UNIVERSITI SAINS MALAYSIA

3rd. Semester Examination
2002/2003 Academic Session
Peperiksaan Semester Ketiga
Sidang Akademik 2002/2003

April 2003

EAG 245E/3 – Soil Mechanic *(Mekanik Tanah)*
JAG341/3 - Kejuruteraan Geoteknik I
Time : 3 hour
Masa : 3 jam

Instruction to candidates:
Arahan Kepada Calon:

1. Ensure that this paper contains **THIRTEEN** *(13)* printed pages included appendix.
1. *Sila pastikan kertas peperiksaan ini mengandungi **TIGA BELAS** (13) muka surat bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.*

2. This paper contains **SIX (6)** question. Answer **FIVE (5)** question only. Marks will be given to the **FIRST FIVE (5)** question put in order on the answer script and **NOT** the **BEST FIVE (5).**
2. *Kertas ini mengandungi **ENAM (6)** soalan. Jawab **LIMA (5)** soalan sahaja. Markah hanya akan dikira bagi **LIMA (5)** jawapan **PERTAMA** yang dimasukkan di dalam buku mengikut susunan dan bukannya **LIMA (5)** jawapan terbaik.*

3. All question carry the same mark.
3. *Semua soalan mempunyai markah yang sama.*

4. All question **CAN BE** answered either in Bahasa Malaysia or English or combination of both languages.
4. *Semua soalan boleh dijawab dalam Bahasa Malaysia atau Bahasa Inggeris ataupun kombinasi kedua-dua bahasa.*

5. Write answered question number on the cover sheet of answer script.
5. *Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.*

…2/-

1. (a) Table 1.0 shows measurements made on an undisturbed sample of clay. Indicate the data necessary to determine the properties listed in the table by marking a "√" in the appropriate boxes in columns 1, 2 and 3. If there is another data needed, mention it in column 4. Derive the appropriate relationships.

(a) *Jadual 1.0 menunjukkan pengukuran yang di buat ke atas sampel tak terganggu untuk tanah lempung. Nyatakan data yang diperlukan dalam menentukan sifat yang disenaraikan dalam jadual secara menandakan "√" di kotak-kotak yang sesuai bagi jalur-jalur 1, 2, dan 3. Jika ada data lain diperlukan, nyatakan di Jalur 4. Terbitkan hubungan yang bersesuaian.*

Table 1.0

Property	Measurement			
	1	2	3	4
	Mass (wet) W	Mass (dry) W	Volume V	Other
Bulk Density				
Dry Density				
Water content				
Porosity				
Degree of Saturation				
Void ratio				

(10 marks)

Jadual 1.0

Kandungan	Pengukuran			
	1	2	3	4
	Jisim (basah) W	Jisim (kering) W	Isipadu V	Lain-lain
Ketumpatan pukal				
Ketumpatan kering				
Kandungan air				
Keliangan				
Darjah ketepuan				
Nisbah Lompang				

(10 markah)

(b) The maximum and minimum volumes occupied by 1555g of dried medium to fine quartz sand were 1165 cc and 958 cc.

- Calculate the maximum density and the void ratios at this maximum density condition.
- What is the dry density of a deposit of this sand if the relative density was 0.67. If the deposits was then saturated what were the bulk density and water content, assuming the saturation did not significantly change the total volume.

(10 marks)

(b) Isipadu maksimum dan minimum untuk 1555g pasir kuarza kering yang terdiri dari sederhana dan halus adalah 1165 and 958 cm padu.

- *Kira ketumpatan maksimum dan nisbah lompang pada keadaan ketumpatan maksimum ini.*
- *Berapakah ketumpatan kering untuk tanah tersebut sekiranya ketumpatan relatifnya adalah 0.67. Sekiranya tanah tersebut tepu berapakah ketumpatan pukalnya dan kandungan lembapannya dengan anggapan jumlah isipadu tidak berubah.*

(10 markah)

2. (a) Show that :

$$n = \frac{V G \gamma_w - W}{V \gamma_w (G - S)}$$

$$n = \frac{G (W - W_s)}{(V G \gamma_w - W_s)}$$

$$w = \frac{nS}{(1 - n) G}$$

$$e = \frac{wS}{G}$$

(12 marks)

(a) Tunjukkan :

$$n = \frac{V G \gamma_w - W}{V \gamma_w (G - S)}$$

$$n = \frac{G (W - W_s)}{(V G \gamma_w - W_s)}$$

$$w = \frac{nS}{(1 - n) G}$$

$$e = \frac{wS}{G}$$

(12 markah)
...4/-

(b) If a saturated cylinder of soil weighs 207.5g and its volume 108.3 cm^3 and weighs 148.5g after drying at 105C for 24hours, what is the specific gravity of the solid particles?

