UNIVERSITI SAINS MALAYSIA

First Semester Examination
2010/2011 Academic Session

November 2010

EAK 263/4 – Geomatic Engineering

[*Kejuruteraan Geomatik*]

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

Please check that this examination paper consists of **ELEVEN (11)** pages of printed material before you begin the examination.
[*Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEBELAS (11)** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.*]

Instructions: This paper contains **FOUR (4)** questions. Answer **ALL** questions.
[***Arahan**: Kertas ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan.*

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 on the questions, the English version shall be used.
[*Sekiranya terdapat percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai*].

1. For the purpose of a systematic maintenance schedule of all buildings and amenities within USM Engineering Campus, the Development Office has decided to produce an up-to-date detail survey plan at a scale of 1:1,000 which shows all features and services. The plan will also be used to identify new areas to cater for the sustainable development program under the 10th Malaysia Plan (2011-2015).

   Several survey operations and techniques may be deployed to achieve the above program but the first basic principle is "to work from the whole to the part".

   Using suitable examples and sketches, explain the meaning of this principle and how it is achieved with respect to the following tasks:

   a) Preliminary survey reconnaissance.

   [5 marks]

   b) Establishment of vertical and horizontal controls.

   [5 marks]

   c) Detailing work.

   [5 marks]

   d) Preparation of a detail survey plan.

   [5 marks]

   [Total: 20 marks]

2. A closed traverse survey was conducted and the results are to be used in a feasibility study on a proposed landfill site (Figure 1) and the following information was gathered (Table 1).

Table 1.

Stn.	Measured external angle	Distance (m)	Bearing	Coordinates	Reduced Level (RL) (m)
A	280° 46′ 47″			1000.000mE, 2000.000mN	17.7
		315.352	283° 41′ 17″		
B	293° 49′ 24″				4.1
		167.956			
C	115° 26′ 51″				17.9
		265.338			
D	315° 02′ 24″				17.5
		359.274			
E	254° 54′ 19″				32.5
		333.470			
A					

a) Determine the adjusted coordinates of stations B, C, D and E using Bowditch adjustment method.

[17 marks]

b) Determine the linear misclosure of the traverse.

[2 marks]

c) Using the adjusted coordinates, calculate the area of the traverse.

[5 marks]

d) The extent of the proposed landfill is represented by the traverse boundary lines. If the requirements set by the Department of Environment (DOE) on the minimum size of a landfill site is 40,000 square meters (4 hectares) and the maximum slope is 1:2.5, determine the feasibility of the study in terms of the following factors:

i. Area of the landfill site.

[2 marks]

ii. Slope condition with reference to traverse lines AB and ED.

[5 marks]

e) If the proposed formation level P for the landfill is at RL = 4.0 m, calculate the volume of the cut section.

[6 marks]

f) Draw a mass haul diagram for the proposed earth work for the landfill.

[3 marks]

[Total: 40 marks]

3. To determine the reduced level of the survey marker (Stn. G) at the entrance of a construction site, an ordinary leveling was carried out and the following data was obtained (Table 2).

Table 2.

Backsight (BS)	Intermediate Sight (IS)	Foresight (FS)	Reduced Level (RL) (m)	Distance (m)	Remarks
0.663			98.760		BM A0147 (RL=98.760 m)
	1.946			0	Stn. A
	1.008			20	Stn. B
	1.153			40	Stn. C
2.787		1.585		60	Stn. D (change point)
	2.270			80	Stn. E
	1.218			100	Stn. F
		0.646		120	Stn. G (survey marker)

a) Calculate the reduced level of the survey marker (Stn. G) using the Rise and Fall Method and show the method of reduction.

[6 marks]

b) Calculate the height of collimation of the change point (Stn. D).

[3 marks]

c) Calculate the gradient of AG.

[2 marks]

d) It was realized after the survey that the reduced level obtained for the survey marker (Stn. G) is out by -10 mm. If the allowable error laid down under the second class survey is $\pm (8.4\sqrt{K})$ mm, can the leveling task be accepted and state your reason.

[2 marks]

e) Sketch the profile of Stn. A to Stn. G.

[1 mark]

f) State four (4) necessary precautions that should be taken to ensure that a leveling result is satisfactory even if the level is in adjustment.

[2 marks]

g) As a result of the outcome from d) above, it was decided that a two-peg test as follows is to be carried out as it was suspected that the line of sight is not horizontal even if the bubble is central.

The level, set up at a position C, 30 m from a staff held at A, and 60 m from a staff held at B, gave readings of 1.914 m and 2.237 m respectively, and the bubble was brought to the centre of its run before each reading was taken. The level was then taken to D, 30 m from B and 60 m from A and the staff readings of 1.874 m and 2.141 m respectively, were obtained. The level stations and the staff stations lay in a straight line.

i. Draw a sketch to illustrate the different positions of instrument and staff.

