



UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2016/2017 Academic Session

June 2017

EAK163 – Geomatic Engineering
[Kejuruteraan Geomatik]

Duration: 3 hours
[Masa: 3 jam]

Please check that this examination paper consists of **TEN (10)** pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEPULUH (10)** 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.]*

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. For a new low-cost housing project to be built at the end of 2017 in Nibong Tebal by the local government in fulfilling the promises to the *rakyat*, a consultant was appointed to carry out a preliminary study at the proposed site. Part of the initial proposal to be submitted to the local council should indicate the location of the proposed site and all existing features on site. As a consultant appointed to monitor the project and responsible for the preparation of the proposal, it was decided that a preliminary study of the area prior to the conduct of a complete detail survey has to be carried out.

Bagi sebuah projek perumahan kos rendah baru yang akan dibina oleh kerajaan tempatan pada hujung tahun 2017 di Nibong Tebal dalam memenuhi janji-janji kepada rakyat, seorang perunding telah dilantik untuk menjalankan kajian awal di tapak yang dicadangkan. Sebahagian daripada cadangan awal yang akan dikemukakan kepada majlis tempatan perlu menunjukkan lokasi tapak yang dicadangkan serta semua ciri-ciri yang sedia ada di tapak. Sebagai perunding yang dilantik untuk memantau projek dan bertanggungjawab dalam penyediaan cadangan itu, ia telah diputuskan supaya kajian awal di kawasan tersebut dilaksanakan sebelum ukuran terperinci dijalankan.

Based on the following scope of work, explain the major tasks listed below that need to be carried out before conducting a complete survey of the proposed site:

Berdasarkan skop kerja berikut, terangkan kerja-kerja utama yang disenaraikan di bawah yang perlu dijalankan sebelum ukuran lengkap dijalankan di tapak cadangan:

- [a] verification of the condition of the major survey instruments to be used at the site;

pengesahan tentang keadaan peralatan ukur utama yang akan digunakan di tapak;

[8 marks/markah]

- [b] establishment of Temporary Bench Marks (TBMs);
penubuhan Batu Aras Sementara (BAS);

[4 marks/markah]

...3/-

- [c] the major steps that should be undertaken for the establishment of the vertical and horizontal controls; and

langkah-langkah utama yang perlu diambil bagi penubuhan kawalan-kawalan pugak dan ufuk; dan

[4 marks/markah]

- [d] the various steps taken on site to reduce any **TWO (2)** personal errors and any **TWO (2)** mistakes to ensure that the results of the levelling survey are acceptable.

*langkah-langkah yang diambil di tapak untuk mengurangkan mana-mana **DUA (2)** ralat peribadi dan mana-mana **DUA (2)** kesilapan untuk memastikan supaya hasil kerja ukur aras boleh diterima.*

[4 marks/markah]

2. In establishing a vertical control that covers the project site, the following levelling was conducted (**TABLE 1**):

*Bagi mewujudkan kawalan ufuk yang merangkumi tapak projek, ukur aras berikut telah dijalankan (**JADUAL 1**):*

TABLE (JADUAL) 1: VERTICAL CONTROL (KAWALAN UFUK) LOW-COST HOUSING PROJECT NIBONG TEBAL (PROJEK PERUMAHAN KOS RENDAH NIBONG TEBAL) PROJECT NO. (NO. PROJEK): PPKR 1/2017/N.TEBAL					
Surveyed by (Diukur oleh): Angela T.K. Tan			Date of survey (Tarikh diukur): 12 March 2017		
Computed by (Dikira oleh): Marcella Chan			Date (Tarikh): 13 March 2017		
Checked by (Disemak oleh): T. Braham			Date (Tarikh): 14 March 2017		
Back Sight (Pandangan Belakang)	Intermediate Sight (Pandangan Antara)	Fore Sight (Pandangan Hadapan)	Rise and Fall/ Ht. of Collimation (Naik dan Turun/ Ketinggian Kolimatan)	Reduced Level (RL) (Aras Laras) (AL)	Remarks (Catatan)
2.027					BM A600 (Kiosk entrance) RL 73.105
	2.109				Pt. A : 10 m from BM A600
	2.543				Pt. B : 20 m from BM A600
	4.681				Pt. C : 35 m from BM A600 (near MH)
2.133		4.427			Pt. D : CP 50 m from BM A600 (nail)
	3.246				Pt. E : 70 m from BM A600 (base stn.)
	1.957				Pt. F : 90 m from BM A600 (sewer)
3.159		0.681			Pt. G : CP 100 m from BM A600 (peg)
		2.988			BM A 601 (footpath) RL 72.333

- [a] Using the provided **BOOKING FORM 1**, calculate the reduced levels (RLs) of all control points A to G using the Height of Collimation method of reduction. Is the survey work acceptable under the Second Class Survey category?