(8 marks)

(b) Sekiranya suatu silinder yang mengadungi tanah tepu beratnya 207.5g berisipadu 108.5 cm^3 dan berat keringnya 148.7g, berapakah graviti tentu pepejal untuk tanah tersebut?

(8 markah)

3. (a) Explain the terms liquid limit, plastic limit and plasticity index. Describe how they are measured.

(8 marks)

(a) Terangkan terminology Had cecair, Had Plastik dan Indeks Keplastikan. Terangkan bagaimana ia di ukur.

(8 markah)

(b) A clayey sand was dry sieved to give the following data.

Sieve (mm)	4.75	2.36	1.18	0.60	0.30	0.15	pan
Mass (g)	-	16	32	65	34	47	64

- Plot the grading curve and calculate the unifromity coefficient.
- Classify the soil on the basis of
  (i) unified soil classification and
  (ii) texture.
- Comment your result.

(12 marks)

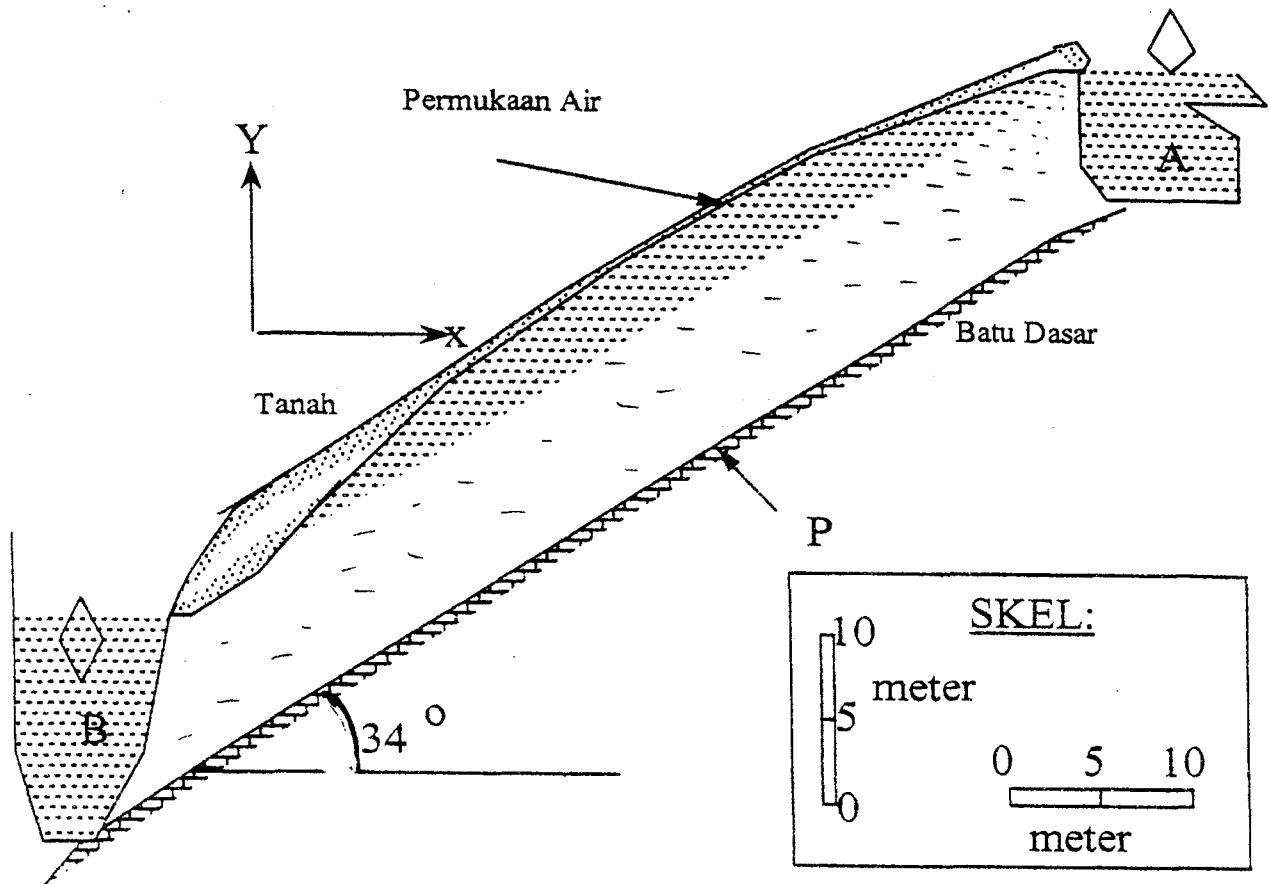*(b) Data ayakan kering untuk Pasir berlempung adalah seperti berikut;*

