UNIVERSITI SAINS MALAYSIA

First Semester Examination
2011/2012 Academic Session

January 2012

EAK 263/4 – Geomatic Engineering
[*Kejuruteraan Geomatik*]

Duration: 3 hours
[*Masa: 3 jam*]

Please check that this examination paper consists of **FIFTEEN (15)** pages of printed material before you begin the examination.
*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **LIMA BELAS (15)** muka surat yang bercetak sebelum anda memulakan peperiksaan ini]*.

Instructions: This paper contains **FIVE (5)** questions. Answer all **THREE (3)** questions from Section A and any **ONE (1)** question from Section B

*[**Arahan**: Kertas ini mengandungi **LIMA (5)** soalan. Jawab semua **TIGA (3)** soalan di Bahagian A dan mana-mana **SATU (1)** soalan di Bahagian B]*.

You may answer the question either in Bahasa Malaysia or English.
[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris].

All questions **MUST BE** answered on a new page.
*[Semua soalan **MESTILAH** dijawab pada muka surat baru]*.

In the event of any discrepancies, the English version shall be used.
[Sekiranya terdapat percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

Section A:

"Hulu Langat Landslide Tragedy Report"
Saturday 21st May 2011
Kampung Gahal, Hulu Langat

The landslide tragedy that happened on Saturday 21st May 2011 in Kampung Gahal, Hulu Langat involving the Hidayah Madrasah Al-Taqwa orphanage where lives were lost and several were injured broke the local news with sadness. It also sends a chilling effect down the spine of the whole nation including local authorities, professionals and the government. The tragedy was an eye-opener for those regulators and the public that rules and regulations must be adhered to by all concerned for hill slope construction.

1. As a consultant engaged by the local authority to monitor any further downhill earth movements, continuous monitoring of the uphill was proposed. Identified permanent technical solutions that could greatly reduce further incidents include an analysis of materials (strength and stability of soil and rock) present in the neighboring areas, ground and surface water conditions, drainage improvements, and strengthening of existing retaining structures.

Based on the above **"Hulu Langat Landslide Tragedy Report",** a survey team was engaged to carry out ground surveys and to establish 3 coordinated monitoring stations P, Q and R (Figure 1), and the survey data is presented in Tables 1 and 2 below.

Table 1: Traverse Survey Data

Line	Mean included angle		Distance (m)
AB	θ_A	115° 45' 30"	397.211
BC	θ_B	88° 13' 50"	251.350
CD	θ_C	101° 52' 40"	276.111
DE	θ_D	137° 09' 10"	238.069
EA	θ_E	96° 59' 40"	189.819

Table 2: Monitoring Stations Survey Data

Whole-circle bearing of AB	197° 22’ 10”
Coordinates of station A	1000.000mN, 1000.000mE
Reduced level of station A	79.990 m AMSL
Coordinates of monitoring station P	1030.450mN, 810.700mE
Reduced level of monitoring station P	89.970 m AMSL
Coordinates of monitoring station Q	1070.550mN, 1000.700mE
Reduced level of monitoring station Q	92.950 m AMSL
Coordinates of monitoring station R	1050.950mN, 1500.700mE
Reduced level of monitoring station R	95.650 m AMSL

