UNIVERSITI SAINS MALAYSIA

KSCP EXAMINATION
Academic Session 2007/2008

June 2008

EAK 263/4 – Geomatic Engineering
[Kejuruteraan Geomatik]

Duration: 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **TEN (10)** printed pages before you begin the examination.
*[Sila pastikan kertas peperiksaan ini mengandungi **SEPULUH** (10) muka surat bercetak sebelum anda memulakan peperiksaan ini.]*

Instructions: This paper consists of **FIVE (5)** questions. Answer **ALL** questions. All questions carry the same marks.
*[Arahan: Kertas ini mengandungi **LIMA** (5) soalan. Jawab **SEMUA** soalan. Semua soalan membawa jumlah markah yang sama].*

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.]

...2/-

1. As a consultant, you were given a task to supervise a survey of the existing PONDS and its surrounding areas that form part of the Bio-ecological Drainage System (BIOECODS) at USM Engineering Campus (Figure 1). It is a pilot project in Malaysia that adopts a "control at source" approach to control storm water quantity and quality, and to achieve Zero Development Impact Contribution.

The survey information will be used in the monitoring of the various storm water facilities such as permeable pavement, swale with subsurface modules, dry and wet ponds, wetland, automatic tidal gates, etc., and its surrounding areas and the performance of the natural processes of sedimentation, filtration and biodegradation, and to ensure that the final discharge from a sustainable urban drainage system will not pollute rivers nor create flooding within the study or downstream areas.

Prepare a detail technical explanation as to how a second class survey is to be carried out to provide sufficient spatial information of the three ponds and its surrounding areas as shown below in terms of the following:

(i) The establishment of sufficient horizontal and vertical controls and its usage; and

(ii) The detailing of natural and man-made features.

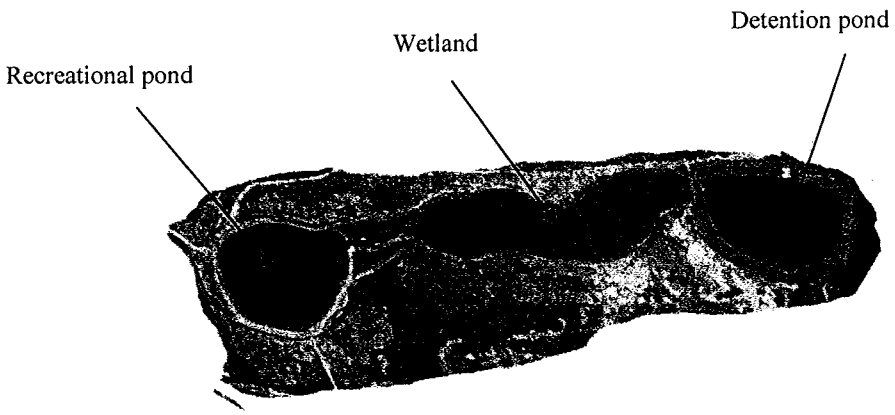


Figure / *Rajah 1*

Sebagai konsultan, anda ditugaskan untuk menyelia kerja-kerja pengukuran beberapa tasik sedia ada dan persekitarannya yang merupakan sebahagian daripada Sistem Saliran Bio-ekologikal (BIOECODS) di USM Kampus Kejuruteraan (Rajah 1). Ia merupakan projek rintis di Malaysia yang menggunakan pendekatan 'kawalan pada punca' untuk mengawal kuantiti dan kualiti air ribut ke arah pencapaian Sumbangan Kesan Pembangunan Sifar.

Maklumat ukur akan digunakan untuk pemantauan beberapa kemudahan air ribut seperti turapan telap, swale dengan modul-modul subpermukaan, 'dry and wet ponds', tanah bencah, pintu air otomatik dan lain-lain, dan persekitarannya serta kemampuan proses-proses semula jadi pemendapan, penyusupan dan biodegradasi, dan untuk memastikan luahan dari sistem saliran bandar mapan tidak akan mencemar sungai-sungai dan berlakunya banjir di kawasan kajian dan bahagian hilir sungai.

