TRANSLATION

UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session of 2005/2006

April/May 2006

EBS 329/3 – Engineering Geophysics

Time : 3 hours

Please ensure that this paper consists of THIRTEEN p rinted pages before you proceed with the examination.

This paper contains 20 objective questions in Part A and SIX questions in Part B.

Answer ALL questions from Part A and FOUR question from Part B. If a candidate answer more than five questions, only the first five answers will be examined and awarded marks.

The answer to any question must start on a new page.

All questions must be answered in Bahasa Malaysia.

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SECTION A: Multiple choice (20 questions).

Answer all questions. Please choose the most appropriate answer.

1. *gobs - gn + 0.3086 h - 0.04193 ρ h (mgal)* is a data gravity corrected expression until to.
   [a] Terrain
   [b] Latitud
   [c] Bouguer
   [d] Free air

2. P-wave propagates through a medium depends on the physical properties or characteristic of the rock, **EXCEPT**?
   [a] Rigidity and density
   [b] Rock type
   [c] Degree of homogeneity of the rock
   [d] Saturation

3. There are three ways in which electric current can be conducted through rock, **EXCEPT?**
   [a] Electrolytic
   [b] Electrokenetic
   [c] Electronic conduction
   [d] Dielectric Conduction

4. Which statement is **untrue** about SP?
   [a] A passive method
   [b] Possess positive and negative anomaly
   [c] Depends on geometry factors
   [d] Measured between two points on the ground surface

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5. Typically, two corrections often applied to SP data?
   [a] Heavy rainfall and latitude effects
   [b] Regional trend and Bioelectric effects
   [c] Electrode configurations and orientation effects
   [d] Mineral and background potential effects

6. The closeness of the flux lines around a bar magnet is known as _____ and measured in _____unit.
   [a] Flux strength, teslas
   [b] Flux density, weber/m
   [c] Flux strength, weber/m^2
   [d] Flux density, teslas

7. In gravity survey, gravity correction is made accordingly to remove or compensate the effects of?
   [a] Bouguer slab
   [b] Hill and valley
   [c] Tidal effect
   [d] Geoid

8. Typical geophone construction consists, EXCEPT?
   [a] Terminal cables/wires
   [b] Magnet and Coil
   [c] Accelerometer
   [d] Top and bottom spring

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9. In resistivity survey, the following statement refer to which electrode configuration?
"All for electrodes have to be moved for each measurement".
[a] Wenner
[b] Schlumberger
[c] Square
[d] Dipole-dipole

10. The magnetic susceptibility, k is in essence a measure of how susceptible a material to becoming magnetized and it is expressed in term of relationship between?
[a] Magnetic flux density and Intensity of magnetization
[b] Magnetization and magnetic permeability
[c] Magnetic flux density and Magnetizing force (strength)
[d] Magnetizing intensity and remnant magnetization

11. In gravity survey, data correction which refers to the effect of instrument sensitivity and accuracy due to temperature or spring factors is known as?
[a] Latitude correction
[b] Tidal correction
[c] Drift correction
[d] Terrain correction

12. Electric circuit has three main properties, EXCEPT?
[a] Inductance (L)
[b] Resistance (R)
[c] Capacitance (C)
[d] Magnetising (M)

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13. There are two main resistivity survey methods, what Constant Separation Traversing (CST) method refer to?

