Second Semester Examination
2017/2018 Academic Session

May/June 2018

EAK163 – 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 **FOUR (4)** questions. Answer **ALL** questions.*

[***Arahan :*** *Kertas ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan.*]

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

[*Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.*]

PROJECT DESCRIPTION / *HURAIAN PROJEK*

A new administrative complex is to be constructed at the South Gate Entrance of the Engineering Campus, Universiti Sains Malaysia under the 11th Malaysia Plan (2016-2020). As the appointed consultant for this project, you were given the task to appoint a Licensed Land Surveyor registered under the Board of Licensed Land Surveyors Malaysia to carry out a detail survey that covers the whole campus and to produce a survey plan at a scale of 1:1,000 which shows all existing details and the layout of the new construction site for designing purposes.

Sebuah kompleks pentadbiran baru akan dibina di Pintu Masuk Selatan Universiti Sains Malaysia, Kampus Kejuruteraan, di bawah Rancangan Malaysia ke-11 (2016-2020). Sebagai perunding yang dilantik untuk projek ini, anda ditugaskan untuk melantik seorang Juruukur Tanah Berlesen yang berdaftar di bawah Lembaga Juruukur Tanah Berlesen Malaysia untuk menjalankan ukuran terperinci yang merangkumi seluruh kampus dan menghasilkan pelan butiran pada skala 1: 1,000 yang menunjukkan semua butiran sedia ada dan susun atur tapak pembinaan baru untuk tujuan rekabentuk.

1. Your main task is to monitor the detail survey to be carried out by the survey team and to give inputs to the management team on the work procedures and the reporting of the progress of the project.

   Using suitable examples and sketches, propose how the following are to be achieved and monitored:

   Tugas utama anda adalah untuk memantau ukuran terperinci yang akan dijalankan oleh pasukan ukur dan memberi input kepada pihak pengurusan mengenai prosedur kerja dan melaporkan kemajuan projek.

   Menggunakan contoh-contoh dan lakaran-lakaran yang sesuai, cadangkan bagaimana perkara berikut dapat dicapai dan dipantau:

...3/-

(a). The preliminary survey reconnaissance based on the principle of “working from the whole to the part” as several survey tasks are to be carried out and delivered on time.

Ukur tinjauan awal berdasarkan prinsip "bekerja dari keseluruhan ke bahagian" kerana beberapa kerja pengukuran perlu dijalankan dan diserahkan tepat pada waktunya.

[5 marks/*markah*]

(b). The establishment of vertical and horizontal controls that covers the whole project area.

Penubuhan kawalan ufuk dan pugak yang merangkumi keseluruhan kawasan projek.

[5 marks/*markah*]

(c). The detailing works and the survey plan to be produced.

Kerja-kerja terperinci dan pelan ukur yang akan dihasilkan.

[5 marks/*markah*]

(d). A new survey team was given the task to establish the vertical control at the above project. The results obtained were later found to be unsatisfactory and were rejected as the misclosure exceeded the permissible limit under the second class survey category.

As the survey work has to be repeated, you were given the task to brief the survey team on the steps that should be taken to improve the work procedures at the site.

Illustrate **FIVE (5)** possible reasons that may have happened on site which end up with misclosure exceeding the possible limit and the steps that should be taken so as to achieve better and acceptable results.

Satu pasukan ukur baru telah ditugaskan untuk menubuh kawalan ufuk untuk projek di atas. Hasil yang diperolehi kemudiannya didapati tidak memuaskan dan ditolak kerana tikaian melebihi had yang dibenarkan di bawah kategori ukur kelas kedua.

Oleh kerana kerja ukur perlu diulang, anda ditugaskan untuk memberi penerangan kepada pasukan ukur tentang langkah-langkah yang perlu diambil untuk memperbaiki prosedur kerja di tapak.

*Huraikan **LIMA (5)** sebab yang mungkin telah berlaku di tapak yang menyebabkan tikaian melebihi had yang dibenarkan dan langkah-langkah yang perlu diambil untuk mendapat keputusan yang lebih baik dan boleh diterima.*

[10 marks/*markah*]

2. (a). It was decided that the permanent adjustment has to be carried out to verify the condition of the level used for this project. Using suitable diagrams or sketches, illustrate how the level is to be tested on site before deciding on whether the instrument can be used, or otherwise, before the vertical control survey can be repeated.

Ia telah ditetapkan bahawa pelarasan tetap perlu dilakukan bagi menentukan keadaan alat aras yang digunakan untuk projek tersebut. Dengan menggunakan rajah atau lakaran yang sesuai, huraikan bagaimana alat ukur diuji di tapak sebelum memutuskan sama ada alat tersebut boleh digunakan, atau sebaliknya, sebelum ukur kawalan ufuk boleh diulang.

