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# UNIVERSITI SAINS MALAYSIA

Second Semester Examination  
Academic Session 2008/2009

April/May 2009

**EBS 329/3 – Engineering Geophysics**  
**[Geofizik Kejuruteraan]**

Duration : 3 hours  
[Masa : 3 jam]

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Please ensure that this examination paper contains ELEVEN printed pages and before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

This paper contains TWO questions from PART A and FIVE questions from PART B.

*[Kertas soalan ini mengandungi DUA soalan dari BAHAGIAN A dan LIMA soalan dari BAHAGIAN B.]*

**Instruction:** Answer ALL questions in **PART A**, and THREE questions from **PART B**. For PART B, if a candidate answers more than three questions only the three answer will be examined and awarded marks.

**[Arahan:** Jawab SEMUA soalan pada **BAHAGIAN A** dan TIGA soalan daripada **BAHAGIAN B**. Bagi soalan di **BAHAGIAN B**, jika calon menjawab lebih daripada tiga soalan hanya tiga soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]

Answer to any question must start on a new page.

*[Mulakan jawapan anda untuk setiap soalan pada muka surat yang baru.]*

You may answer a question either in Bahasa Malaysia or in English.

*[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

**PART A / BAHAGIAN A**

1. Answer the following questions:

*Jawab kesemua soalan-soalan berikut:*

- [a] Discuss constrains on seismic velocity. What is the P velocity of the geological formation which buried at the depth of 200m below ground surface and aged about 100 millions years?

*Bincangkan kekangan dalam halaju seismik? Apakah halaju gelombang P bagi formasi geologi yang tertimbus pada kedalaman 200m di bawah paras permukaan bumi dan berumur sekitar 100 juta tahun?*

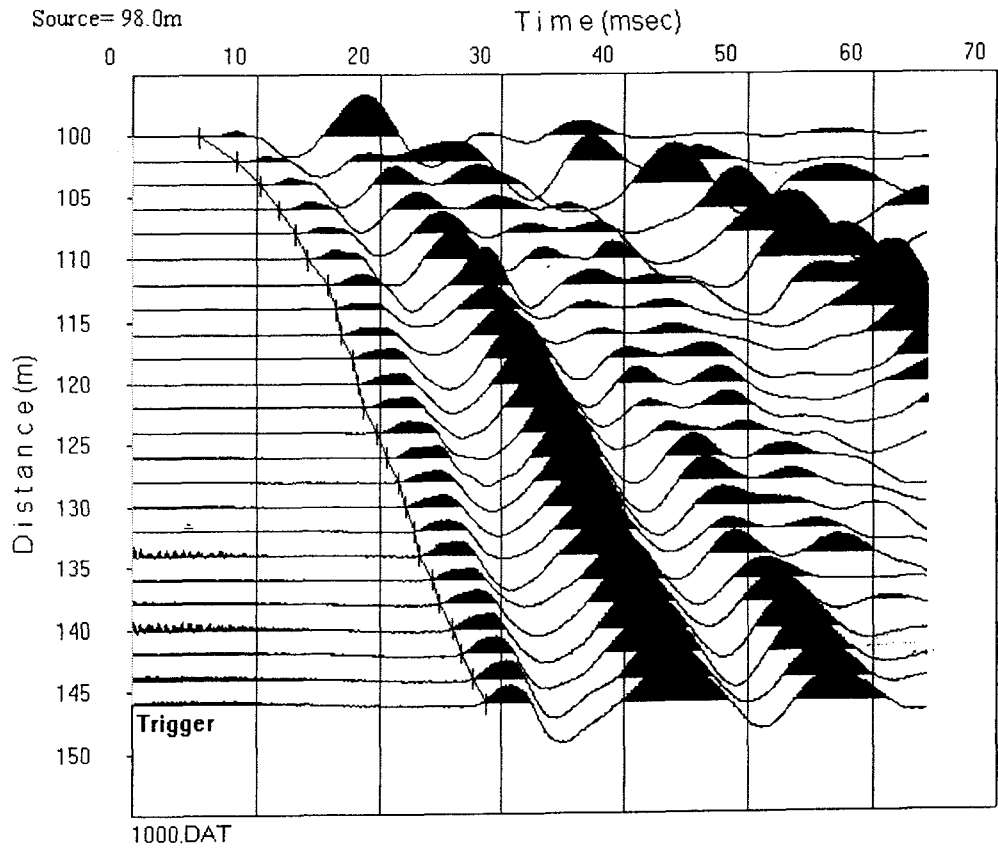
- [b] The following seismogram shows a result of refraction survey along a survey line. Shot point is located at 98.0m (Data file: 1000.dat):
- (i) Plot the Time-Distant (T-D) or travelttime curve.
  - (ii) Determine the velocities,  $V$  of top (overburden) and reflector (bedrock).
  - (iii) Determine the thickness of the overburden.