[a] Lateral variation in resistivity

[b] Depth variation in resistivity

[c] Measurement of repeat array

[d] Electrode configuration

14. Magnetics data reduction is usually simpler than gravity survey, normally which involve, **EXCEPT?**

[a] Diurnal correction

[b] Geomagnetic Correction

[c] Instrument correction

[d] Elevation or terrain correction

15. Practically, which geophysical method often use for "rip ability" investigation of overburden

[a] SP

[b] Resistivity

[c] Seismic refraction

[d] Seismic reflection

16. The basic components of seismic refraction experiment normally comprises, **EXCEPT**?

[a] Refraction intercept distance

[b] Crossover distance

[c] Crossover point

[d] Critically refracted arrivals

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17. A basic seismic refraction survey layout on the land should consist the following, **EXCEPT?**

[a] A bottom drag cable

[b] "Forward" and "off-end" shots

[c] Split-spread shot point

[d] Geophone spread

18. Gravity methods are sensitive to density contrasts within the sub-surface and so are ideal for exploring?

[a] Forensic geophysics

[b] Hydrological investigation

[c] Major sedimentary basin study

[d] Engineering site investigations

19. In geophysics survey, a variation in physical properties relative to some background value due to burial target is call as?

[a] Geophysical target

[b] Geophysical anomaly

[c] Residual effects

[d] Responding values

20. Which geophysical survey is the most appropriate method for mapping of leachate and contaminant plumes and sub-surface cavities?

[a] Gravity

[b] Resistivity

[c] Self-Potential

[d] Seismic refraction

(20 marks)

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SECTION B:

1. Answer any **FOUR (4)** of the following questions:

[a] In sedimentary rocks, effects of porosity and grain cementation are more important in seismic velocity relationships. P wave is function of age and depth of rock. Determine the seismic velocity of underlying rock formation which thickness is 500 meter and geological age of 400 million years.

[b] Self-potential comprises two components (anomaly), mineral potential and background potential. Please elaborate.

[c] Geophysical methods respond to the physical properties of the sub-surface media (rocks, sediments, water, voids, etc.) and can be classified into two distinct types. Please briefly discuss?

[d] Define applied geophysics from the perspective or in the contact of "Engineering Geophysics" and "Environmental geophysics" applications.

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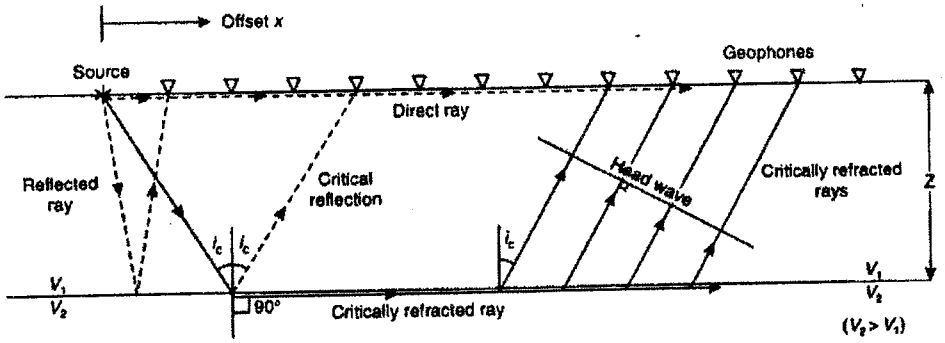
[e] The following sketch shows a schematic diagram of refraction and reflection survey conception? Please describe or define the following.



(i) Critically refracted ray

(ii) Geophone and Source

(iii) Direct wave

(20 marks)

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2. Answer any **FOUR (4)** of the following questions:

[a] Seismic refraction energy sources use to produce adequate signal attenuation often a function of the geology. State the major requirements should be considered in the seismic source energy selection.

[b] What is total magnetic field, **B**?

[c] SP surveying is very sample. Please show and describe the basic characteristics of the device use in the survey and the two typical survey methods of SP.

[d] Rock can become permanently magnetized in the earth's magnetic field, Primary remnant magnetization refers to permanent magnetization created during formation of a rock. What are Thermal Remnat Magnetization (TRM) and Detrital Remnat Magnetization (DRM)?

[e] In seismic refraction survey, discuss factors that have a major constrains on seismic velocity? How does some of these factors effect seismic velocity propagating in igneous and metamorphic rocks.