[1 mark]

ii. Calculate the collimation error of the level, the corrected difference in level between A and B, and the staff readings obtained from D when the instrument has been placed in adjustment.

[3 marks]

[Total: 20 marks]

4. a) A 01″ reading theodolite having a 100 multiplying constant and 0 additive constant was used to carry out tacheometric observations in the study on the stability of an embankment and the following data was recorded (Table 3).

Table 3.

Instrument at station P. Reduced level of P (RL_P) = 71.62 m. Height of instrument above station = 1.55 m.						
Staff point	Horizontal circle reading	Vertical circle reading	Stadia reading			Remarks
			Upper	Middle	Lower	
Q	00° 00′					Traverse station Q
P1	24° 17′	87° 48′	2.113	1.829	1.547	End of embankment
P2	48° 32′	88° 18′	2.438	2.212	1.988	Bottom of embankment
P3	48° 32′	86° 43′	1.806	1.415	1.027	Top of embankment
P4	81° 03′	87° 37′	2.143	1.846	1.552	End of embankment
Q	00° 00′					Traverse station Q

Calculate:

i. The slope distance between the top and bottom of the embankment.

[5 marks]

ii. The extent of embankment from P1 to P4.

[5 marks]

b) During a traversing job, a horizontal angle reading was observed to station B from station A. Before an observation was carried out to station C to determine the internal angle BAC, one of the tripod legs was accidently kicked. Explain what should be done to ensure that the observed angle BAC is correct.

[10 marks]

[Total: 20 marks]

1. *Untuk tujuan penyelenggaraan semua bangunan dan kemudahan di USM Kampus Kejuruteraan secara berkala dan sistematik, Jabatan Pembangunan telah menetapkan supaya satu pelan ukur butiran terkini pada skala 1:1,000 yang memaparkan semua butiran dan perkhidmatan disediakan. Pelan tersebut juga akan digunakan untuk mengenalpasti kawasan-kawasan baru di bawah program pembangunan lestari Rancangan Malaysia Ke-10 (2011-2015).*

   Pelbagai kaedah ukur boleh digunakan untuk mencapai matlamat program tersebut tetapi prinsip asas pertama iaitu "bekerja dari keseluruhan ke sebahagian" mesti dipatuhi.

   Dengan menggunakan beberapa contoh dan lakaran yang sesuai, terangkan maksud prinsip tersebut dan bagaimana ianya dicapai dalam pengendalian kerja-kerja berikut:

   e) Ukur tinjauan awalan.

   [5 markah]

   f) Penubuhan kawalan-kawalan pugak dan ufuk.

   [5 markah]

   g) Kerja-kerja butiran.

   [5 markah]

   h) Penyediaan pelan ukur butiran.

   [5 markah]

   [Jumlah: 20 markah]

2. *Satu ukur travers tertutup telah dijalankan dan hasilnya akan digunakan dalam kajian kebolehlaksanaan cadangan sebuah tapak timbus tanah (Rajah 1) dan maklumat berikut telah dicatat (Jadual 1).*

Jadual 1.

Stn.	*Sudut luar dicerap*	*Jarak (m)*	*Bearing*	*Koordinat*	*Aras Laras (AL) (m)*
A	*280° 46' 47"*			*1000.000mT, 2000.000mU*	*17.7*
		315.352	*283° 41' 17"*		
B	*293° 49' 24"*				*4.1*
		167.956			
C	*115° 26' 51"*				*17.9*
		265.338			
D	*315° 02' 24"*				*17.5*
		359.274			
E	*254° 54' 19"*				*32.5*
		333.470			
A					

g) Tentukan koordinat terlaras bagi stesen B, C, D dan E menggunakan kaedah pelarasan Bowditch.

[17 markah]

h) Tentukan tikaian lurus travers.

[2 markah]

i) Kira keluasan travers menggunakan koordinat terlaras.

[5 markah]

j) Kawasan cadangan tapak timbus tanah diwakili oleh garis sempadan travers. Jika syarat yang ditetapkan oleh Jabatan Alam Sekitar (JAS) mengenai keluasan minimum tapak timbus tanah ialah 40,000 meter persegi (4 hektar) dan cerun maksimum ialah 1:2.5, tentukan kebolehlaksanaan kajian berdasarkan faktor-faktor berikut:

iii. Keluasan tapak timbus tanah.

[2 markah]

iv. Keadaan cerun dengan merujuk kepada garisan travers AB dan ED.

[5 markah]

k) Jika aras bentukan cadangan P bagi tapak timbus tanah ialah pada AL = 4.0 m, kira isipadu bahagian potong.

