UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	GEOTECHNIC II
COURSE CODE	:	BFC 33802
PROGRAMME	:	3 BFF
DATE	:	JUNE 2013
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **FOUR** OUT OF FIVE QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **THIRTEEN (13)** PAGES

Q1 (a) Discuss a potential geotechnical problems of the soil that arise from:

(i) Soil shrinkage;

(5 marks)

(ii) Soil expansion.

(5 marks)

(b) Refer to **Figure Q1 (b).**

(i) Draw a flow net for a single row of sheet piles driven into a permeable layer. Consider N_f=4 and N_d=8.

(9 marks)

(ii) Calculate the seepage lost per meter length at point A.

(6 marks)

Q2 (a) A six storey shopping complex is proposed to be constructed at a flat site. The earthwork will involve a deep excavation for a basement. As the engineer in-charge of the project, explain the state of stress for the soil before, during and after the excavation work. Support your explanation with appropriate illustrations.

(7 marks)

(b) Calculate the Rankine's active and passive forces per unit length of the wall shown in **Figure Q2 (b).** Then, determine the location of the resultant.

(18 marks)

Q3 (a) Briefly describe:

(i) Elastic equilibrium.

(ii) Plastic equilibrium.

(4 marks)

(b) As refer to **Figure Q3 (b)**, a rectangular concrete slab, 3 x 4.5 m, rests on the surface of a soil mass. The load on the slab is 2025 kN. Determine the vertical stress increase at a depth of 3 m:

(i) Under the center of the slab, point A.

(7 marks)

(ii) Under point B.

(7 marks)

(iii) At a distance of 1.5 m from a corner, point C.

(7 marks)

Q4 (a) In general, structures built on soil especially soft soil are subject to settlement. It is important to identify the causes of settlement and predicting the settlement. List **FOUR (4)** possible causes of settlement.

(4 marks)

(b) The data in **Table Q4 (b)** below were taken during an oedometer test on saturated clay when the applied pressure was increased from 220 kPa to 435 kPa.

Table Q4 (b)

Time (min)	0	0.25	0.5	1	2.25	4	9	16	25
Gauge (mm)	5.00	4.67	4.62	4.53	4.41	4.28	4.01	3.75	3.49

Time (min)	36	49	64	81	100	200	400	1440
Gauge (mm)	3.28	3.15	3.06	3.00	2.96	2.84	2.76	2.61

Given:
Specific gravity, $G_s = 2.73$
Thickness of the specimen after 1440 min = 13.60 mm
Final moisture content = 35.9%

Based on the results:

(i) Determine the coefficient of consolidation using Taylor method.

(15 marks)

(ii) Determine also the value of coefficient of permeability.

(6 marks)

Q5 (a) Sketch and briefly explains **THREE (3)** types of slopes failure.

(6 marks)

(b) Determine the factor of safety for the trial slip circle shown in **Table Q5 (b)** using the ordinary method of slices.

Table Q5 (b)

Slice No.	W (kN/m)	α (°)	b_n (m)
1	104	61	1.1
2	172	43	2
3	168	30	2
4	140	18	2
5	100	7	2
6	36	-5	1.4

The soil properties are:

Effective cohesion, c′ is 8 kN/m²

Effective internal friction angle, ø′ is 35°

Radius of the slip circle is 10.6 m

Angle subtended at the centre of rotation of the sliding arc is 85°.

(19 marks)

- END OF QUESTIONS -

S1 (a) Bincangkan masalah geoteknikal yang mungkin berlaku disebabkan oleh perkara-perkara yang dinyatakan di bawah:

(i) Pengecutan tanah;

(5 markah)

(ii) Pengembangan tanah.

(5 markah)

(b) Rujuk **Gambarajah Q1(b)**.

(i) Lukiskan rajah aliran untuk struktur cerucuk keping yang dipacu ke atas satu lapisan tanah yang telap. Pertimbangkan N_f=4 and N_d=8.

(9 markah)

(ii) Kirakan kehilangan resipan per meter panjang pada titik A.

