UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2009/2010

November 2009

EAK 263/4 – Geomatic Engineering
[Kejuruteraan Geomatik]

Duration : 3 hours
[Masa : 3 jam]

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

Instructions: This paper contains **FIVE (5)** questions. Answer **ALL** questions.
*[**Arahan**: Kertas ini mengandungi **LIMA (5)** 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.]*

Write the answered question numbers on the cover sheet of the answer script.
[Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Enggeris hendaklah diguna pakai]

1. (a) The usual method of testing and adjusting a level is to carry out the permanent adjustment check. Explain why this check is carried out for an automatic and digital level and how it differs with the tilting level.

(5 marks)

(b) With the help of suitable diagrams, explain how the test is carried out to determine the presence of a collimation error in the level.

(10 marks)

(c) The readings obtained from a two-peg test carried out on an automatic level with a single staff set up alternately at two pegs A and B placed 50 m apart were as follows.

With the level midway between A and B:

Staff reading at A = 1.282 m

Staff reading at B = 0.859 m

With the level positioned 5 m from peg B on the line AB produced:

Staff reading at A = 1.611 m

Staff reading at B = 1.218 m

Calculate:

i) The collimation error of the level per 50 m of sight.

ii) The reading that should have been observed on the staff at A from the level in position 5 m from B.

(5 marks)

2. A leveling work was carried out to determine the elevation of survey control of points and the information is booked in the table below.

BS	IS	FS		Remarks
2.191				TBM P (RL 49.873 m)
	2.505			Stn. A
	2.325			Stn. B
3.019		1.496		Stn. C
	2.513			Stn. D
1.752		2.811		Stn. E
		3.824		TBM Q (RL 48.710 m)

(a) Design a typical leveling form and reduce the levels of stations A, B, C, D and E using the Height of Collimation Method. Show all the necessary adjustments and the arithmetic checks.

(10 marks)

(b) When is the Height of Collimation Method of reduction more suitable to use as compared to the Rise and Fall Method?

(4 marks)

(c) Many sources of error exist in leveling and some of the common ones met in practice are parallax, staff not vertical and unstable ground. Explain how these sources of error are dealt with on site.

(6 marks)

3. (a) A closed-loop traverse survey ABCDEA gave the information as shown in the following table. Determine the closing error and the coordinates of the traverse stations if the coordinates of station A are 1200.000 mE, 1200.000 mN.

(15 marks)

Line	Length (m)	Bearing
AB	293.271	45º 10′ 10″
BC	720.831	72º 04′ 55″
CD	497.120	161º 51′ 45″
DE	523.340	228º 43′ 10″
EA	761.871	300º 41′ 50″

b) The table below shows data for the three of the four sides of a closed traverse. Calculate the bearing and distance of line DA.

(5 marks)

Line	Length (m)	Bearing
AB	79.64	N 31º 22′ E
BC	98.38	N 79º 11′ E
CD	157.78	S 19º 59′ W
DA	-	-

4. (a) A tacheometric observation was carried out at an intermediate station C of the line AB and the following readings were obtained:

Staff Stn.	Vertical Angle θ	Staff Readings		
		Lower	Middle	Upper
A	- 06° 25' 40"	0.445	1.675	2.905
B	+ 04° 36' 10"	0.950	1.880	2.810

The instrument was fitted with an anallactic lens and the constant was 100. Find the gradient of the line joining stations A and B.

(10 marks)

b) The determination of scale, zero and cyclic errors of EDM instruments is by means of calibration and can be carried out by a number of different methods.

i) Explain how the zero error *z* is determined in the field using the unknown baseline lengths method and compare that with the known baseline lengths method.

(6 marks)

ii) State one advantage and one disadvantage for both above methods of calibration.

(4 marks)

5. (a) The area of a plot of land numbered ABCDE has the following coordinates as described in the table below.

Stn.	Easting (m)	Northing (m)
A	100.00	200.00
B	206.98	285.65
C	268.55	182.02
D	292.93	148.80
E	191.74	85.70

In general, the area by coordinates is given by the formula:

$$A = \frac{1}{2} [\Sigma N_i (E_{i+1} - E_{i-1})]$$

Fill up the following table below with the correct values and determine the area of the plot of land ABCDE in hectares.

Station	$\mathbf{N_i}$	$\mathbf{E_{i+1}}$	$\mathbf{E_{i-1}}$	$\mathbf{N_i(E_{i+1} - E_{i-1})}$
A				
B				
C				
D				
E				
			Σ	

(10 marks)

(b) The volume from spot heights is generally calculated using the grid elements as shown in Figure 1. The formula for volume is:

$$V = \frac{d^2 (s_i h_1 + s_i h_2 + s_i h_3 + s_i h_4)}{4}$$

for a standard 4-sided grid, where d = size of the grid, s_i = number of times the heights are counted, and h is the height above the proposed spot level.

