



Banha University
Faculty of Science
Geology Department
2nd Year Geophysics

Date: Sunday 30/12/2018
Subj.: Basics of Geophysics
Subject Code: (G 250)
Time: 120 Minutes

Part I (Seismic and Electric Methods)

Answer the following questions..... (24 Marks)

I- How seismic waves are generated in the field? **Write in detail.**

..... (6 Marks)

Seismic exploration is an **active technique**. In contrast to gravity studies, a signal must be generated. A range of techniques can be used, depending on the depth of study.

There are different kinds of seismic sources in practice; in general we have to decide between impulsive sources and the vibroseis method or between terrestrial and marine sources.

- Shallow exploration on land: hammer on a plate, weight drops, specialized guns.
- Offshore: air guns, water guns and explosives.
- Deeper studies on land: vibroseis, conventional explosives, nuclear explosions.

II- **Write briefly on:** (a) the Resistivity Sounding Survey and (b) Sources of Electric Noise.

..... (6 Marks)

Resistivity Soundings

When doing resistivity sounding surveys, one of two survey types is most commonly used. For both of these survey types, electrodes are distributed along a line, centered about a midpoint that is considered the location of the sounding. The simplest in terms of the geometry of electrode placement is

referred to as a Wenner survey. The most time effective in terms of field work is referred to as a Schlumberger survey.

Sources of Electric Noise

There are a number of sources of noise that can affect our measurements of voltage and current from which we will compute apparent resistivity .

- Electrode Polarization** - A metallic electrode, like a copper or steel rod, in contact with an electrolyte other than a saturated solution of one of its own salts, like ground water, will generate a measurable contact potential. In applications such as SP, these contact potentials can be larger than the natural potential that you are trying to record .

- Telluric Currents** is the naturally existing currents flow within the earth. The existence of these currents can generate a measurable voltage across the potential electrodes even when no current is flowing through the current electrodes. By periodically reversing the current from the current electrodes, or by employing a slowly varying AC current, the effects of telluric currents on the measured voltage can be cancelled .

- Presence of Nearby Conductors** -Electrical surveys can not be performed around conductors that make contact with the ground. For example, the presence of buried pipes or chain-linked fences will act as current sinks. Because of their low resistivity, current will preferentially flow along these structures rather than flowing through the earth. The presence of these nearby conductors essentially acts as electrical shorts in the system .

- Low Resistivity at the Near Surface** -Just as nearby conductors can act as current sinks that short out an electrical resistivity experiment, if the very near surface has a low resistivity; it is difficult to get current to flow more deeply within the earth. Thus, a highly conductive* near-surface layer such as a perched water table can prevent current from flowing more deeply within the earth .

- Near-Electrode Geology and Topography** - Any variations in geology or water content localized around an electrode that produce near-surface variations in resistivity can greatly influence resistivity measurements. In addition, rugged topography will act to concentrate current flow in valleys and disperse current flow on hills .

- Current Induction in Measurement Cables** - Current flowing through the cables connecting the current source to the current electrodes can produce an induced current in the cables connecting the voltmeter to the voltage

electrodes, thereby generating a spurious voltage reading. This source of noise can be minimized by keeping the current cables physically away from, a meter or two, the voltage cables.

III- Complete the sentences :.....(5 Marks)

- 1- Seismic section consists of numerous traces with location given along the x-axis and two-way traveltime or depth along the y-axis.
- 2- Change in acoustic impedance is caused due to change in velocity and density.
- 3- The interface between layers of contrasting acoustic properties is termed reflector.
- 4- Snell's law gives the relationship between incidence and refraction of a wave.

IV- Chose the most accurate answer:.....(7 Marks)

- 1- *Nearly all geophones currently used for seismic recording in marine (offshore) are of the electromagnetic type.*
 - a. True
 - b. False
- 2- *Seismic survey for oil exploration is belonging to*
 - a. Geophysical active methods
 - b. Geophysical passive methods
 - c. Geophysical passive and active methods
- 3- *The geometry of an array (or geophone group) is designed to :*
 - a. Cancel certain unwanted signals.
 - b. Enhance the reflected events.
 - c. Cancel certain unwanted signals and enhance the reflected events.
- 4- *Which of the following is NOT a seismic exploration source?*
 - a. Earthquakes

- b. Airgun
- c. Explosives

5- The sample interval unit used during the digital recording is.....

- a. millimeter
- b. millisecond
- c. centimeter

6- Nearly all hydrophones currently used for seismic recording in marine (onshore) are pressure-sensitive phones (piezoelectric).

- a. True
- b. False

7- If an S-wave was to go from a solid to a liquid - what would happen to its velocity?

- a. increase
- b. decrease to zero
- c. decrease

Best wishes
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