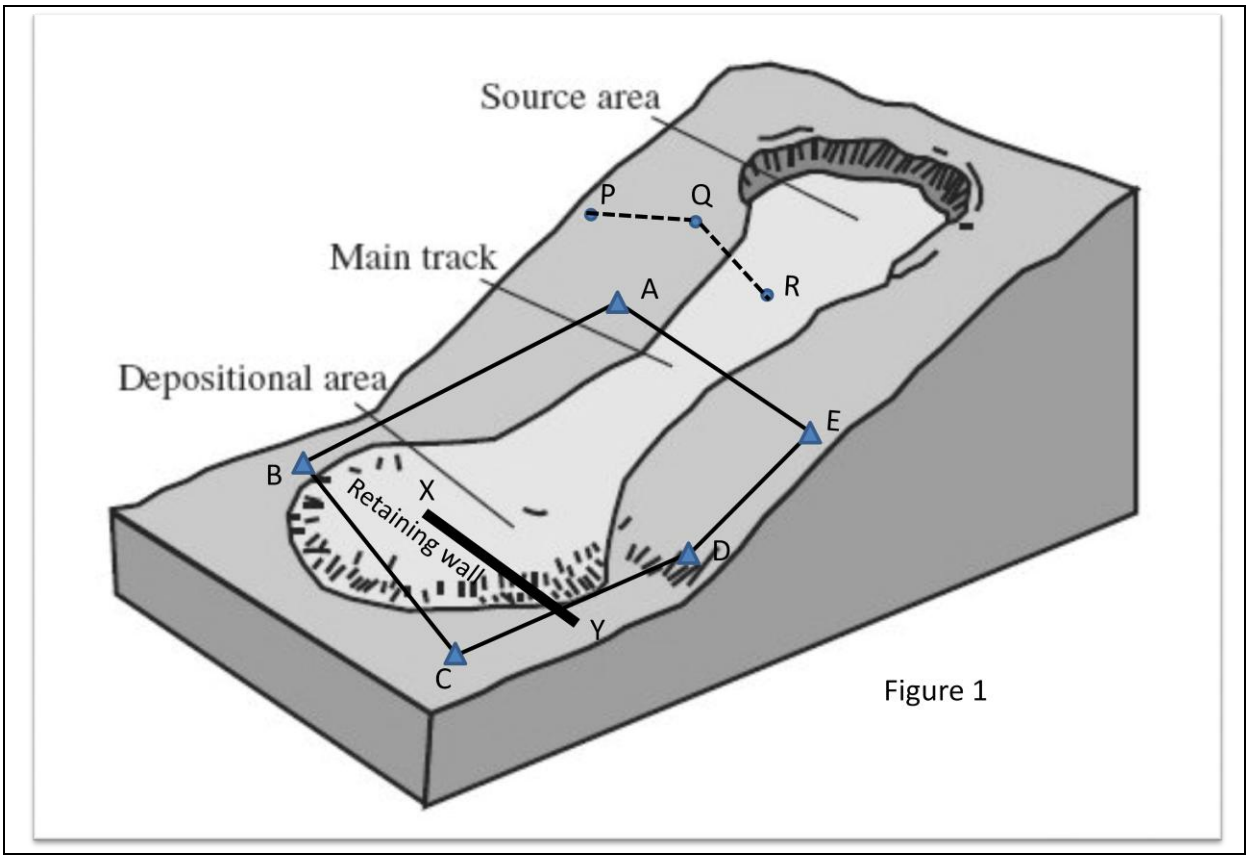


Figure 1

(a) Determine the misclosure in the observed angles of the traverse.

[5 marks]

(b) Carry out the traverse adjustment using Bowditch Method and determine the bearings of the traverse lines and its linear misclosure. Comment on the results obtained.

[20 marks]

2. (a) The position of station A next to the main track was re-observed a week after the landslide and its coordinates were as follows:

Coordinates of A: 995.950mN, 993.990mE

Determine the rate of ground movement at station A and its direction.

[5 marks]

(b) Determine the bearings and distances of PQ and QR.

[5 marks]

(c) Prepare a detail technical explanation as to how a second class survey is to be carried out to provide sufficient spatial information of the landslide area for monitoring purposes in terms of the following:

(i) certain considerations that should be kept in mind when planning the traverse scheme with regards to the establishment of sufficient horizontal and vertical controls, and the various field tests on the major instruments used in the monitoring process; and

[10 marks]

(ii) the types of visible and unseen changes including changing landscape patterns that must be depicted during the monitoring process.

[5 marks]

3. Throughout the monitoring process at the landslide area, the level was used extensively and it was decided to carry out a two-peg test to determine the existence of collimation error, if any. The following readings were noted:

Position 1: Instrument at K, midway between J and L where KJ = KL = LM
Staff reading on J = 1.726 m
Staff reading on L = 1.262 m

Position 2: Instrument at M
Staff reading on J = 2.245 m
Staff reading on L = 1.745 m

(a) Draw a sketch to show the different instrument positions.

[5 marks]

(b) Determine the collimation error of the level.

[10 marks]

(c) Explain the correction to be carried out to the level.