[5 marks/*markah*]

(b). Explain the fundamental lines of a level and the desired relationship of the fundamental lines.

Jelaskan garisan-garisan asas sesebuah alat aras dan hubungkait yang diperlukan bagi garisan-garisan asas ini.

[5 marks/*markah*]

(c). A level was set up midway on site at point C between two points A and B, 80 m apart. The staff readings at point A and point B were 3.200 m and 3.015 m, respectively. The level was then moved to point D, 20 m ahead of point B, in line with the other two points.

Calculate the staff readings on the two points A and B to provide a horizontal line of sight.

Sebuah alat aras telah didirikan di tapak di titik C di pertengahan antara dua titik A dan B, 80 m jarak. Bacaan staf di titik A dan titik B adalah masing-masing 3.200 m dan 3.015 m. Alat aras kemudiannya dipindahkan ke titik D, 20 m di hadapan titik B, sejajar dengan kedua-dua titik tersebut.

Kira bacaan staf di kedua-dua titik A dan B untuk mendapatkan garis pandangan ufuk.

[5 marks/*markah*]

(d). The following levelling was carried out at the site to determine the levels of the points along the slope starting from BM 164 to point B (**Table 1)**.

Calculate the reduced levels of all survey points using both the Rise and Fall Method and the Height of Collimation Method and apply all the arithmetic checks. **Use Booking Forms 1 and 2**.

*Pengukuran aras berikut telah dijalankan di tapak untuk menentukan aras titik-titik di cerun yang bermula dari BM 164 ke titik B (**Jadual 1)**.*

*Kira aras laras kesemua titik ukur dengan menggunakan Kaedah Naik dan Turun dan Kaedah Ketinggian Pengkolimatan dan gunakan semua semakan aritmetik. **Guna Borang Pembukuan 1 dan 2**.*

[10 marks/*markah*]

Table 1/*Jadual 1*

Levelling/*Ukur Aras*

Project/*Projek*:
Administrative Complex, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang/
Kompleks Pentadbiran, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang

Surveyed by: Jonathan Wong ***Diukur oleh:***			**Checked by:** Wani Hasrita ***Disemak oleh:***		
Date: 15 April 2018 ***Tarikh:***			**Date:** 20 April 2018 ***Tarikh:***		
Backsight (BS)/ *Pandangan Belakang (PB)*	**Intermediate Sight (IS)/ *Pandangan Antara (PA)***	**Foresight (FS)/ *Pandangan Hadapan (PH)***	**Reduced Level (RL) (m)/ *(Aras Laras) (AL)(m)***	**Distance (m)/ *(Jarak) (m)***	**Remarks/ *Catatan***
0.780			180.750	0	BM 164
	1.535			30	
	1.955			60	
	2.430			90	
	2.985			120	
1.155		3.480		150	CP 1
	1.960			180	
	2.365			210	
0.935		3.640		240	CP 2
	1.045			270	
	1.630			300	
		2.545		330	B

3. A closed traverse survey was conducted by the survey team at the proposed administrative complex site. The results will be used by the engineers to determine the layout of the building and the information is presented in **Table 2**.

Satu ukur travers tertutup telah dijalankan oleh pasukan ukur di tapak kompleks pentadbiran yang dicadangkan. Hasilnya akan digunakan oleh jurutera untuk menentukan bentangan bangunan dan maklumat adalah seperti di ***Jadual 2****.*

Table 2 /*Jadual 2*
Traverse/*Travers*

Project/*Projek:*
Administrative Complex, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang/
Kompleks Pentadbiran, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang

Surveyed by: Jessica Lam ***Diukur oleh:***	**Checked by:** Ara Johari ***Disemak oleh:***
Date: 20 April 2018 ***Tarikh:***	**Date:** 21 April 2018 ***Tarikh:***

Line/ *Garisan*	**Mean included angle/ *Min sudut dalam***	**Distance (m)/ *Jarak (m)***	**Remarks/ *Catatan***
AB	A = 94º 10’ 00”	103.401	A: Guard house
BC	B = 178º 19’ 00”	157.249	B: Manhole
CE	C = 118º 21’ 45”	143.360	C: Road junction
EG	E = 94º 42’ 25”	169.080	E: Walkway near bridge
GJ	G = 158º 07’ 30”	176.741	G: CERIA Building
JL	J = 89º 03’ 55”	110.599	J: Near TBM 5
LA	L = 167º 15’ 50”	140.831	L: TM point

Whole circle bearing of AB = 187º 22’ 20”
Bearing bulatan penuh AB = 187º 22’ 20”

Coordinates of A = 2000.000 mN, 1000.000 mE
Koordinat A = 2000.000 mU, 1000.000 mT

(a). Calculate the coordinates of all survey points at the site and the accuracy of the survey carried out using the **Traverse Computation Form 3**.