(20 marks)

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3. Answer any **FOUR (4)** of the following questions:

[a] Please specify five major application of seismic refraction in subsurface engineering investigation.

[b] Gravity meter do not give direct measurements of gravity and must be corrected before the results of the survey can be interpreted in geological terms. Briefly states types of correction normally taken during gravity data correction process.

[c] Discuss the factors that normally measure in geophysical magnetic surveys, and what is magnetic susceptibility, ***k***.

[d] With a help of appropriate illustration, shows and discuss the three major electrode configuration used in a most electrical resistivity survey? Which configuration mod is the most efficient for horizontal traverse (*Constant separation Traversing*) and sensitive to unhomogenized lateral.

[e] In magnetic survey, what induced magnetization, J_i and remnant magnetization are.

(20 marks)

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4. Answer any **FOUR (4)** of the following question?

[a] State and discuss the two major components of self-potential (SP) anomalies?

[b] Compute the apparent resistivity for Wenner Electrode system, R_a, as given in *Table A*. Plot cumulative apparent resistivity vs. electrode spacing.

TABLE A: **Resistivity data (Wenner Configuration : $R_a : 2\pi$ a dV/I)**

Electrode Half-distance, a (*feet*)	**Current Applied, I (*mA*)**	**Potential difference, *dV* (*mV*)**	**Apparent resistivity, R_a (*ohm-feet*)**	**Cumulative Resistivity, ΣR_a (*ohm-feet*)**
2	115	230		
4	123	75		
6	135	35		
8	130	20		
10	187	18		
12	375	25		
14	345	15		
16	320	12		
18	315	10		
20	330	9		

[c] Please state major application of geomagnetics surveys in mapping and locating works.

[d] Define *Terrain Corrected Bouguer Gravity (**gt**)*?. Write down general correction formula for this Bouguer gravity anomaly, ***gt***?

[e] Basically there are two type of gravity measurements?. Briefly discuss and which one is the most required.

(20 marks)

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5. Answer any **FOUR (4)** of the following questions:

[a] In magnetic survey, discuss the principle of Proton Precession Magnotometer.

[b] Electrical current can flow in rocks and soils, but process is usually different from current flowing in a metal wire. Discuss main mechanisms of current flow in such geological materials.

[c] The speed of seismic waves is related to the elastic properties of geological materials. Discuss constrains or factors that effects seismic velocity in various rocks.

[d] What is *Observed Gravity (**g**obs)*?

[e] What are the differences between regional and residual anomalies? Write down a general equation of gravity corrections for final Bouguer anomaly?

(20 marks)

6. Answer any **FOUR (4)** of the following questions:

[a] Discuss the effects of earth shape with regard to the variation of gravity values?

[b] Magnetic susceptibilities, k is the physical parameter of magnetic survey. Discuss primary remnant magnetization of the rocks and minerals and its types.

[c] The following *Table B* shows the arrival time-distance data collected from a single forward short profile of a seismic refraction survey over a flat landscape.

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***TABLE B*: Refraction survey data sheet**

Geophone	Location, x (m)	Arrival times
1	201	3
2	205	13
3	209	23
4	213	33
5	217	41.5
6	221	46
7	225	50
8	229	56
9	233	59
10	237	63
11	241	67
12	245	71

(i) Plot travel-time graph or T-X plot

(ii) Determines velocities of layers (Horizontal layers)

(iii) Thickness of upper layer, *t*

[d] Discuss factors or elements that governed the DC current flow by electrolytic conduction in resistivity survey.

[e] What is *Free Air Corrected Gravity (**gfa**)?* The form of the Free-Air gravity anomaly, ***gfa***, is given by:

$$gfa = gobs - gn + 0.3086\,h \ (mgal)$$

Determine the *Corrected Gravity (**gfa**)* at a gravity station located near 36.37840544N with elevation of 448.96m from goeid?. The gravitimeter reading after tidal and drift correction is 979149.9 mgal.

(20 marks)

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