Ayakan (mm)	4.75	2.36	1.18	0.60	0.30	0.15	pan
Jisim (g)	-	16	32	65	34	47	64

- *Plotkan garis lengkung dan kirakan pekali keseragaman*
- *Beri pengelasan tanah tersebut dengan berasaskan*
  (i) Pegelasan bersepadu dan
  (ii) tekstur
- *Komen keputusan anda*

(12 markah)

4. Figure 1.0 shows the cross section of two water channels, A and B, and the earth
    between them. The coefficient of permeability, k, of the earth material is given as
    10^{-4} cm/s. the bedrock is impermeable.

    *Rajah 1.0 menunjukkan keratan rentas cerun tanah dengan suatu terusan air, A,
    di bahagian hulu dan suatu terusan air lagi, B, di hilir. Nilai pekali
    kebolehtelapan, k, bagi tanah tersebut 10^{-4} cm/s sementara batu dasar tidak telap
    air.*

Rajah 1.0

(a) Draw the flow net of flow from channel A into channel B through the earth
    material. Use 3 no. of flows. Verify the correctness of your drawing by ensuring
    the width of each net equals to its length and equal potential lines to cut across
    flow lines at right angle.

                                                        (5 marks)

*(a) Lukiskan jaring aliran bagi aliran air dari terusan A ke terusan B. Gunakan 3
    laluan air. Uji ketepatan lukisan anda dengan memastikan lebar setiap jaring
    sama dengan panjangnya dan garisan-garisan seturus memotong tepat garisan-
    garisan aliran.*

                                                        (5 markah)

(b) For each m width of slope (thickness in Z direction is 1.0m), determine the rate of loss of water from channel A into channel B in m^3/day.

(5 marks)

(b) *Bagi satu meter lebar cerun (ketebalan pada arah Z bersamaan 1.0 m), tentukan kadar aliran air dari terusan A ke terusan B dalam unit m^3/ hari.*

(5 markah)

(c) Determine the water pressure at P. Determine also the effective stress at that particular location. Assume wet unit wt. as 21 kN/m^3 while dry unit wt. as 18 kN/m^3.

(10 marks)

(c) *Tentukan tekanan air di suatu kedudukan di permukaan batu dasar, ditandakan P di Rajah 1.0. Tentukan juga nilai tegasan berkesan di tempat tersebut. Anggap berat unit tanah basah 21 kN/m^3 sementara berat unit tanah kering 18 kN/m^3.*

(10 markah)

5. (a) Based on the diagram of a falling head test of Figure 2.0, the height of water level in the burette above datum is given as h_1 at the start of the test, and h_2 at the end of the test. Therefore the velocity at which water level descends in the burette can be given as $v = -\dfrac{dh}{dt}$.

(a) *Rajah 2.0 menunjukkan skema suatu ujian kebolehtelapan turus jatuh. Pada awal ujian, ketinggian paras air di buret bersamaan h_1 di atas datum sementara pada akhir ujian ketinggian paras air di buret bersamaan h_2 di atas datum. Oleh itu kelajuan air menuruni buret $v = -\dfrac{dh}{dt}$*

    i. If the cross-sectional area of the burette is given as a, express the term for the rate of flow into the soil sample, q in.

(6 marks)

    i. *Jika luas keratan rentas buret diberi sebagai a, nyatakan ungkapan bagi kadar aliran masuk ke dalam sampel tanah, q in.*

(6 markah)

ii.   If the cross-sectional area of the soil sample is given as A. Coefficient of permeability as k, difference of upstream water level to that of downstream as h, and length of sample as L, express the term for the rate of flow out of the sample, q out.