Sediakan secara terperinci huraian penerangan teknikal bagaimana pengukuran kelas kedua dijalankan untuk membekal maklumat spatial yang mencukupi bagi ketiga-tiga kolam dan persekitarannya seperti di gambar rajah merangkumi perkara-perkara berikut:

(i) kewujudan kawalan-kawalan ufuk dan pugak yang mencukupi dan kegunaannya; dan

(ii) pembutiran ciri-ciri semula jadi dan buatan manusia.

[20 marks / *markah*]

2. (a) While carrying out a levelling task, it was suspected that the instrument is out of adjustment and a two-peg test was recommended. State **THREE (3)** possible reasons why the test was required.

Semasa menjalankan kerja ukur aras, alat disyaki tidak berada dalam pelarasan yang baik dan ujian dua piket telah dicadangkan. Nyatakan ***TIGA (3)*** *sebab kenapa ujian ini diperlukan.*

[5 marks / *markah*]

(b) A above two-peg test was carried out for the above level and the following observations were recorded (Table 1):
Ujian dua piket ke atas alat aras tersebut telah dijalankan dan cerapan berikut telah dicatat (Jadual 1):

BS *PB*	IS *PA*	FS *PH*	Rise *Naik*	Fall *Turun*	Remarks *Catatan*
First set-up *(Kedudukan pertama alat)*					
1.075					Staff at A; AB = 60 m *Staf di A; AB = 60 m*
		1.247			Staff at B; instr. midway at C *Staf di B; alat di tengah-tengah di C*
Second set-up *(Kedudukan kedua alat)*					
1.783					Staff at A *Staf di A*
		1.946			Staff at B; instr. at D, 0.5m right of A on line AB *Staf di B; alat di D, 0.5m di sebelah kanan A di atas garisan AB*

Table / *Jadual 1*

[5 marks/markah]

(c) Draw a sketch to represent the two instrument positions, show the effect of the collimation error and determine the collimation error of the instrument.
Lukis satu lakaran yang menunjukkan kedua-dua kedudukan alat dan kesan selisih kolimatan dan tentukan selisih kolimatan alat tersebut.

(d) If the level had been in perfect adjustment, what reading would have been observed at B from the second instrument set-up?.

Jika alat aras berada dalam pelarasan yang baik, apakah bacaan yang akan dibaca pada staf di B dari kedudukan alat yang kedua?.

[5 marks / *markah*]

(e) It was decided to continue with the leveling work despite the presence of the collimation error. What steps must be taken to ensure that the errors are reduced and the leveling work is acceptable for second class survey?.

Ia telah diputuskan untuk meneruskan kerja-kerja ukur aras walaupun wujud selisih kolimatan. Apakah langkah-langkah yang perlu diambil supaya selisih dikurangkan dan kerja ukur aras boleh diterima untuk ukuran kelas kedua?

[5 marks / *markah*]

3. For the proposed construction of a mosque, a traverse was carried out to determine its location and the design of the access road. The abstract of the survey data is given in Table 2.

Bagi cadangan pembinaan sebuah masjid, satu ukur travers telah dijalankan bagi menentukan kedudukannya dan rekabentuk jalan masuk. Ringkasan data ukur diberi di dalam Jadual 2 berikut.

(a) Calculate the bearings of the other traverse lines.

Kira bearing bagi garisan-garisan travers yang lain.

[3 marks / *markah*]

Line *Garisan*	Mean included angle *Min sudut dalam*		Distance *Jarak (m)*
AB	θ_A	94° 10' 00"	103.401
BC	θ_B	178 ° 00' 00"	157.251
CE	θ_C	118 °21' 45"	143.359
EG	θ_E	94 ° 42' 25"	169.082
GJ	θ_G	158 ° 07' 30"	176.742
JL	θ_J	89 ° 03' 55"	110.601
L_A	θ_L	167 ° 15' 50"	140.828
Whole-circle bearing of AB = 187° 22' 20" Coordinates of station A is 1000.000mN, 1000.000mE. *Bearing bulatan penuh AB = 187 ° 22' 20"* *Koordinat stesen A ialah 1000.000mU, 1000.000mT.*			

Table / *Jadual 2*

(b) Calculate the coordinates of the other survey stations and determine the accuracy of the traverse using the Bowditch method of adjustment. You may use the Traverse Computation Sheet provided.

