Geology Department *Date: Monday. 23-05-2016*

Geophysics Branch *Advanced Seismic Survey*

Pre-Master Exam. *Time: 120 Minutes*

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الإجابة النموذجية لمقرر المسح السيزمي المتقدم.....تمهيدي ماجستير جيوفيزياء تطبيقية

كلية العلوم – قسم الجيولوجيا.....الدكتور/ محمد أحمد محمد سالم الأعصر

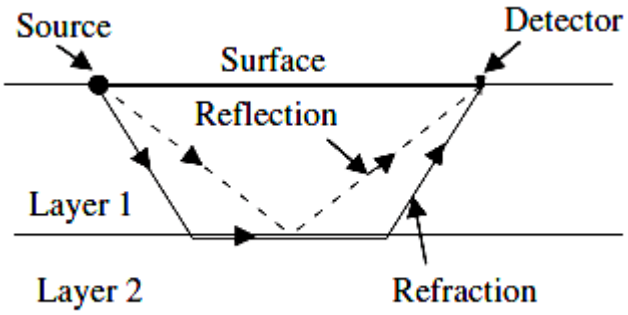
Part I- Write on the following (describe with neat sketches): 68 points

1- Differentiation between the offshore and onshore seismic survey. 23

SEISMIC SURVEY METHOD

The seismic method is rather simple in concept. An energy source (dynamite in the early days) is used to produce seismic waves (similar to sound) that travel through the earth to detectors of motion, on land, or pressure, at sea. The detectors (Geophones onshore and hydrophones offshore) convert the motion or pressure variations to electricity that is recorded by electronic instruments.

There are two paths between source and receiver of particular interest – reflection and refraction. In Fig. ( ) layers 1 and 2 differ in rock type, in the rate at which seismic waves travel (*acoustic or seismic velocity*), and *density* (mass per unit volume).



When the seismic waves encounter the boundary between layers 1 and 2 some of the energy is reflected back to the surface in layer 1 and some is transmitted into layer 2. If the seismic velocity of layer 2 is faster than in layer 1, there will be an angle at which the transmitted seismic wave is bent or refracted to travel along the boundary between layers, as shown in Fig. (*). These two path types are the bases of seismic *reflection* and *refraction* surveys.

2- Types of seismic velocities and the factors affecting velocity. 20

Types of Velocities

Various types of seismic velocities are reported on seismic profile legends and in reports of seismic processing and interpretation.

***Average Velocity** *(Vav)* The distance to an interface, divided by the one-way travel time to that interface, is the average velocity for the material above the interface.

***Root Mean Square (RMS) Velocity** *(VRMS)* Snell's Law describes bending as rays refract across an interface separating different velocities.

***Stacking Velocity** The *stacking velocity* is the velocity that best corrects an event on a CMP gather for normal moveout.

Interval Velocity (Vint***)** The interval velocity is the average velocity of the material between two interfaces.

3- Common midpoint or common depth point and seismic section. 10

Traces from different shot gathers are rearranged as common midpoint (CMP) gathers.

Depth Conversion is an important step of the seismic reflection method, which converts the acoustic wave travel time to actual depth, based on the acoustic velocity of subsurface medium (sediments, rocks, water).

A seismic section used for interpretation, however, has undergone processing that condenses the results of many shots. The standard portrayal of the data, an unmigrated *time section*, presents each seismic trace as *if a source and a receiver were in the same position*.

Reflections from the common source/receiver positions result from raypaths striking reflectors at 90°, or *normal incidence.*

4- Types of Multiples and seismic gather process. 15

Multiples are a common type of noise on seismic reflection profiles.
A *long-path multiple* arrives as a distinct event, arrives as a distinct event, sometime after the primary event. An example would be the reflection from an interface that reflects downward from the surface, then reflects upward again from the same interface.
Short-path multiples arrive soon after the primary event, so that they interfere with the primary event. An example is a peg-leg multiple that reverberates in a nearsurface layer, then reflects from deeper.

Part II- Multiple-choice questions (12 points)

1- For seismic S-wave velocity, V, the rigidity modulus, μ, is proportional to ----------
(a) $\sqrt{V}$
(b) V
(c) V^2
(d) V^3

2- In seismic reflection, the seismic trace is modelled as ---------
(a) convolution of source wavelet with the reflection coefficient series
(b) Multiplication of source wavelet with the reflection coefficient series
(c) Correlation of source wavelet with the reflection coefficient series
(d) Addition of source wavelet with the reflection coefficient series

3- The bulk modulus measures ----------
(a) The resistance to flow of a liquid
(b) The resistance to change in colour
(c) The resistance to change in volume
(d) The resistance to change in shape

4- The shear modulus measures ----------
(a) The resistance to flow of a liquid
(b) The resistance to change in shape
(c) The resistance to change in volume of a liquid
(d) The resistance to change in volume of a solid

5- If only density increases with increasing depth within the Earth, the velocity of a P wave should ----------
(a) Stay the same
(b) Increase
(c) Decrease
(d) None of the above.

6- If P waves were to go from a solid to a liquid - what would happen to its velocity?
(a) Stay the same
(b) Increase
(c) Decrease to zero
(d) Decrease

7- If an S wave were to go from a solid to a liquid - what would happen to its velocity?
(a) Stay the same
(b) Increase
(c) Decrease to zero
(d) Decrease

8- For a frequency of 30 Hz and wavelength of 100 m, the seismic velocity is:
(a) 70 m/s
(b) 2500 m/s
(c) 3000 m/s
(d) 3.33 m/s

Best wishes
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