(6 markah)

S2 (a) Sebuah bangunan 6 tingkat dicadangkan untuk dibangunkan pada tapak yang rata. Kerja tanah yang bakal dijalankan akan melibatkan pengorekan yang dalam untuk membina bangunan tersebut. Sebagai jurutera yang bertanggungjawab ke atas projek ini, terangkan situasi tekanan dalam tanah sebelum, semasa dan selepas kerja pengorekan. Sertakan illustrasi yang sesuai bagi membantu penerangan yang dibuat.

(7 markah)

(b) Kirakan daya aktif dan pasif Rankine untuk setiap meter panjang tembok penahan yang ditunjukkan pada **Gambarajah Q2(b)**. Seterusnya, tentukan lokasi untuk paduan daya tersebut.

(18 markah)

S3 (a) Terangkan secara ringkas:

(i) Keseimbangan elastik.

(ii) Keseimbangan plastik.

(4 markah)

(b) Merujuk kepada Rajah **Q3 (b)**, Sebuah slab konkrit, 3 x 4.5 m, terhampar di atas permukaan tanah. Beban di atas slab adalah 2025 kN. Tentukan penambahan tegasan pugak di kedalaman 3 m:

(i) Di bawah tengah slab, titik A.

(7 markah)

(ii) Di bawah titik B.

(7 markah)

(iii) Di jarak 1.5 m daripada sudut, titik C.

(7 markah)

S4 (a) Umumnya, satu struktur yang dibina di atas tanah terutamaya tanah lembut akan mengalami enapan. Adalah penting untuk mengenalpasti factor penyebab kepada enapan dan ramalan terhadap enapan. Senaraikan **EMPAT (4)** faktor kemungkinan terhadap penyebab enapan tersebut.

(4 markah)

(b) Jadual di dalam **Jadual S4 (b)** di bawah telah diambil ketika ujikaji oedometer yang dijalankan ke atas tanah liat tepu ketika pertambahan tekanan dikenakan daripada 220 kPa ke 435 kPa.

Jadual S4 (b)

Masa (min)	0	0.25	0.5	1	2.25	4	9	16	25
Tolok (mm)	5.00	4.67	4.62	4.53	4.41	4.28	4.01	3.75	3.49

Masa (min)	36	49	64	81	100	200	400	1440
Tolok (mm)	3.28	3.15	3.06	3.00	2.96	2.84	2.76	2.61

Diberikan:
Graviti tekanan, $G_s = 2.73$
Ketebalan specimen selepas 1440 min = 13.60 mm
Kandungan air akhir = 35.9%

Berdasarkan keputusan tersebut:

(i) Tentukan pekali pengukuhan menggunakan kaedah Taylor.

(15 markah)

(ii) Tentukan juga pekali kebolehtelapan tanah.

(6 markah)

S5 (a) Lakar dan terangkan secara ringkas, **TIGA (3)** jenis-jenis kegagalan cerun. (6 markah)

(b) Tentukan faktor keselamatan bagi cubaan cerun yang ditunjukkan dalam **Jadual S5 (b)** di bawah dengan menggunakan kaedah hirisan lazim.

Jadual S5 (b)

Bil. Hirisan	W (kN/m)	α (°)	b_n (m)
1	104	61	1.1
2	172	43	2
3	168	30	2
4	140	18	2
5	100	7	2
6	36	-5	1.4

Ciri-ciri tanah adalah:

Kejeleketan berkesan, c' adalah 8 kN/m^2

Sudut geseran dalaman berkesan, ϕ' adalah 35°

Jejari bulatan kegagalan adalah 10.6 m

Sudut yang tercangkum antara pusat putaran dengan arka gelangsaran ialah 85°.

(19 markah)

- SOALAN TAMAT -

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/2012/2013
COURSE : GEOTECHNIC II

