UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2015/2016 Academic Session

June 2016

EAK163 – Geomatic Engineering
[*Kejuruteraan Geomatik*]

Duration: 3 hours
[Masa: 3 jam]

Please check that this examination paper consists of **ELEVEN (11)** pages of printed materials 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 **FIVE (5)** questions. Answer **ALL** questions.
*[**Arahan**: Kertas ini mengandungi **LIMA (5)** soalan. Jawab **SEMUA** soalan].*

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].

1. You were given the task to manage the construction of a school on a 20 acres ex-mining land in Nibong Tebal. As an engineer, your tasks include the appointment of a Licensed Land Surveyor and to prepare the Terms and Conditions that shall cover all items pertaining to the survey to be carried out and the submission of the detail survey plans to Majlis Perbandaran Nibong Tebal and the Ministry of Education.

Anda ditugaskan untuk mengurus pembinaan sebuah sekolah di atas tanah bekas lombong seluas 20 ekar di Nibong Tebal. Sebagai seorang jurutera, tugas-tugas anda termasuk melantik seorang Juruukur Tanah Berlesen dan menyediakan Terma dan Syarat yang meliputi semua perkara yang berkaitan dengan pengukuran yang akan dijalankan dan penyerahan pelan-pelan butiran terperinci kepada Majlis Perbandaran Nibong Tebal dan Kementerian Pelajaran.

Describe the necessary points that must be included in the Terms of Reference of Appointment with regards to the conduct of the following items:

Terangkan perkara-perkara yang perlu dinyatakan dalam Terma dan Syarat Perlantikan berkaitan dengan pengendalian perkara-perkara berikut:

[a] Site visits and reconnaissance survey by the survey team prior to the conduct of the survey at the site.

Lawatan tapak dan ukuran tinjauan oleh pasukan ukur sebelum menjalankan pengukuran di tapak.

[6 marks/*markah*]

[b] Carry out the vertical control and horizontal control at the site.

Menjalankan kawalan pugak dan kawalan ufuk di tapak.

[7 marks/*markah*]

[c] A complete detailing of all features and the submission of an approved detail survey plan to be used for the design of all infrastructures at the site.

Pembutiran lengkap semua ciri-ciri dan penyerahan pelan ukur butiran yang diluluskan untuk penggunaan reka bentuk semua infrastruktur di tapak.

[7 marks/*markah*]

2. [a] A leveling circuit is illustrated in **Figure 1** below. Demonstrate the complete adjustment procedure of this leveling circuit towards obtaining the final elevations of points P1 and P2.

*Satu ukuran aras digambarkan dalam **Rajah 1** di bawah. Tunjukkan prosedur pelarasan yang lengkap bagi ukur aras ini untuk mendapat ketinggian muktamad bagi titik-titik P1 dan P2.*

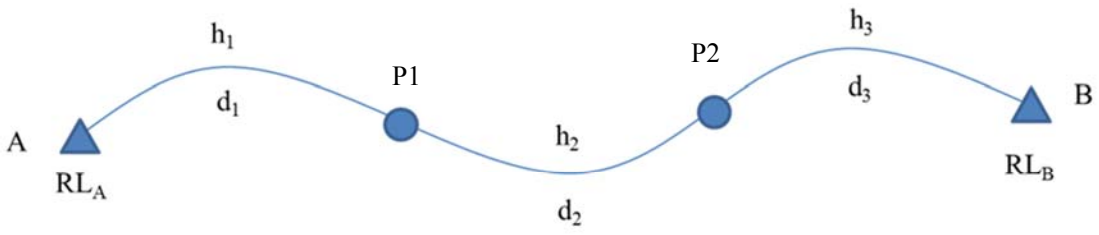

Figure 1/*Rajah 1*

where:

h_i = height difference (i = 1, 2, 3)

d_i = leveling distance (i = 1, 2, 3)

RL_A, RL_B = reduced levels for points A and B

di mana:

h_i = *perbezaan ketinggian (i = 1, 2, 3)*

d_i = *jarak ukuran aras (i = 1, 2, 3)*

RL_A, RL_B = *aras laras bagi titik-titik A dan B*

[5 marks/*markah*]

[b] A two-peg level test was performed with the instrument set up midway between two points A and B, and the staff readings at point A and point B were 3.750 m and 8.930 m respectively. The instrument was then moved 5 m after point B and the staff reading at point A was 5.370 m.

Ujian dua piket telah dijalankan menggunakan alat yang dipasang ditengah antara dua titik A dan B, dan bacaan staf di titik A dan titik B adalah masing-masing 3.750 m dan 8.930 m. Alat aras kemudiannya dipindahkan 5 m selepas titik B dan bacaan staf pada titik A adalah 5.370 m.

[i] Draw a sketch to illustrate the sequence of the instrument test.

Lukis satu lakaran untuk menggambarkan urutan ujian alat.

[ii] What should the staff reading be at point B for the line of sight to be parallel with the axis of the bubble tube of the level?

Apakah bacaan staf di titik B bagi garis penglihatan yang selari dengan paksi tiub gelembung alat aras?