[5 marks]

(d) In carrying out the two-peg test above, explain the relationship between the fundamental lines of a level.

[5 marks]

Section B:

4. From survey station C in Figure 1, tacheometric observations were carried out to depict both ends (X and Y) of a retaining wall at the depositional area that shows sign of cracks. The following observations (Table 3) were made with a theodolite and the constants of the instrument are 0 and 100. The instrument was set up at station C at a height of 1.500 m and the RL of station C was 30.030 m.

Table 3: Tacheometric observations of retaining wall

From C	Bearing	Stadia readings	Vertical angle
To X	345° 01’ 10”	0.750, 1.435, 2.120	20° 20’ 40”
To Y	75° 00’ 50”	0.626, 1.837, 3.050	10° 32’ 40”

Calculate the following:

(a) Horizontal distances CX and CY.

[10 marks]

(b) Reduced levels of both ends of retaining wall X and Y.

[5 marks]

(c) Length of retaining wall XY.

[5 marks]

(d) Difference of elevation between X and Y and its gradient.

[5 marks]

5. (a) Area is assumed projected upon the horizontal plane and not the actual area of the surface. The determination of area depends upon the topography of the terrain and the accuracy required.

With the aid of diagram(s), briefly describe TWO [2] methods of calculating area from:-

(i) the field notes; and

(ii) the plotted plans or maps.

[6 marks]

(b) Figure 2 shows a two level section with formation width of 16 m where the ground is not level. The transverse slope is given as 1:10, the inclination slopes as 1:6, and the depth of cutting as 10 m.

Show the appropriate formula and calculate the side widths and the cross-sectional area of the cutting ABCD.

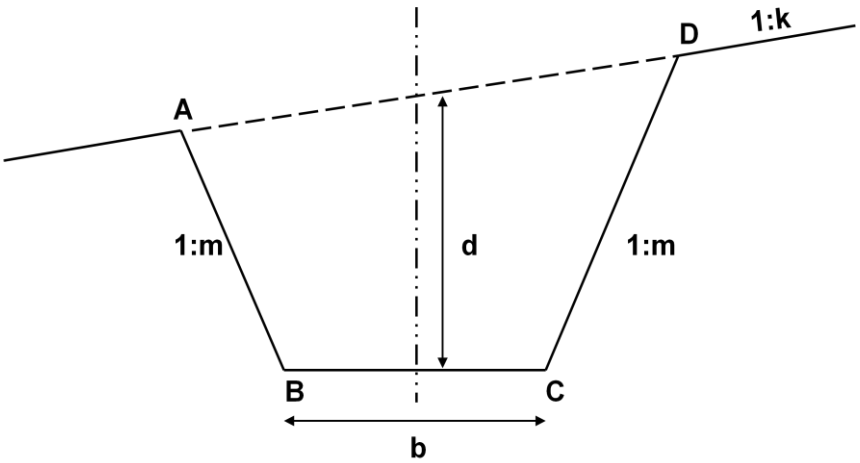


Figure 2

[9 marks]

(c) You are required to determine the quantity of earthwork in cubic meters, contained in a length of 350 m. The cross-sectional area at every 50 m is given as follows:

Chainage (m)	0	50	100	150	200	250	300	350
Cross-sectional area (m^2)	5.50	19.50	24.40	28.00	21.12	14.88	28.00	7.98

Calculate the volume of the earthwork using TWO [2] separate formulae as follows:-

(i) the Prismoidal formula; and

(ii) the Trapezoidal formula.

[10 marks]

Bahagian A:

"Laporan Tragedi Tanah Runtuh Hulu Langat"
Sabtu 21 Mei 2011
Kampung Gahal, Hulu Langat

Berita tragedi tanah runtuh yang berlaku pada hari Sabtu 21hb. Mei 2011 di Kampung Gahal, Hulu Langat yang melibatkan rumah anak yatim Hidayah Madrasah Al-Taqwa di mana beberapa kehilangan nyawa dan kecederaan telah menyelubungi berita tempatan dengan penuh kesedihan. Ia juga telah memberi mesej kepada seluruh negara termasuk pihak berkuasa tempatan, golongan profesional dan kerajaan. Tragedi ini telah menyedarkan semua pihak berkuasa dan orang ramai bahawa undang-undang dan peraturan perlu dipatuhi oleh semua pihak yang terlibat dalam pembinaan di lereng bukit.