*Berikut adalah seismogram hasil daripada satu profil survei seismik biasan. Titik tembak (SP) terletak pada kedudukan 98.00m (Fail data: 1000.dat):*

- (i) *Plot lengkung Masa-Jarak (T-D) atau lengkung masa perembatan.*
- (ii) *Tentukan halaju,  $V$  lapisan beban atas dan pembalik (batuan dasar).*
- (iii) *Tentukan ketebalan,  $t$  lapisan beban atas.*

(Notes: This is a two layers case with horizontal or planer interfaces)

(Nota: Ini adalah kes dua lapisan dengan lapisan antaramuka mendatar)



(20 marks/markah)

2. Briefly describe or defines any **five (5)** of the following:

*Secara ringkas perjelas atau takrifkan lima (5) perkara-perkara berikut:*

- [a] Geophysical anomalies.

*Anomali geofizik.*

- [b] Environmental geophysics (application).

*Geofizik persekitaraan (aplikasi).*

- [c] Earthquake seismology.

*Seismologi gempa bumi.*

- [d] Relative gravity (in gravity survey)

*Graviti bandingan (dalam survei graviti).*

- [e] Background potential (in SP survey)

*Keupayaan latar (dalam survei SP).*

- [f] Active/artificial method (in geophysical survey principle)

*Kaedah aktif/palsu (dalam prinsip survei geofizik).*

(20 marks/markah)

**PART A / BAHAGIAN B**

3. Answer all of the following questions:

*Jawab kesemua soalan berikut:*

- [a] There are three (3) different of geoelectrics methods on the basis of their electrical property. State and briefly describe these methods.

*Terdapat tiga (3) kaedah survei geoelektrik yang berlandaskan kepada sifat-sifat elektrik yang berlainan. Nyata dan bincangkan secara ringkas kaedah-kaedah ini.*

- [b] Gravity surveys measures the acceleration due to gravity,  $g$ . Gravitational attraction depends on the density of underlying rocks, to which gravity survey are sensitive. So value of  $g$  varies across the surface of earth. State and briefly describe three (3) major scales (magnitude) of gravity survey which are carried out for different purposes.

*Survei graviti mengukur pecutan akibat pengaruh graviti,  $g$ . Tarikan graviti bergantung kepada ketumpatan bahan bumi (batuan) yang amat sensitif kepada survei graviti. Oleh yang demikian nilai  $g$  adalah berubah-ubah daripada satu kawasan ke kawasan yang lain. Nyata dan bincangkan secara ringkas tiga (3) sekala (magnitud) survei yang lazim dijalankan untuk maksud tertentu.*

- [c] Magnetic susceptibility,  $\kappa$  is the physical parameter to which magnetic surveys are sensitive. States three (3) main applications of this survey method.

*Kerentanan magnetik,  $\kappa$  adalah parameter fizikal yang sensitif kepada survei magnet. Nyatakan tiga kegunaan utama survei magnetik.*

- [d] What is body wave? States types and characteristics of these waves.

*Apakah itu gelombang jasad? Nyatakan jenis-jenis dan ciri-ciri gelombang tersebut.*

(20 marks/markah)

4. Answer all of the following questions:

*Jawab kesemua soalan berikut:*

- [a] States and describes the similarity and differences between gravity and magnetic methods.