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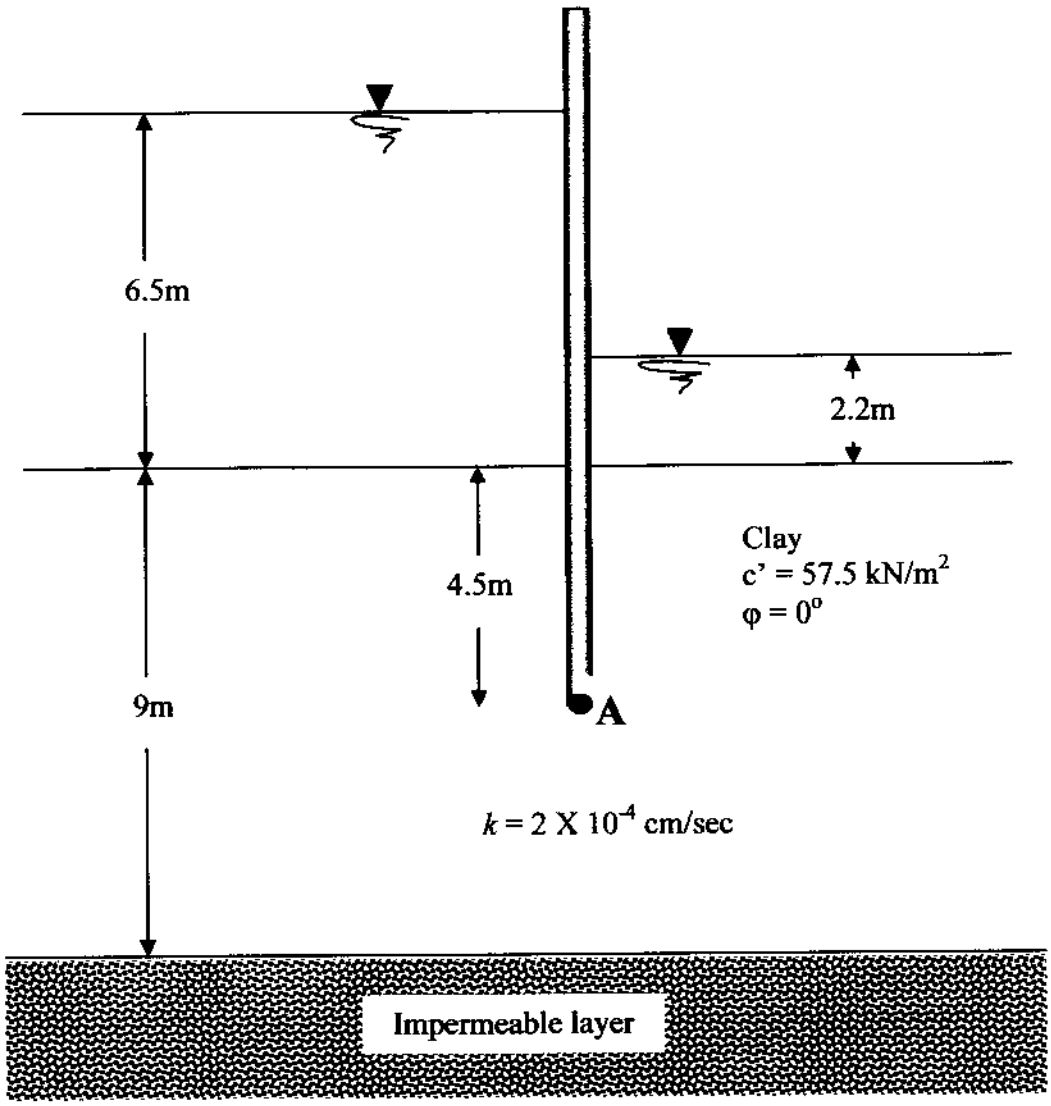

FIGURE Q1 (b)