Help : $q_{in} = f(a, \frac{dh}{dt})$; $q_{out} = f(k,h,A,L)$

(6 marks)

ii.   *Jika luas keratan rentas sampel tanah diberi sebagai A. Pekali kebolehtelapan sebagai k, beza paras turus daripad hulu ke hilir sampel sebagai h, dan panjang sampel sebagai L, nyatakan ungkapan bagi kadar aliran keluar dari sample tanah, q out.*

Bantuan: $q_{in} = f(a, \frac{dh}{dt})$; $q_{out} = f(k,h,A,L)$

(6 markah)

iii.   Derive the expression of coefficient of permeability based on the results of a falling head test, starting when the upstream water level is at h_1 above datum and ending when the upstream water level is at h_2 above datum.
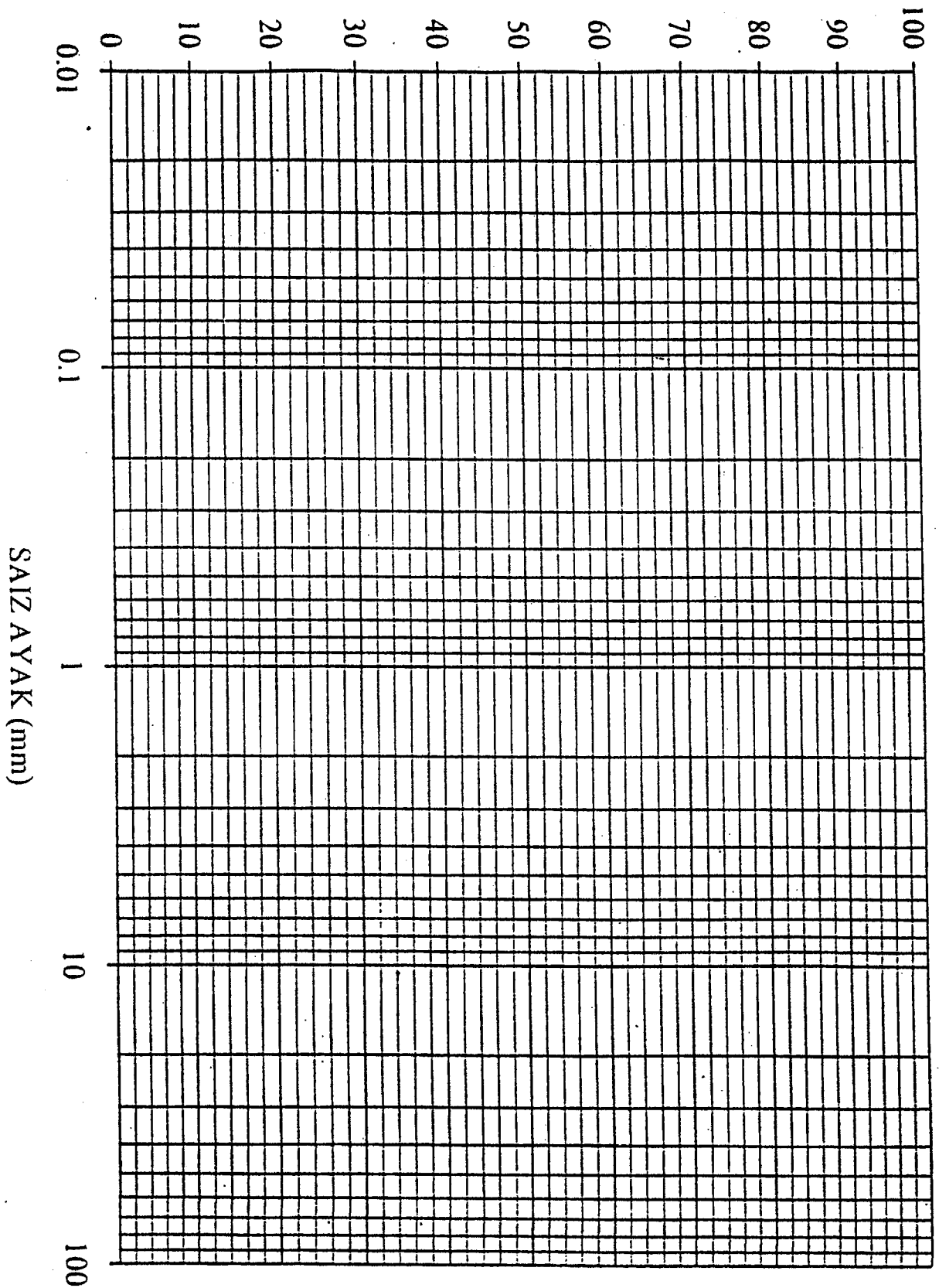
(8 marks)