*Nyata dan perihalkan persamaan dan perbezaan antara kaedah-kaedah graviti dan magnetik.*

- [b] Several corrections must be applied to observed gravity data to obtain sea level reference and anomaly. State and explains at least three (3) of these data correction.

*Beberapa proses pembetulan terhadap data graviti cerapan perlu dilakukan terlebih dahulu sebelum memperolehi rujukan paras laut dan anomali-anomali. Nyata dan terangkan sekurang-kurangnya tiga (3) jenis pembetulan data ini.*

- [c] What is "Local Latitude Correction"? Estimate the local latitude correction at 51° N. (unit  $g/km$ ).

*Apakah itu "Pembetulan latitud tempatan"? Anggarkan nilai pembetulan latitud tempatan pada 51° N. (unit  $g/km$ ).*

- [d] Write down the final Bouger Anomaly.

*Tuliskan rumus untuk anomali Bouger (akhir).*

(20 marks/markah)

5. Answer all of the followings questions:

*Jawab kesemua soalan berikut:*

[a] Defines or describes the following:

- (i) Electrode arrays (in resistivity survey) and geometrics factors.
- (ii) Apparent resistivity.

*Takrif atau jelaskan perkara-perkara berikut:*

- (i) *Susunan/tatarajah elektrod (dalam survei resistivity) dan faktor geometrik.*
- (ii) *Resistiviti nyata.*

[b] Plot the following resistivity data (**Table 1**) and determine the resistivity of layers 1 and 2 and thickness of layer 1 for the given data.

*Plot data resistiviti berikut (Jadual 1) dan tentukan nilai resistiviti lapisan 1 dan 2 serta ketebalan lapisan 1 untuk data yang diberikan.*

(Master curve and graph paper (log-log) are provided).

*(Lengkung master dan kertas graf (log-log) adalah disediakan).*



Table I : Resistivity data (Wenner Configuration)

*Jadual 1 : Data Resistiviti (Konfigurasi Wenner)*

"a" spacing / Jarak "a" (meters)	Apperent resistivity / Resistiviti Nyata (ohm-meters)
5	210
10	276
15	360
20	450
30	610
50	850
100	1210

(20 marks/markah)

6. Defines or briefly describes the following:

*Takrif atau jelaskan perkara-perkara berikut:*

[a] Electrokinetic (streaming potential) – (in SP survey).

*Elektrokinetik (Keupayaan aliran) – (survei SP).*

[b] Free-air correction – (gravity survey).

*Pembetulan udara-bebas - (survei graviti).*

[c] Curie temperature (magnetic survey).

*Suhu Curie (survei magnetik).*

[d] Short point and spreads (seismic refraction).

*Short point and spreads (seismik biasan).*

[e] Wenner array (resistivity survey).

*Tatarajah Wenner (survei resistiviti)*

(20 marks/markah)

7. Answer all of the following questions:

*Jawab semua soalan berikut:*

- [a] There are two main methods in resistivity (VES and CST). State and briefly discuss the procedures and advantages or usage of these methods.

*Terdapat dua kaedah utama pelaksanaan survei resistiviti (VES dan CST) Nyata dan bincangkan secara ringkas prosedur dan kesesuaian penggunaan kaedah-kaedah ini.*

- [b] State the typical uses of electrical resistivity survey and factors that governed resistivity (increasing or reducing).

*Nyatakan kegunaan lazim survei elektrik resistiviti dan faktor-faktor yang mengekang/mempengaruhi nilai resistiviti (meningkat dan mengurangkan).*

- [c] What is geophone? State main applications of seismic refraction in engineering geology/geophysics

*Apakah itu geofon? Nyatakan aplikasi utama seismik biasan dalam kejuruteraan geologi/geofizik.*

- [d] What are the measuring units for apparent resistivity, gravity, magnetic and Self-Potential (SP)?

*Apakah unit-unit pengukuran resistiviti nyata, graviti, magnetik dan keupayaan diri (SP).*

(20 marks/markah)