*Dengan menggunakan **BORANG PEMBUKUAN 1** yang disediakan, kira aras laras (AL) kesemua titik kawalan A ke G menggunakan kaedah penurunan Ketinggian Kolimatan. Bolehkah kerja-kerja ukur diterima di bawah kategori Ukuran Kelas Kedua?*

[18 marks/markah]

- [b] Determine the gradient of control points A to G.

Tentukan kecerunan titik kawalan A ke G.

[2 marks/markah]

3. For the purpose of establishing the horizontal control at the project site, the following traverse survey (**TABLE 2**) was carried out to furnish the consultant in preparing the proposed layout plan of the new low-cost housing project and the necessary infrastructures.

Bagi tujuan mewujudkan kawalan ufuk di tapak projek, ukur travers berikut (JADUAL 2) telah dijalankan bagi membolehkan perunding menyediakan pelan susun atur cadangan projek perumahan kos rendah tersebut dan infrastruktur yang diperlukan.

TABLE (JADUAL) 2: HORIZONTAL CONTROL (KAWALAN UFUK) LOW-COST HOUSING PROJECT NIBONG TEBAL (PROJEK PERUMAHAN KOS RENDAH NIBONG TEBAL) PROJECT NO. (NO. PROJEK): PPKR 1/2017/N.TEBAL				
Surveyed by (Diukur oleh): Jessica Low			Date of survey (Tarikh diukur): 18 March 2017	
Line Garis	Mean included angle Min sudut dalam	Distance (m) Jarak (m)	Notes Catatan	
AB	θ_A	94° 10' 00"	103.401	
BC	θ_B	178° 19' 00"	157.251	
CD	θ_C	118° 21' 45"	143.359	
DE	θ_D	94° 42' 25"	169.082	Along main road (<i>sepanjang jalan utama</i>)
EF	θ_E	158° 07' 30"	176.742	Near traffic light (<i>berdekatan lampu isyarat</i>)
FG	θ_F	89° 03' 55"	110.601	
FA	θ_G	167° 15' 50"	140.828	
Whole circle bearing of AB = 187° 22' 20"				
Coordinates of station A is 1000.000mN, 1000.000mE				
<i>Bearing bulatan penuh AB = 187° 22' 20"</i>				
<i>Koordinat stesen A ialah 1000.000mU, 1000.000mT</i>				

- [a] Calculate the bearings of the other traverse lines.

Kira bearing bagi garisan-garisan travers yang lain

[3 marks/markah]

- [b] Calculate the coordinates of the other survey stations and determine the accuracy of the traverse using the Bowditch Method of Adjustment. Give your comment on the results of the survey work carried out.

You may use the **BOOKING FORM 2** provided.

Kira koordinat bagi stesen-stesen ukur yang lain dan tentukan kejituan travers menggunakan Kaedah Pelarasan Bowditch. Beri komen anda ke atas hasil kerja ukur yang dijalankan.

*Anda boleh gunakan **BORANG PEMBUKUAN 2** yang dibekalkan.*

[14 marks/markah]

- [c] “Good adjustment does not improve bad field work. If the field work is good, the method of adjustment becomes less important”.

Based on the above statement, state **THREE (3)** measures that should be taken when locating the control points at the work site to ensure that the survey results are acceptable.

“Pelarasan yang baik tidak akan menambahbaik kerja lapangan yang teruk. Jika kerja lapangan adalah baik, kaedah pelarasan menjadi kurang penting”.

*Berdasarkan kenyataan di atas, nyatakan **TIGA (3)** langkah yang perlu diambil semasa menentukan titik-titik kawalan di tapak kerja supaya hasil kerja ukur boleh diterima.*

[3 marks/markah]

4. [a] With the help of a schematic diagram, explain how you would compute the horizontal and vertical distances from the instrument station in stadia tacheometric surveying, and deduce the equations for the horizontal and the vertical distances when both the vertical angles measured are angles of elevation.

Dengan bantuan gambarajah skema, terangkan bagaimana anda hitung jarak-jarak ufuk dan pugak dari stesen alat dalam ukur tekimetri stadia, dan buat kesimpulan bagi rumusann jarak-jarak ufuk dan pugak apabila sudut-sudut pugak yang dicerap adalah sudut ketinggian.

[6 marks/markah]

- [b] **THREE (3)** principal sources of error must be considered to achieve a better accuracy to both the measured length and the difference in height in stadia tacheometric surveying. Explain how these sources of errors are treated to achieve an acceptable accuracy.