Kira koordinat bagi stesen-stesen ukur yang lain dan tentukan kejituan travers menggunakan kaedah pelarasan Bowditch. Anda boleh guna Borang Pengiraan Travers yang dibekalkan.

[15 marks / *markah*]

(c) Comment on the results of the survey work achieved.
Komen ke atas keputusan kerja pengukuran yang dicapai.

[2 marks / markah]

4. (a) In stadia tacheometry, three principal sources of error must be considered to achieve a better accuracy to both the measured length and the difference in height. Explain how these sources of errors are treated in order to achieve an acceptable accuracy.

Dalam tekimetri stadia, tiga sumber utama selisih mesti diberi perhatian supaya kejituan yang baik diperolehi bagi pengukuran jarak dan perbezaan ketinggian. Terangkan bagaimana sumber-sumber selisih ini ditangani supaya kejituannya boleh diterima.

[6 marks / *markah*]

(b) A theodolite with a multiplying constant of 100 and no additive constant was set up over station A which is 24.260m above datum. The height of the instrument above station A (2246.518mN, 2247.031mE) is 1.325m. A station B (2047.401mN, 2360.567mE) was sighted. Readings were then taken successfully to a staff held vertically on stations P and Q and the observations in Table 3 were recorded. If the positive and negative signs in the vertical circle column denote angles of elevation and depression respectively, calculate:

(i) The horizonal length of PQ;
(ii) The bearing of PQ; and
(iii) The heights of points P and Q above datum.

Sebuah tiodolit yang mempunyai pemalar daraban 100 dan tiada pemalar campuran telah didirisiapkan di atas stesen A yang berada 24.260m di atas datum. Ketinggian alat di atas stesen A (2246.518mU, 2247.031mT) ialah 1.325m. Cerapan ke stesen B (2047.401mU, 2360.567mT) telah dibuat. Bacaan kepada staf yang didiri tegak di atas stesen P dan Q telah dicerap dan ditunjukkan dalam Jadual 3. Jika tanda-tanda positif dan negatif dalam ruangan bulatan pugak masing-masing bermaksud sudut-sudut dongak dan tunduk, kira:

(i) Jarak ufuk PQ;
(ii) Bearing PQ; dan
(iii) Ketinggian titik-titik P dan Q di atas datum.

Instr. stn. *Stn. alat*	**Stn. sighted** *Stn. dicerap*	**Stadia readings** *Bacaan stadia*	**Vertical circle** *Bulatan pugak*	**Horizontal circle** *Bulatan ufuk*
A	B	-	-	15 ° 20' 30"
A	P	2.687, 2.097, 1.508	+01° 15' 20"	22 ° 28' 55"
A	Q	2.744, 1.965, 1.187	- 02° 04' 50"	141 ° 15' 40"

Table / ***Jadual 3***

[14 marks / *markah*]

5. During a profiling survey, levels were taken across a BIOECODS pond with a staff held on the water bed at 5 m intervals to determine the depth of the water level as shown in Figure 2 below. The heights of the water levels at different points were recorded as follows (Table 4):

Dalam pengukuran profil, bacaan aras telah dicerap ke staf merentasi kolam BIOECODS yang diletakkan di dasar kolam pada sela 5m untuk menentukan kedalaman paras air seperti di Rajah 2 di bawah. Ketinggian paras air di beberapa titik telah dicatat seperti berikut (Jadual 4):

Point No. (*No. Titik*)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Staff readings at water level (m) *Bacaan staf pada permukaan air (m)*	0.775	2.365	3.370	3.600	3.810	3.235	2.545	0.125