Sebagai perunding yang ditugaskan oleh pihak berkuasa tempatan untuk memantau sebarang pergerakan tanah, pemantauan berterusan di bahagian atas bukit telah dicadangkan. Langkah penyelesaian teknikal kekal yang dikenal pasti boleh mengurangkan kejadian berulang termasuk analisis bahan-bahan (kekuatan dan kestabilan tanah dan batuan) di kawasan berhampiran, keadaan air tanah dan permukaan, pembaikan saliran, dan pengukuhan struktur penahan sedia ada.

1. *Berdasarkan **"Laporan Tragedi Tanah Runtuh Hulu Langat"** di atas, satu pasukan ukur telah dilantik untuk menjalankan kerja-kerja pengukuran dan menubuh 3 stesen pemantauan berkoordinat P, Q dan R (Rajah 1) dan data ukur dilaporkan dalam Jadual 1 dan 2 di bawah.*

Jadual 1: Data Ukur Travers

Garisan	*Sudut dalam min*		*Jarak (m)*
AB	θ_A	*115° 45' 30"*	*397.211*
BC	θ_B	*88° 13' 50"*	*251.350*
CD	θ_C	*101° 52' 40"*	*276.111*
DE	θ_D	*137° 09' 10"*	*238.069*
EA	θ_E	*96° 59' 40"*	*189.819*

Jadual 2: Data Ukur Stesen-Stesen Pemantauan

Bearing bulatan penuh AB	*197° 22' 10"*
Koordinat stesen A	*1000.000mU, 1000.000mT*
Aras laras stesen A	*79.990 m APL*
Koordinat stesen pemantauan P	*1030.450mU, 810.700mT*
Aras laras stesen pemantauan P	*89.970 m APL*
Koordinat stesen pemantauan Q	*1070.550mU, 1000.700mT*
Aras laras stesen pemantauan Q	*92.950 m APL*
Koordinat stesen pemantauan R	*1050.950mU, 1500.700mT*
Aras laras stesen pemantauan R	*95.650 m APL*