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SEMESTER/SESSION : SEM II/2012/2013
COURSE : GEOTECHNIC II

COURSE : 3 BFF
SUBJECT CODE : BFC 33802

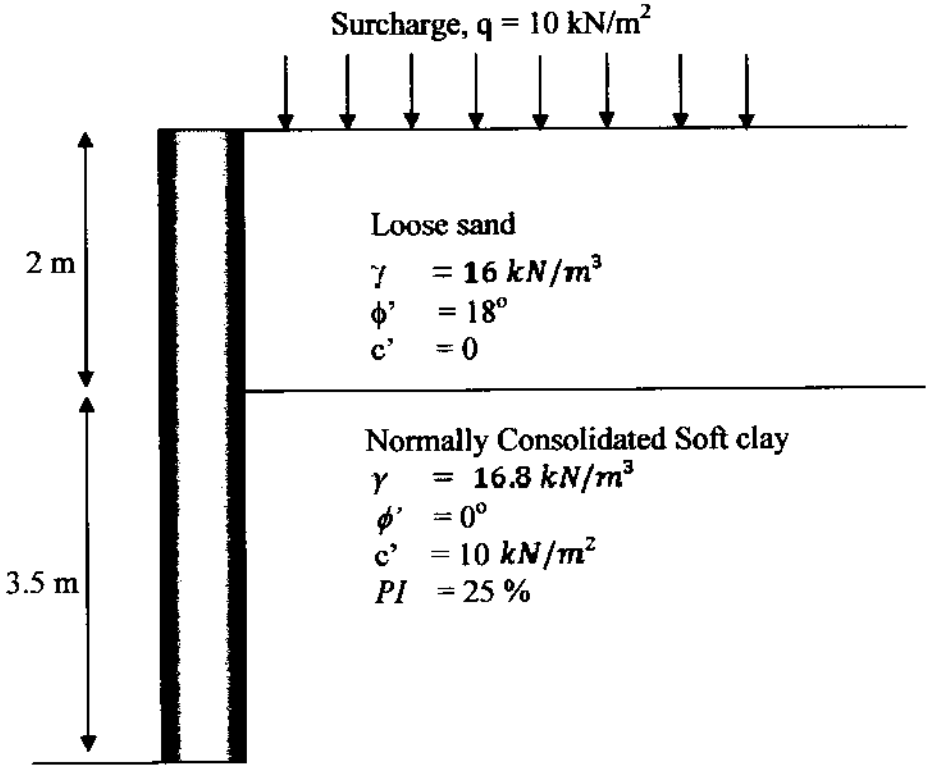

FIGURE Q2 (b)

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/2012/2013
COURSE : GEOTECHNIC II

COURSE : 3 BFF
SUBJECT CODE : BFC 33802

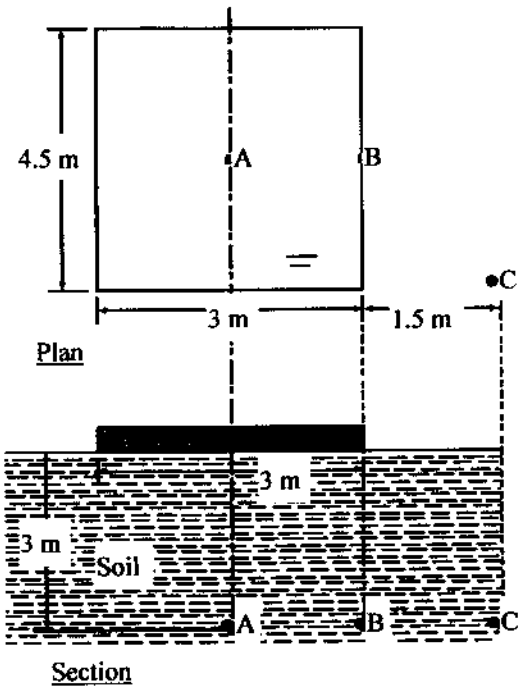

FIGURE Q3 (b)