Kira koordinat bagi kesemua titik ukur di tapak dan ketepatan pengukuran yang dijalankan dengan menggunakan ***Borang Pengiraan Travers 3****.*

[18 marks/*markah*]

(b). To determine the distance between two points X (near manhole) and Y (South Gate) and their elevations, the following tacheometric observations were made from two traverse stations R and S (**Table 3**).

Compute the distance XY, the gradient from X to Y and the bearing of XY.

*Untuk menentukan jarak antara dua titik X (berhampiran lurang) dan Y (Pintu Selatan) dan ketinggiannya, cerapan tekimetri berikut dibuat dari dua stesen travers R dan S (****Jadual 3****).*

Kira jarak XY, kecerunan dari X ke Y dan bearing XY.

[7 marks/*markah*]

Table 3/*Jadual 3* **Tacheometry/*Tekimetri***										
Project/*Projek:* Administrative Complex, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang *Kompleks Pentadbiran, Universiti Sains Malaysia, Kampus Kejuruteraan, Nibong Tebal, Pulau Pinang*										
Surveyed by: Chong Chore-Day ***Diukur oleh:***					**Checked by:** Heyman Ttinoo ***Disemak oleh:***					
Date: 21 April 2018 ***Tarikh:***					**Date:** 23 April 2018 ***Tarikh:***					
Traverse Stn./ ***Stn. Travers***	**R.L./** ***A.L.***	**Ht. of Instr./** ***Ketinggian Alat***	**Coordinates of Stn./** ***Koordinat Stn.***		**Staff Stn./** ***Stn. Staf***	**Bearing/** ***Bearing***	**Vertical Angle/** ***Sudut Pugak***	**Staff Readings/** ***Bacaan Staf***		
			Lat.	Dep.						
R	101.260	1.500	800	1800	X	15º 14’ 00”	+ 08º 09’	1.100	1.850	2.600
S	102.210	1.530	950	2500	Y	340º 18’ 00”	+ 02º 03’	1.320	1.911	2.501

4. (a). The triangular plot of land ABC at the proposed site in **Figure 1** has only one straight side AC, while sides AB and BC are irregular. The length of AB = 200 m, BC = 150 m and AC = 230 m. Offsets were taken along lines AB and BC to the irregular boundaries and the readings are tabulated as shown in **Table 4**.

*Plot segi tiga tanah ABC di tapak cadangan dalam **Rajah 1** hanya mepunyai sisi AC yang lurus manakala sisi-sisi AB dan BC mempunyai garisan tidak sekata. Jarak sisi AB = 200 m, BC = 150 m dan AC = 230 m. Garis ofset telah diambil di sepanjang garisan AB dan BC ke garisan tidak sekata dan bacaan adalah seperti dalam **Jadual 4**.*

Table 4/*Jadual 4*			
Offsets outwards along line AB (m)/ ***Bacaan ofset keluar garisan AB (m)***		**Offsets outwards along line BC (m)/** ***Bacaan ofset keluar garisan BC (m)***	
0	0.00	0	0.00
40	1.50	30	1.62
80	2.00	60	2.45
120	2.25	90	2.30
160	1.75	120	1.22
200	0.00	150	0.00

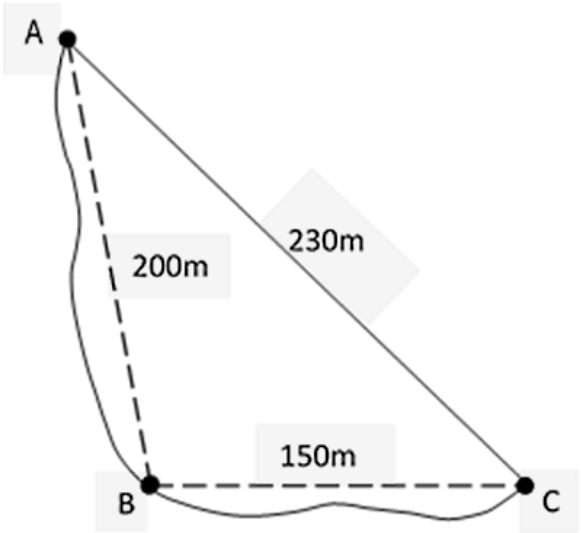

Figure 1/*Rajah 1*

Using the appropriate formula, calculate the area of the plot ABC.