[5 marks/*markah*]

[c] The following closed loop leveling survey was carried out at the site from BM A311 (RL = 66.555 m) to verify the reduced levels of all lamp posts (LP), covering a total distance of 1.5 km along the road and closed at BM A448 (RL = 66.682 m) **Table 1**.

Ukur aras tertutup yang berikut telah dijalankan di tapak dari BM A311 (AL = 66.555m) bagi menentukan aras laras kesemua tiang lampu (LP) yang meliputi jarak keseluruhan 1.5 km di sepanjang jalan dan ditutup pada BM A448 (AL = 66.682 m) ***Jadual 1.***

[i] Is the survey acceptable under the Second Class Survey?

Adakah pengukuran ini boleh diterima di bawah Ukuran Kelas Kedua?

[ii] Determine the corrected reduced levels of all lamp post points.

Tentukan aras laras terlaras bagi kesemua tiang lampu.

[10 marks/*markah*]

Table 1 / *Jadual 1*
Leveling Survey / *Ukur Aras*

Project No:/ *No. Projek:* AJG 6/2016		Site:/ *Tapak:* Palekbang, Tumpat		Job No:/ *No. Kerja:* PGS/PKNP/2016/3/HM 1(6)		
Surveyed by: / *Diukur oleh:* Jessica K. K. Leong		Date of Survey: / *Tarikh diukur*: 12 Jan. 2016		Checked by:/ *Disemak oleh:* Lesley K. C. Pang		Date:/ *Tarikh:* 18 Jan. 2016
BS/ *(PB)*	**IS/ *(PA)***	**FS/ *(PH)***	**Rise/ *(Naik)***	**Fall/ *(Turun)***	**RL/ *(AL)***	**Remarks/ *(Catatan)***
2.145					66.555	BM A311
1.506		2.954				LP 1
2.556		1.235				LP 2
	1.987					LP 3
	1.122					LP 4
	2.108					LP 5
3.426		2.995				LP 6
	3.181					LP 7
1.652		2.316				LP 8
	1.255					LP 9
		1.635				BM A448

3. [a] The establishment of horizontal control for the project involves carrying out a traverse survey at the site. As the site engineer who was tasked to monitor the survey carried out, state the measures that must be followed with regards to field work practices for [i] angle and bearing observations and [ii] distance observation as per the Director General of Survey and Mapping Malaysia Circular No. 6 Year 2009 - Guidelines for Cadastral Survey Practice in e-Cadastre Environment.

Penubuhan kawalan ufuk bagi projek yang dijalankan melibatkan pengukuran ukur travers di tapak. Sebagai jurutera tapak yang ditugaskan untuk memantau pengukuran yang dijalankan, nyatakan langkah-langkah yang mesti dipatuhi dalam amalan kerja luar bagi [i] cerapan sudut dan bering dan [ii] cerapan jarak mengikut Pekeliling Ketua Pengarah Ukur dan Pemetaan Bil 6 Tahun 2009 - Garis Panduan Amalan Kerja Ukur Kadaster Dalam Persekitaran e-Kadaster.

[5 marks/*markah*]

[b] A closed-loop traverse was carried out by a team of engineers at the proposed site of a car park and the following data were recorded **Table 2.**
Coordinates of Stn. A from CP14678 is N10,000.234, E 10,222.667.

Satu ukur travers tertutup telah dijalankan oleh sepasukan jurutera di tapak cadangan tempat letak kereta dan data berikut telah dicatat ***Jadual 2.***
Koordinat Stn. A dari PA14678 adalah U10,000.234, T 10,222.667.

Calculate:

Kira:

[i] The coordinates of the other stations; and

Koordinat stesen-stesen lain; dan

[ii] The linear misclosure of the traverse.

Tikaian lurus travers tersebut.

[15 marks/*markah*]

Table 2 / *Jadual 2*
Traverse Survey / *Ukur Travers*

Project No:/ *No. Projek:* AJG 7/2016	Site:/ *Tapak:* Flower Hill Resort	Job No:/ *No. Kerja:* PGS/PKNP/2016/3/HM 1(7)	
Surveyed by: *Diukur oleh:* Agnes Tan	Date of Survey: *Tarikh diukur*: 16 Jan. 2016	Checked by: *Disemak oleh:*	Date: *Tarikh:*

Stn.	**Bearing/ *Bering***	**Distance/ *Jarak***	**Remarks *Catatan***
A			Outside car park at Main Entrance
	10˚ 00’ 00”	209.731	
B			Guard House A
	269˚ 10’ 36”	163.289	
C			Guard House B
	276˚ 31’ 12”	181.790	
D			TNB Sub-station
	177˚ 10’ 03”	245.329	
E			Manhole
	86˚ 06’ 09”	295.601	
A			

4. [a] State **FIVE (5)** necessary precautions that should be taken on site to ensure that the leveling results are satisfactory even if the level is in good adjustment.