Find the volume within the grid as in the figure if the grid size is given as 8 m.

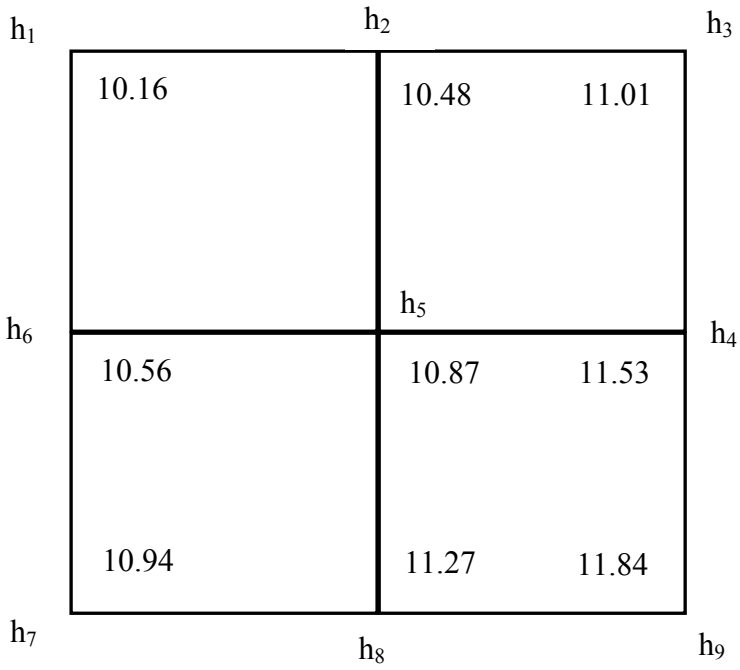


Figure 1

(10 marks)

1. *(a) Cara lazim menguji dan melaras sebuah alat aras ialah dengan menjalankan semakan pelarasan tetap. Terangkan bagaimana ujian ini dijalankan bagi alat aras jenis automatik dan digital dan bagaimana ianya berbeza dengan alat aras jongkit.*

(5 markah)

(b) Dengan bantuan gambar rajah sesuai, terangkan bagaimana ujian dijalankan bagi menentukan kewujudan selisih kolimatan bagi sebuah alat aras.

(10 markah)

(c) Bacaan dari ujian dua piket yang dijalankan ke atas sebuah alat aras automatik dengan sebatang staf yang didirikan di atas dua piket A dan B 50 m jaraknya adalah seperti berikut:

Dengan alat aras di tengah di antara A dan B:

Bacaan staf di A = 1.282 m

Bacaan staf di B = 0.859 m

Dengan alat aras diletakkan 5 m dari piket B di atas garisan AB dipanjangkan:

Bacaan staf di A = 1.611 m

Bacaan staf di B = 1.218 m

Kira:

i) Selisih kolimatan bagi alat aras per 50 m garis pandangan.

ii) Bacaan yang sepatutnya dicerap pada staf di B dari alat aras yang terletak 5 m dari B.

(5 markah)

2. *Satu kerja untuk aras telah dijalankan untuk menentukan ketinggian titik-titik kawalan ukur dan maklumat dicatat dalam jadual berikut:*

PB	***PA***	***PH***		***Catatan***
2.191				*TBM P (RL 49.873 m)*
	2.505			*Stn. A*
	2.325			*Stn. B*
3.019		*1.496*		*Stn. C*
	2.513			*Stn. D*
1.752		*2.811*		*Stn. E*
		3.824		*TBM Q (RL 48.710 m)*

(a) Reka borang tipikal pembukaan aras dan laraskan aras bagi stesen A, B, C, D dan E menggunakan Kaedah Ketinggian Kolimatan. Tunjukkan semua pelarasan dan semakan matematik yang diperlukan.

(10 markah)

(b) Bilakah Kaedah Ketinggian Kolimatan lebih sesuai digunakan jika dibandingkan dengan Kaedah Naik Turun?

(4 markah)

(c) Terdapat banyak sumber selisih dalam ukur aras dan antaranya yang sering dihadapi ialah paralaks, staf tidak pugak dan keadaan tanah yang tidak stabil. Terangkan bagaimana sumber-sumber selisih ini ditangani di lapangan.