Dengan menggunakan rumusan yang sesuai, kira keluasan plot ABC.

[10 marks/*markah*]

(b). **Figure 2** shows a transverse cross-sectional cutting at the side of the proposed administrative complex with the slope ratio of 1:10. The road width is 20 m, the side slope ratio is 1:2 and the depth of cutting is 10 m.

Rajah 2 *menunjukkan satu potongan keratan rentas melintang di sisi tapak cadangan kompleks pentadbiran dengan nisbah cerun 1:10. Lebar aras bentukan ialah 20 m, cerun sisi ialah 1:2 dan kedalaman pemotongan ialah 10 m.*

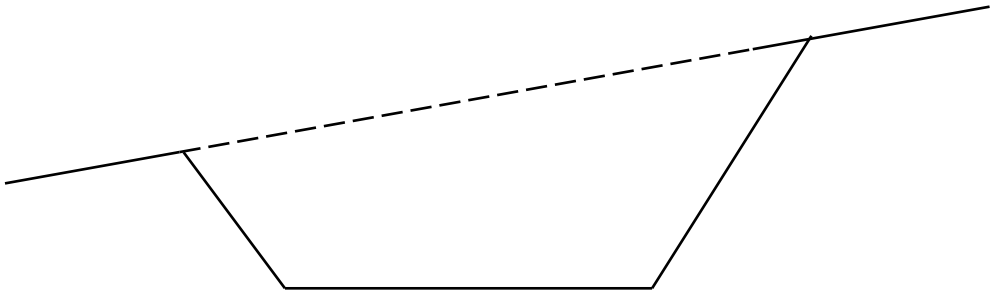

Figure 2/*Rajah 2*

(i). Calculate the side width and the cross-sectional area of the cutting of the two level sections as shown in **Figure 2**.

Kira lebar formasi sisi dan luas potongan keratan rentas melintang kedua-dua bahagian aras seperti dalam ***Rajah 2****.*

[8 marks/m*arkah*]

(ii). Calculate the volume of the earthwork removal if the cross section is constant along a proposed road 100 m in length.

Kira jumlah isipadu potongan tanah jika keratan rentas tersebut adalah malar sepanjang cadangan jalan sejauh 100 m.

[7 marks/*markah*]

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INDEX NO/*ANGKA GILIRAN*:_____

BOOKING FORM 1: LEVELLING
RISE AND FALL METHOD OF REDUCTION
PROJECT: ADMINISTRATIVE COMPLEX, UNIVERSITI SAINS MALAYSIA, KAMPUS KEJURUTERAAN, NIBONG TEBAL, PULAU PINANG

PROJECT NO: PPKR 1/2018/MPKB

Surveyed by: Jonathan Wong	**Date:** 15 April 2018
Checked by: Wani Hasrita	**Date:** 20 April 2018

Back Sight	Intermediate Sight	Fore Sight	Rise	Fall	Reduced Level (RL)	Distance	Remarks

Computed by:	**Matrix No:**

INDEX NO/*ANGKA GILIRAN*:_____

BOOKING FORM 2: LEVELLING **HEIGHT OF COLLIMATION METHOD OF REDUCTION** **PROJECT: ADMINISTRATIVE COMPLEX, UNIVERSITI SAINS MALAYSIA,** **KAMPUS KEJURUTERAAN, NIBONG TEBAL, PULAU PINANG**						
PROJECT NO: PPKR 1/2018/MPKB						
Surveyed by: Jonathan Wong				**Date:** 15 April 2018		
Checked by: Wan Amanda Zulaikha				**Date:** 20 April 2018		
Back Sight	**Intermediate Sight**	**Fore Sight**	**Height of Collimation**	**Reduced Level (RL)**	**Distance**	**Remarks**
Computed by:				**Matrix No:**		

INDEX NO/*ANGKA GILIRAN*:_____

TRAVERSE COMPUTATION FORM 3 **PROJECT: ADMINISTRATIVE COMPLEX, UNIVERSITI SAINS MALAYSIA, KAMPUS KEJURUTERAAN, NIBONG TEBAL, PULAU PINANG**										
Traverse No: 1/2018/KP-USM			**Project No:** PPKR 1/2018/MPKB				**Instrument ID:** Sokisha X-01			
Surveyed by: Hakim Rosley			**Date:** 27 April 2018				**Verified by:**			
Checked by: Ara Johari			**Date:** 2 May 2018				**Date:**			
Stn	**Bearing**	**Distance**	**Latitude**		**Departure**		**Corrected**		**Coordinates**	
			N	**S**	**E**	**W**	**Latitude**	**Departure**	**N/S**	**E/W**
Computed by: **Date:**							**Matrix No:**			