Table / ***Jadual 4***

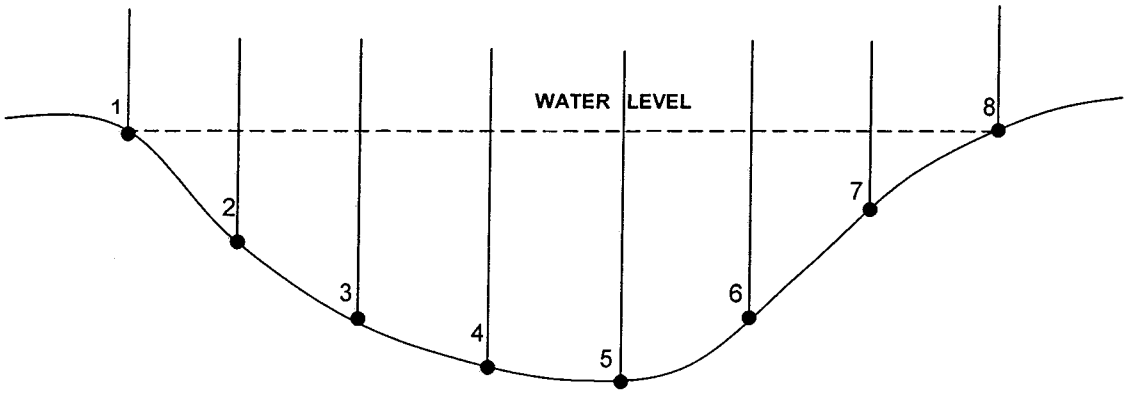


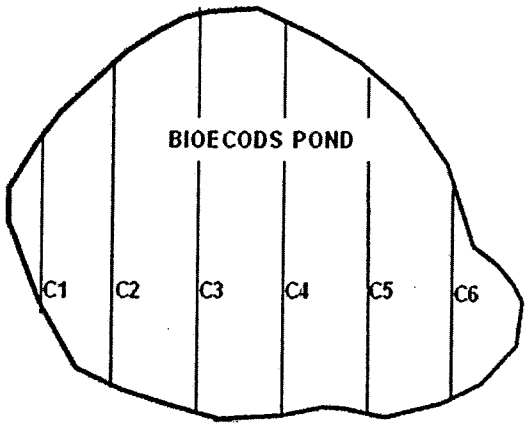
Figure / *Rajah 2*

(a) Using the appropriate formula, calculate the cross-sectional area of the water section.
Kira luas kawasan rentas kawasan yang dilitupi air menggunakan rumusan yang sesuai.

[5 marks / *markah*]

(b) The profiling survey at the BIOECODS pond in the USM Engineering Campus requires the formation of 6 cross-sections at every 10m intervals as shown in Figure 3 below. You are required to determine the volume of water capacity in the pond.

Pengukuran profil di persekitaran kolam BIOECODS Kampus Kejuruteraan USM melibatkan penghasilan 6 keratan rentas pada sela setiap 10m seperti di Rajah 3 di bawah. Anda ditugaskan untuk menentukan jumlah isipadu air dalam kolam tersebut.



Layout of cross-sections in the BIOECODS Pond

Figure / *Rajah 3*

(i) Describe in detail the procedures to determine the depth of the water level at 5m intervals along the 6 cross-sections in the BIOECODS pond. Your explanation must be supported by diagram(s) and a description of field process(es) to be applied.

Huraikan secara terperinci kaedah menentukan kedalaman paras air pada sela 5m di sepanjang 6 keratan rentas dalam kolam BIOECODS tersebut. Penjelasan anda perlu dibantu dengan gambar rajah dan kaedah kerja lapangan yang harus dibuat.

[10 marks / *markah*]

(ii) Given the cross-sectional areas of C1 = 110m^2, C2 = 425m^2, C3 = 640m^2, C4 = 620m^2, C5 = 450m^2 and C6 = 150m^2. Find the volume of the water capacity of the BIOECODS pond using Trapezoidal Rule.

Diberi luas keratan rentas C1 = 110m^2, C2 = 425m^2, C3 = 640m^2, C4 = 620m^2, C5 = 450m^2 dan C6 = 150m^2. Kira jumlah isipadu air yang terdapat dalam kolam BIOECODS menggunakan Rumusan Trapezoid.

[5 marks / *markah*]

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