although there are many conditions attached to this generalization.
- The resistivity method envisages interpretation of the qualitative as well as quantitative characters of the subsurface materials which are governed by two basic principles

(i) If material below is of uniform nature, the resistivity values would be of regular character.

(ii) If the material is non-uniform, that is, it consists of layers or masses of different character, then these would be indicated by irregularities or anomalies in the resistivity values.

(iii) The depths at which these anomalies occur can be calculated and also the nature of the subsurface material broadly understood.

Applications:

(a) In Prospecting: The electrical methods have been successfully employed in delineation of ore bodies occurring at shallower depths. For such surveys at great depths, these are not of much help.

In table 1, some typical value-ranges of resistivity are given. As may be seen, rocks exhibit a great variation ranging from as high resistivity as > io ohms-meters in igneous rocks to as low as less than I ohm-rn for clayey mans.

In Civil Engineering: Resistivity methods have been widely used in engineering investigation for determination of

Depth to the bed rock —as for instance, in important projects like dams, buildings and bridge foundations, where it would be desirable that the structure should rest on sound hard rocks rather than on overburden or soil

Location of geological structures —like folds, buried valleys, crushed and fractured zones due to shearing and faulting.

Location of Aquifers —and other water bearing zones which could be easily interpreted on the basis of known resistivity values of moisture rich rocks and dry rocks.

SEISMIC

METHODS Principle.

- Shocks or explosions within the earth' s crust are always accompanied by generation of elastic waves, which travel in all directions from the point or place of shock, the focus.
- Velocity of these shock waves is related to the nature of the medium through which they travel. In nature these waves are produced during earthquakes. The

seismic waves reveal a great deal of information about the internal constitution of the earth.

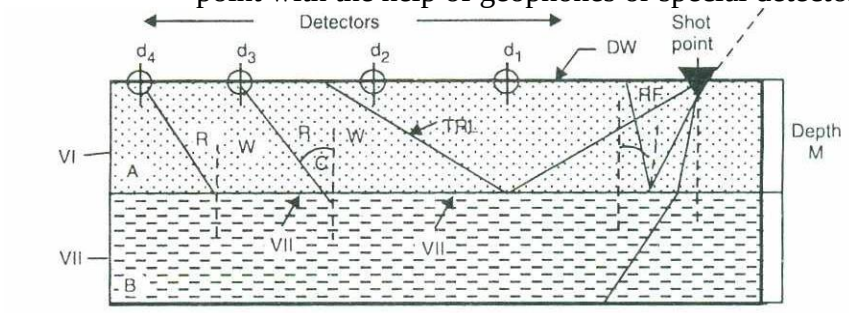
- Although different types of waves are generated when a shock occurs, these are the P waves (longitudinal waves), which are the fastest and strongest. Their velocity, Vp, is related broadly to the medium (rocks) through the following equation:

$$Vp = \left[E \cdot \frac{(1-v)}{e(1+v)(1-2v)} \right]^{1/2}$$

- where E is Modulus of elasticity, e is density and v is the Poisson' s Ratio of the medium.
- The controlling factor is, obviously, the modulus of elasticity which itself is dependent upon nature of rock, its chemical and mineralogical composition, degree of freedom from structural discontinuities and degree of saturation with water and other fluids.
- From experimental investigations, characteristic velocity values for P waves have been broadly established for different rock types.
- As such, if the velocity of seismic waves travelling through a section of the ground is known, nature of the ground can be fairly assessed.
- This is the underlying principle of all the seismic methods.

Method.

- The fundamental procedure in all seismic investigations for subsurface explorations is the same: a shock is created at a chosen point or location either by exploding a charge, of dynamite;
- the waves so produced are recorded at different distances from the shot point with the help of geophones or special detectors.



- The instant of shot, that is the shot time and the first arrival are recorded very carefully from which time —distance plots are prepared in a selected manner.
- A proper interpretation of these time-distance plots may reveal presence of unusually high or low velocity media at certain depths.
- Reflection methods have been found especially useful for subsurface studies under! bodies of water (e.g. lakes, rivers, and estuaries) because in such surveys signals from surface and shear waves are obliterated by water and arrival times of only longitudinal waves are recorded clearly and easily.