TIGA (3) sumber utama selisih mesti diberi perhatian supaya kejituan yang baik kepada jarak diukur dan perbezaan ketinggian diperolehi dalam ukur tekimetri stadia. Terangkan bagaimana sumber-sumber selisih ini ditangani untuk memperolehi kejituan yang boleh diterima.

[6 marks/markah]

- [c] Stadia readings were taken with an electronic theodolite on a vertical staff held at Station K4 at the entrance of the housing project with the telescope declined at an angle of depression of $03^{\circ} 30'$. The staff readings were 2.990, 2.055 and 1.120. The reduced level of instrument station is 100.000 m and the height of the instrument is 1.400 m. If the instrument's multiplying and additive constants are 100 and 0 respectively, what is the reduced level of Station K4?

Bacaan stadia telah dicerap kepada staf pugak di Stesen K4 di pintu masuk projek perumahan menggunakan sebuah tiodolit elektronik di mana teleskop condong dengan sudut tundukan sebanyak $03^{\circ} 30'$. Bacaan staf adalah 2.990, 2.055 dan 1.120 dan ketinggian alat ialah 1.400 m. Jika pemalar-pemalar daraban dan campuran alat ialah 100 dan 0, apakah aras laras Stesen K4?

[8 marks/markah]

5. [a] The traverse survey stations have the following coordinates listed in **TABLE 3**:

*Stesen ukur travers berikut mempunyai nilai koordinat seperti dalam **JADUAL 3**:*

TABLE (JADUAL) 3: MINOR CONTROL POINTS (TITIK KAWALAN MINOR) LOW-COST HOUSING PROJECT NIBONG TEBAL (PROJEK PERUMAHAN KOS RENDAH NIBONG TEBAL)		
Computed by (Dikira oleh):		Jessica Low
Date (Tarikh):		19 April 2017
Checked by (Disemak oleh):		Masri Bashah
Date (Tarikh):		21 April 2017
Station Stesen	Northing (m) Utara (m)	Easting (m) Timur (m)
1	2000.00	1000.00
2	2850.00	2060.00
3	1820.00	2680.00
4	1480.00	2920.00
5	850.00	1910.00

- [i] Using the coordinate values of N 1000.00 and E 1000.00 as the origin, produce a rough plot the traverse stations.

Dengan menggunakan nilai titik koordinat pusat U 1000.00 dan T 1000.00, hasilkan plotan kasar stesen travers tersebut.

[4 marks/markah]

- [ii] Determine the area of the survey traverse in hectares using the coordinate formula for area, $A = \frac{1}{2} [\sum N_i (E_{i+1} - E_{i-1})]$.

Dapatkan keluasan travers ukur tersebut dalam hektar menggunakan rumusan keluasan kaedah kordinat, $A = \frac{1}{2} [\sum N_i (E_{i+1} - E_{i-1})]$.

[6 marks/markah]

- [b] You are required to test the sensitivity in the volume calculation process by determining the quantity of earthwork in cubic meters, contained in a length of 350m with cross-sectional areas at every 50 m as in **TABLE 4**:

*Anda dikehendaki menguji kepekaan proses pengiraan isipadu dengan menentukan kuantiti kerja tanah dalam meter padu, pada jarak 350m dengan keluasan keratan rentas setiap 50 m seperti dalam **JADUAL 4**:*

TABLE (JADUAL) 4: VOLUME CALCULATION (KIRAAN ISI PADU) LOW-COST HOUSING PROJECT NIBONG TEBAL (PROJEK PERUMAHAN KOS RENDAH NIBONG TEBAL)								
Surveyed by (Diukur oleh):			Kevin Tan					
Date (Tarikh):			22 April 2017					
Checked by (Disemak oleh):			T. Tangga					
Date (Tarikh):			23 April 2017					
Chainage (m) <i>Rantaian (m)</i>	0	50	100	150	200	250	300	350
Cross-sectional area (m ²) <i>Luas keratan rentas (m²)</i>	5.50	19.50	24.40	28.00	21.12	14.88	28.00	7.98

- [i] Determine the volume of the earthwork using the distinct formulae as follows:-

Tentukan isi padu kerja tanah menggunakan rumusan yang berbeza seperti berikut:-

Prismoidal formula; and

Formula Prismoid; dan

[4 marks/markah]

Trapezoidal formula.

Formula Trapezoid.

[4 marks/markah]

- [ii] What assumption on the accuracy can you made in explaining the difference in volume achieved?

Apakah andaian yang anda boleh buat pada ketepatan dalam menjelaskan perbezaan isi padu yang diperolehi?

[2 marks/markah]