[6 markah]

l) Lukis gambar rajah angkut jisim bagi kerja-kerja tanah untuk tapak tanah timbus yang dicadang.

[3 markah]

[Jumlah: 40 markah]

3. Untuk menentukan aras laras penanda ukur (Stn. G) di laluan masuk tapak pembinaan, ukur aras biasa telah dijalankan dan maklumat berikut diperolehi (Jadual 2).

Jadual 2.

Pandangan Belakang (PB)	*Pandangan Antara (PA)*	*Pandangan Hadapan (PH)*	*Aras Laras (AL) (m)*	*Jarak (m)*	*Catatan*
0.663			*98.760*		*BM A0147 (AL=98.760 m)*
	1.946			*0*	*Stn. A*
	1.008			*20*	*Stn. B*
	1.153			*40*	*Stn. C*
2.787		*1.585*		*60*	*Stn. D (titik alih)*
	2.270			*80*	*Stn. E*
	1.218			*100*	*Stn. F*
		0.646		*120*	*Stn. G (penanda ukur)*

a) Kira aras laras penanda ukur (Stn. G) menggunakan Kaedah Naik Turun dan tunjukkan kaedah pelarasan.

[6 markah]

b) Kira ketinggian kolimatan titik alih (Stn. D).

[3 markah]

c) Kira kecerunan AG.

[2 markah]

d) Setelah selesai kerja ukur, ralat aras laras bagi penanda ukur (Stn. G) sebanyak -10 mm dikesan. Jika ralat yang dibenarkan dalam ukuran kelas kedua ialah ± (8.4√K) mm, bolehkah kerja ukur aras diterima dan nyatakan sebab anda.

[2 markah]

e) Lakarkan profil bagi Stn. A ke Stn. G.

[1 markah]

f) Nyatakan empat (4) langkah penting yang patut diambil supaya hasil kerja ukur aras adalah memuaskan walau pun alat aras dalam keadaan pelarasan yang baik.

[2 markah]

g) Hasil dari d) di atas, ujian dua piket perlu dijalankan setelah garis pandangan disyakki tidak ufuk walau pun gelembung memusat.

Alat aras yang didirisiap di C, 30 m dari staf di A dan 60 m dari staf di B menghasilkan bacaan 1.914 m dan 2.237 m. Gelembung dipusatkan sebelum tiap-tiap bacaan diambil. Alat aras seterusnya didirisiap di D, 30 m dari B dan 60 m dari A dan bacaan staf adalah 1.874 m dan 2.141 m. Stesen-stesen alat dan staf adalah segaris.

iii. Lukis satu lakaran untuk menjelaskan kedudukan alat aras dan staf.

[1 markah]

iv. *Kira selisih kolimatan bagi alat aras, beza aras terlaras di antara A dan B, dan bacaan pada staf dari D jika alat telah terlaras.*

[3 markah]

[Jumlah: 20 markah]

4. a) *Sebuah tiodolit 01" yang mempunyai pemalar daraban 100 dan pemalar campuran 0 telah digunakan untuk menjalankan cerapan tekimetri semasa menjalankan kajian kestabilan benteng dan maklumat berikut telah dicatat (Jadual 3).*

Jadual 3.

Alat di stesen P. *Aras laras P (RL_P) = 71.62 m.* *Ketinggian alat di atas stesen = 1.55 m.*						
Titik staf	*Bacaan bulatan ufuk*	*Bacaan bulatan pugak*	*Bacaan stadia*			*Catatan*
			Atas	*Tengah*	*Bawah*	
Q	*00° 00′*					*Stesen travers Q*
P1	*24° 17′*	*87° 48′*	*2.113*	*1.829*	*1.547*	*Hujung benteng*
P2	*48° 32′*	*88° 18′*	*2.438*	*2.212*	*1.988*	*Bahagian bawah benteng*
P3	*48° 32′*	*86° 43′*	*1.806*	*1.415*	*1.027*	*Bahagian atas benteng*
P4	*81° 03′*	*87° 37′*	*2.143*	*1.846*	*1.552*	*Hujung benteng*
Q	*00° 00′*					*Stesen travers Q*

Kira:

i. *Jarak cerun di antara bahagian atas dan bawah benteng.*

[5 markah]

ii. *Had benteng dari P1 ke P4.*

[5 markah]

b) *Semasa menjalankan kerja travers, bacaan suduk ufuk telah dicerap di stesen A ke stesen B. Sebelum cerapan dibuat ke stesen C bagi menentukan sudut dalam BAC, salah satu kaki tripod telah terlanggar. Terangkan apa yang patut dilakukan supaya cerapan sudut BAC dianggap betul.*

[10 markah]

[Jumlah: 20 markah]

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