(6 markah)

3. *a) Maklumat sebuah ukur travers tertutup ABCDEA adalah seperti di dalam jadual berikut. Tentukan selisih tertutup koordinat stesen-stesen travers jika koordinat stesen A ialah 1200.000 mT, 1200.000 mU.*

(15 markah)

Garisan	***Jarak (m)***	***Bearing***
AB	*293.271*	*45° 10′ 10″*
BC	*720.831*	*72° 04′ 55″*
CD	*497.120*	*161° 51′ 45″*
DE	*523.340*	*228° 43′ 10″*
EA	*761.871*	*300° 41′ 50″*

b) *Jadual di bawah menunjukkan data bagi tiga dari empat sisi sebuah travers tertutup. Kira bearing dan jarak garisan DA.*

(5 markah)

Garisan	***Jarak (m)***	***Bearing***
AB	*79.64*	*U 31° 22′ T*
BC	*98.38*	*U 79° 11′ T*
CD	*157.78*	*S 19° 59′ B*
DA	-	-

4. (a) *Satu cerapan tekimetri telah dijalankan di sebuah stesen pengantara C di antara garisan AB dan bacaan berikut telah diperolehi:*

Stn. Staf	***Sudut Pugak θ***	***Bacaan Staf***		
		Bawah	***Tengah***	***Atas***
A	*- 06° 25' 40"*	*0.445*	*1.675*	*2.905*
B	*+ 04° 36' 10"*	*0.950*	*1.880*	*2.810*

Alat telah dilengkapi dengan kanta analaktik dan pemalarnya ialah 100. Kira cerun garisan yang menyambung stesen A dan B.

(10 markah)

(b) *Penentuan selisih skala, sifar dan berkitar bagi alat EDM dilakukan melalui kaedah kalibrasi dan ianya boleh ditentukan dengan pelbagai cara.*

i) *Terangkan bagaimana selisih sifar z ditentukan di lapangan menggunakan kaedah jarak garis asas tidak diketahui dan bandingkan dengan kaedah jarak garis asas diketahui.*

(6 markah)

ii) *Nyatakan satu kelebihan dan satu kekurangan bagi kedua-dua kaedah kalibrasi di atas.*

(4 markah)

5. (a) *Sebidang tanah ABCDE yang terletak di suatu kawasan mempunyai nilai koordinat seperti tercatat dalam jadual berikut:*

Stn.	***Timur (m)***	***Utara (m)***
A	*100.00*	*200.00*
B	*206.98*	*285.65*
C	*268.55*	*182.02*
D	*292.93*	*148.80*
E	*191.74*	*85.70*

Lazimnya keluasan sesuatu kawasan yang dikira dengan cara koordinat menggunakan rumus luas:

$$A = \frac{1}{2} [\Sigma N_i (E_{i+1} - E_{i-1})]$$

Penuhkan jadual berikut dengan mengisi nilai-nilai sebenar dan tentukan luas kawasan sebidang tanah ABCDE dalam hektar.

Stesen	$\mathbf{N_i}$	$\mathbf{E_{i+1}}$	$\mathbf{E_{i-1}}$	$\mathbf{N_i(E_{i+1} - E_{i-1})}$
A				
B				
C				
D				
E				
			Σ	

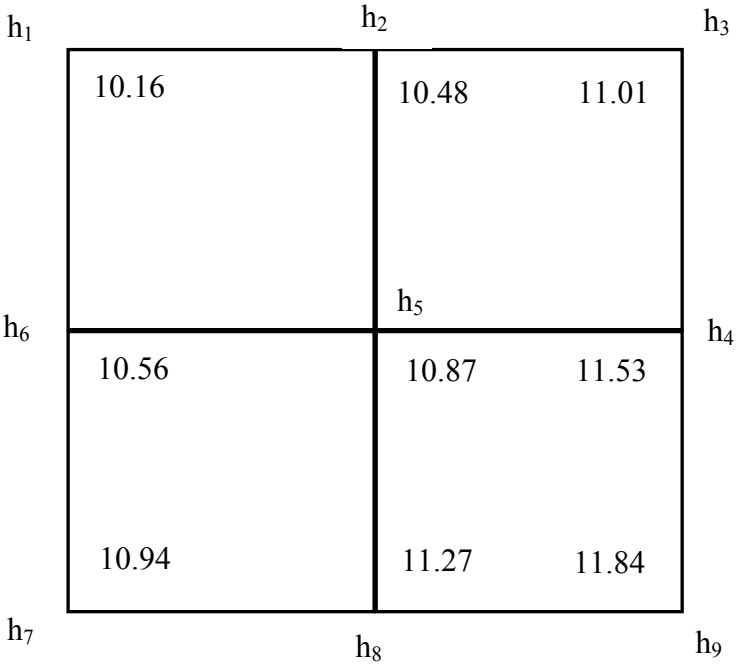
(10 markah)

(b) Pengiraan jumlah isipadu dengan kaedah titik ketinggian lazimnya menggunakan elemen-elemen grid seperti di dalam Rajah 1 di bawah. Rumusan isipadu untuk grid 4-sisi diberi sebagai:

$$V = \frac{d^2 (s_i h_1 + s_i h_2 + s_i h_3 + s_i h_4)}{4}$$

di mana d = saiz grid, s_i = kekerapan nilai titik ketinggian itu digunakan, dan h ialah ketinggian di atas aras sesuatu rujukan.

Kira nilai isipadu di kawasan grid seperti di dalam rajah jika saiz grid yang digunakan ialah 8 m.



Rajah 1

(10 markah)

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