iii.   *Terbitkan persamaan kebolehtepan bagi ujian turus jatuh* $k = \frac{aL}{At} \ln \frac{h_1}{h_2}$

daripada paras air di ketinggian h_1 hingga paras air di ketinggian h_2,

(8 markah)

6. (a) Figure 3.0 shows a constant head test set up. The upstream water level is 15.0 m higher than the downstream level. The length of sample is 15 cm and its cross sectional area is 120 cm^2. The time taken for test is 15 minutes and the amount of flow is 100 cm^3.
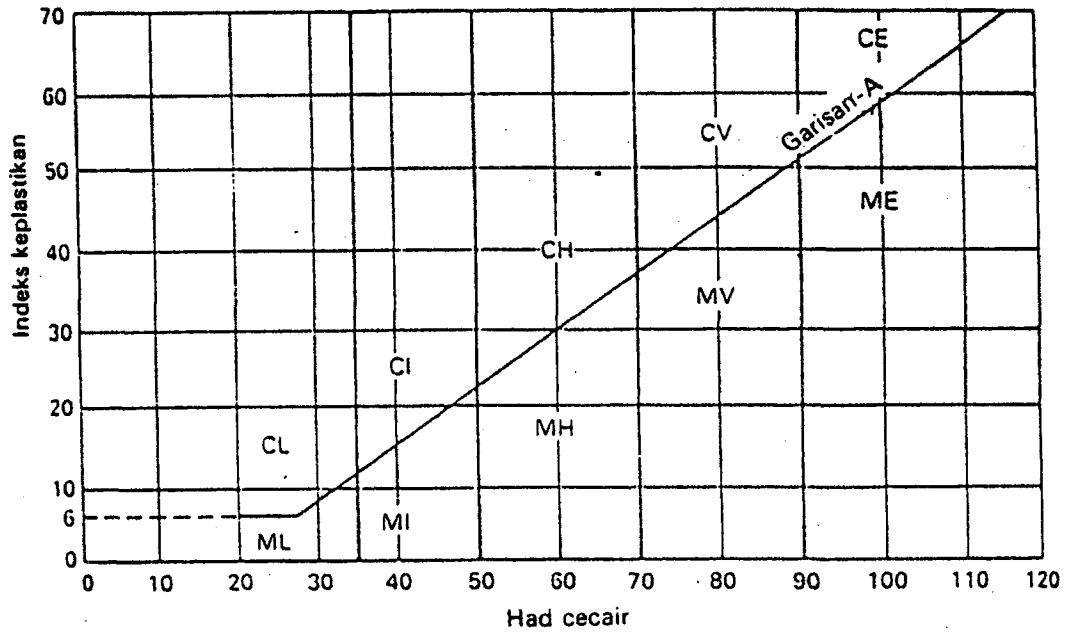
(a) *Rajah 3.0 menunjukkan skema suatu ujian kebolehtelapan turus tetap. Paras air di hulu 15 m lebih tinggi daripada paras air di hilir (h = 15.0 m). Panjang sampel tanah, L 15 cm sementara luas keratan rentasnya, A, 120 cm^2. Ujian dijalankan dalam tempoh, t, 15 minit dan jumlah air yang melepasi sampel dalam tempoh ini, Q, 100 cm^3.*

PERATUSAN KETELUSAN (%)

0 10 20 30 40 50 60 70 80 90 100

SAIZ AYAK (mm)

0.01 0.1 1 10 100

LAMPIRAN

Mekanik Tanah

Carta keplastikan: Sistem British (BS 5930: 1981). Disalin dengan izin BSI. Salinan penuh boleh didapati daripada BSI di Linford Wood, Milton Keynes, MK14 6LE.

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