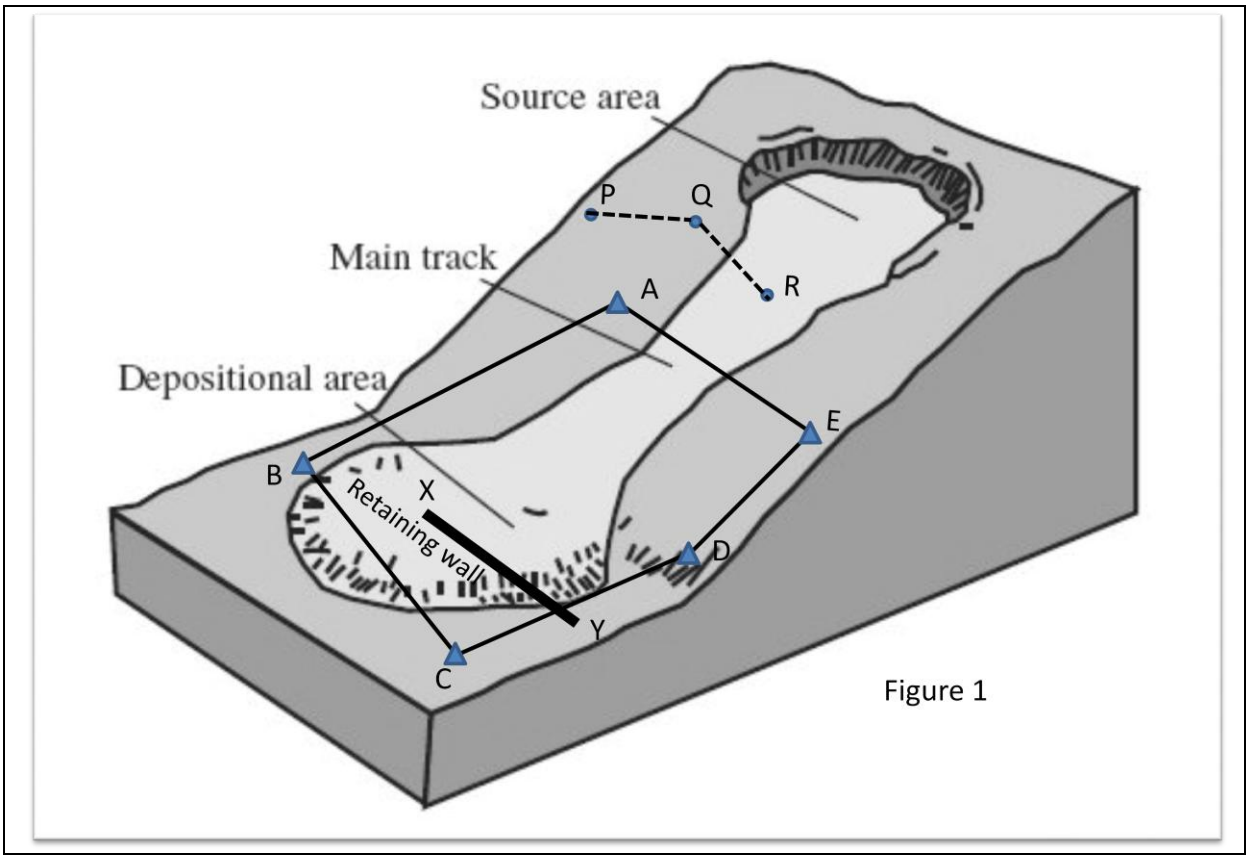


Figure 1

(a) *Tentukan selisih tutupan sudut travers yang dicerap.*

[5 markah]

(b) *Lakukan pelarasan travers menggunakan Kaedah Bowditch dan tentukan bearing bagi garisan travers dan selisih tututpan linear. Komen keputusan yang diperolehi.*

[20 markah]

2. (a) *Kedudukan stesen A bersebelahan trek utama (main track) telah dicerap semula seminggu selepas kejadian tanah runtuh dan koordinat adalah seperti berikut:*

Koordinat A: 995.950mU, 993.990mT

Tentukan kadar dan arah pergerakan stesen A.

[5 markah]

(b) *Tentukan bearing dan jarak PQ dan QR.*

[5 markah]

(c) *Sediakan satu laporan teknikal terperinci bagaimana ukuran kelas kedua dijalankan untuk mendapatkan maklumat reruang mencukupi di kawasan tanah runtuh bagi tujuan pemantauan berdasarkan perkara-perkara berikut:*

(i) *beberapa pertimbangan yang perlu diambil kira semasa merancang skim travers dengan merujuk kepada penubuhan kawalan ufuk dan pugak yang mencukupi, dan pelbagai ujian lapangan ke atas peralatan utama yang digunakan semasa proses pemantauan; dan*

[10 markah]

(ii) *jenis-jenis perubahan yang nampak dan tidak nampak termasuk pola muka bumi yang mesti dicerap semasa proses pemantauan.*

[5 markah]

3. *Sepanjang proses pemantauan kawasan tanah runtuh, alat aras telah digunakan secara kerap menyebabkan ianya perlu dilakukan ujian dua piket untuk menyemak samada wujudnya selisih kolimatan. Bacaan berikut telah dicatat:*

Kedudukan 1: *Alat di K, di tengah-tengah antara J dan L di mana KJ = KL = LM*
Bacaan staf di J = 1.726 m
Bacaan staf di L = 1.262 m

Kedudukan 2: *Alat di M*
Bacaan staf di J = 2.245 m
Bacaan staf di L = 1.745 m

(a) *Lukis satu lakaran bagi menunjuk kedudukan alat yang berbeza.*

[5 markah]

(b) *Tentukan selisish kolimatan alat aras.*

[10 markah]

(c) *Terangkan pembetulan yang perlu dibuat ke atas alat aras.*

[5 markah]

(d) *Semasa menjalankan ujian dua piket seperti di atas, terangkan hubungan di antara garisan-garisan asas sebuah alat aras.*

[5 markah]

Bahagian B:

4. *Dari stesen ukur C dalam Rajah 1, cerapan tekimetri telah dijalankan untuk memaparkan kedua-dua penghujung (X dan Y) tembuk penahan di kawasan longgokan (depositional area) yang menunjukkan tanda-tanda keretakan. Cerapan berikut (Jadual 3) dibuat dengan sebuah tiodolit dan pemalar alat adalah 0 dan 100. Alat telah diset di stesen C pada ketinggian 1.500 m dan aras laras stesen C ialah 30.030 m.*

Jadual 3: Cerapan tekimetri tembuk penahan

Dari C	*Bearing*	*Bacaan stadia*	*Sudut pugak*
Ke X	*345° 01' 10"*	*0.750, 1.435, 2.120*	*20° 20' 40"*
Ke Y	*75° 00' 50"*	*0.626, 1.837, 3.050*	*10° 32' 40"*

Kira yang berikut:

(a) Jarak ufuk CX dan CY.

[10 markah]

(b) Aras laras kedua-dua penghujung tembuk penahan X dan Y.

[5 markah]

(c) Panjang tembuk penahan XY.

[5 markah]

(d) Perbezaan ketinggian antara X dan Y dan kecerunannya.

[5 markah]

5. (a) *Keluasan dianggap sebagai satu unjuran ke atas satah ufuk dan bukan keluasan sebenar sesuatu permukaan. Penentuan keluasan bergantung kepada topografi rupa bumi dan ketepatan yang diperlukan.*

Dengan bantuan gambar rajah, huraikan secara kasar DUA [2] kaedah mengira keluasan melalui:-

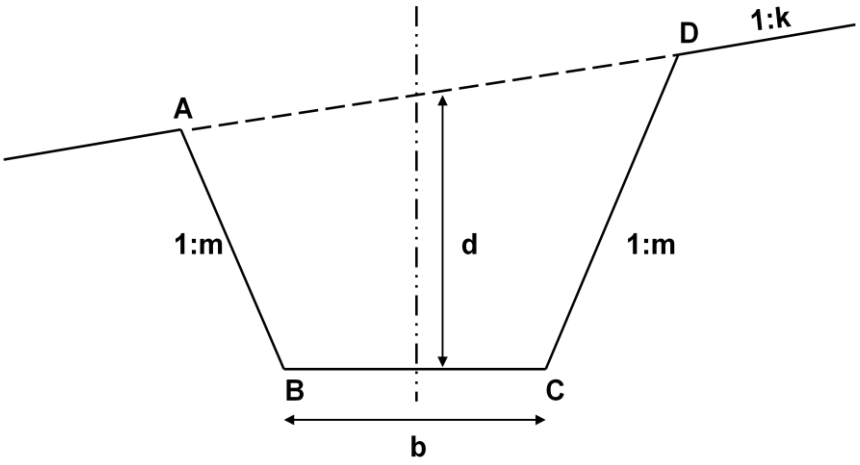
(i) nota lapangan; dan

(ii) pelan lukis atau peta.

[6 markah]

(b) *Rajah 2 menunjukkan dua aras keratan dengan lebar formasi 16m di mana bentuk tanah tidak selaras. Diberi cerun permukaan dalam nisbah 1:6, sendeng sisi adalah 1:10, dan kedalaman korekan adalah 10m.*

Tunjukkan rumusan yang sesuai dan kira lebar sisi dan luas keratan rentas pemotongan ABCD.



Rajah 2

[9 markah]

(c) *Anda dikehendaki menentukan kuantiti kerja tanah dalam unit meter isi padu, untuk suatu jarak rantaian 350m. Luas keratan rentas pada setiap 50m diberi seperti berikut:*

Rantaian (m)	*0*	*50*	*100*	*150*	*200*	*250*	*300*	*350*
Luas keratan rentas (m^2)	*5.50*	*19.50*	*24.40*	*28.00*	*21.12*	*14.88*	*28.00*	*7.98*

Kira isipadu kerja tanah menggunakan DUA [2] rumusan berasingan seperti berikut:-

(i) *Rumusan Prismoid; dan*

(ii) *Rumusan Trapezoid.*

[10 markah]

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