*Nyatakan **LIMA (5)** langkah berjaga-jaga yang perlu diambil di tapak untuk memastikan bahawa hasil ukur aras adalah memuaskan walaupun alat aras berada dalam pelarasan yang baik.*

[5 marks/*markah*]

[b] If the misclosure of the levelling task exceeds the allowable limit under the Second Class Survey category, describe the field procedures that should be carried out to determine the condition of the level.

Jika selisih pengukuran aras melebihi had yang dibenarkan di bawah kategori Ukuran Kelas Kedua, terangkan prosedur di lapangan yang perlu dijalankan untuk menentukan keadaan alat aras.

[5 marks/*markah*]

[c] A theodolite having its additive and multiplicative constants 0 and 100 was set up at station C (RL_C = 5.568 m) and the following observations were recorded **Table 3**.

Sebuah tiodolit yang mempunyai pemalar campuran dan daraban 0 dan 100 telah didirisiapkan di stesen C (AL_C = 5.568 m) dan cerapan berikut telah dicatat ***Jadual 3.***

Calculate:
Kira:

[i] The horizontal distance and difference of elevation between the points A and B;

Jarak ufuk dan perbezaan ketinggian di antara titik A dan B;

[ii] The gradient of the line joining the points A and B; and

Kecerunan garisan yang menghubungi titik-titik A dan B; dan

[iii] The reduced levels of points A and B.

Aras laras bagi titik-titik A dan B.

[10 marks/*markah*]

Table 3 / *Jadual 3*
Tacheometric Survey / *Ukur Tekimetri*

Observed station/ *Stesen dicerap*	Bearing/ *Bering*	Stadia reading/ *Bacaan stadia*	Vertical angle/ *Sudut pugak*
A	315° 43' 40″	1.015, 1.850, 2.685	+06° 36′ 30″
B	55° 40' 20″	0.865, 2.310, 3.755	- 02° 24′ 50″

5. [a] The tract of land where USM Engineering Campus is situated has three straight boundaries A-B, B-C, and C-D. However, the fourth boundary D-A, which separates the campus with Sg. Kerian is irregular. The measured lengths and north bearings of the straight boundaries are given as AB = 650 m (215°), BC = 490 m (175°), CD = 660 m (40°), and BD = 810 m (130°). Consecutively, the offsets measured from D-A to the irregular boundary at a regular interval of 100 m from D, are as given in **Table 4**:

*Sebidang tanah di mana USM Kampus Kejuruteraan terletak mempunyai tiga sempadan lurus A-B, B-C, dan C-D. Walau bagaimanapun, sempadan keempat D-A, yang memisahkan kampus tersebut dengan Sg. Kerian adalah tidak sekata. Jarak ukuran sempadan-sempadan lurus dan nilai-nilai bearing utara diberikan sebagai AB = 650 m (215°), BC = 490 m (175°), CD = 660 m (40°), dan BD = 810 m (130°). Nilai ofset pada sela 100 m yang diukur dari D-A ke sempadan yang tidak sekata adalah seperti di dalam **Jadual 4**:*

Table 4 / *Jadual 4*
Offset Values / *Nilai Ofset*

Distance from D (m) *Jarak dari D (m)*	0	100	200	300	400	500	600
Offsets (m) *Ofset (m)*	0.0	37.0	49.0	42.0	28.0	36.0	0.0

[i] Make a rough plot (not to scale) of the boundary layout of the USM Engineering Campus.

Buat pelotan secara kasar (tidak berskala) paparan sempadan USM Kampus Kejuruteraan.

[2 marks/*markah*]

[ii] Based on the concept of irregular boundary, determine the area of the USM Engineering Campus in hectares.

Berdasarkan konsep sempadan tidak sekata, dapatkan keluasan USM Kampus Kejuruteraan dalam hektar.

[8 marks/*markah*]

[b] An embankment is to be constructed along the irregular boundary of the USM Engineering Campus. The proposed formation width is 20 m wide with side slopes of 1 in 2.5. The embankment heights at the centre line of three successive cross-sections are designed as 3.5 m, 4.5 m, and 5.5 m, respectively. The existing ground level has a transverse slope of 1 in 10.

Satu benteng akan dibina sepanjang bahagian sempadan tidak sekata di USM Kampus Kejuruteraan. Lebar pembentukan yang dicadangkan ialah 20 m dengan cerun sisi 1 dalam 2.5. Ketinggian tambakan pada garis tengah direka bentuk untuk tiga keratan rentas berturutan masing-masing pada 3.5 m, 4.5 m dan 5.5 m. Aras tanah sedia ada mempunyai cerun melintang 1 dalam 10.

[i] Calculate the area of the respective cross-sections using the two-level sections problem.

Kira luas keratan rentas pada setiap bahagian menggunakan masalah keratan dua-aras.

[6 marks/*markah*]

[ii] If the three successive cross-sections are 50 m apart, determine the volume of embankment earthworks to be filled.

Jika jarak di antara ketiga-tiga keratan rentas berturutan adalah 50 m, tentukan isipadu kerja tanah tambakan yang perlu diisi.

[4 marks/*markah*]

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