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/2012/2013
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COURSE : 3 BFF
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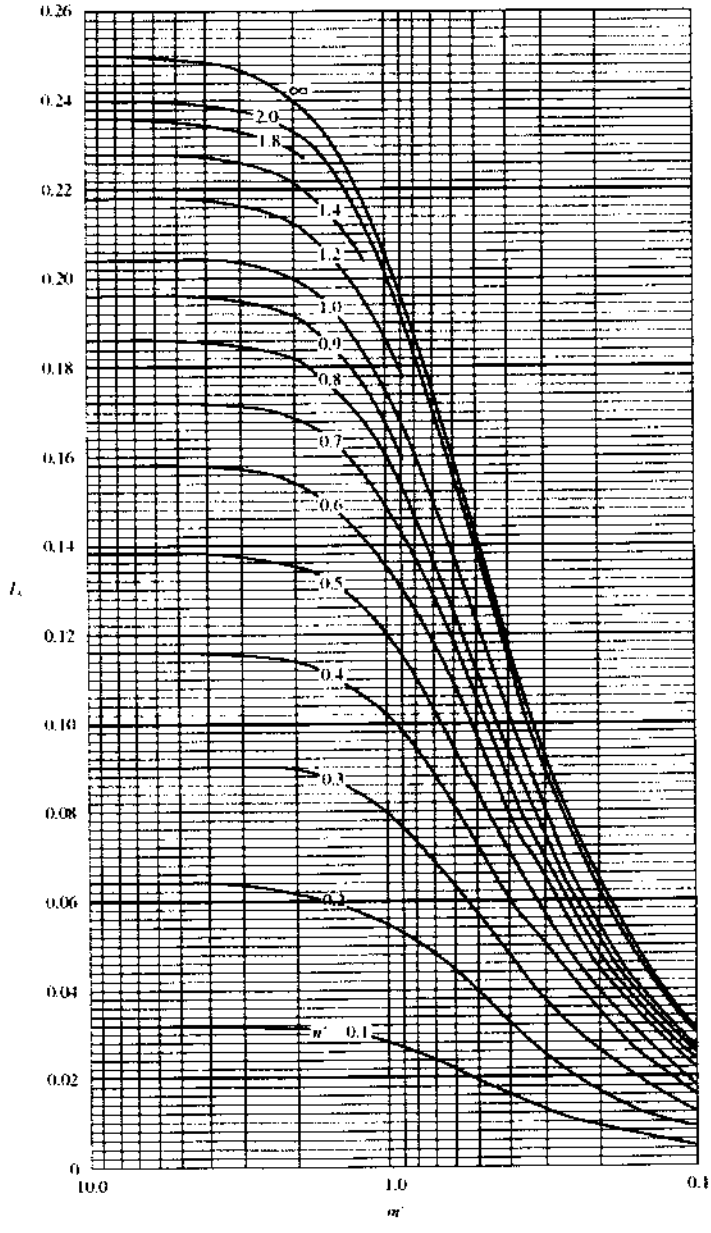

FIGURE Q4 (b)

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/2012/2013
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COURSE : 3 BFF
SUBJECT CODE : BFC 33802

Formulae

CONSOLIDATION

$$S_{c(p)} = \frac{C_c H_c}{1+e_o} \log \frac{\sigma_o' + \Delta\sigma_{(p)}'}{\sigma_o'}$$

$$S_{c(p+f)} = \frac{C_c H_c}{1+e_o} \log \frac{\sigma_o' + \left[\Delta\sigma_{(p)}' + \Delta\sigma_{(f)}'\right]}{\sigma_o'}$$

$$U = \frac{\log\left[\dfrac{\sigma_o' + \Delta\sigma_{(p)}'}{\sigma_o'}\right]}{\log\left[\dfrac{\sigma_o' + \Delta\sigma_{(p)}' + \Delta\sigma_{(f)}'}{\sigma_o'}\right]}$$

$$T_v = \frac{c_v t}{H_c^2}$$

For U%: 0% to 60%; $T_v = \frac{\pi}{4}\left(\frac{U\%}{100}\right)^2$

For U% > 60%;
$T_v = 1.781 - 0.931 \log(100 - U\%)$

$$U = \frac{\log\left[1 + \dfrac{\Delta\sigma_{(p)}'}{\sigma_o'}\right]}{\log\left[1 + \dfrac{\Delta\sigma_{(p)}'}{\sigma_o'}\left(1 + \dfrac{\Delta\sigma_{(f)}'}{\sigma_{(p)}'}\right)\right]}$$

FINAL EXAMINATION

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SUBJECT CODE : BFC 33802

Formulae

LATERAL EARTH PRESSURE

$$k_o = 1 - \sin\phi'$$

$$k_o = 0.95 - \sin\phi'$$

$$k_{o_{(\text{overconsolidated})}} = k_{o_{(\text{normally consolidated})}}\sqrt{OCR}$$

$$P_o = qk_oH + \frac{1}{2}\gamma H^2 k_o$$

$$P_a = \frac{1}{2}\gamma H^2 k_a - 2c'H\sqrt{k_a}$$

$$z_c = \frac{2c'}{\gamma\sqrt{k_a}}$$

$$P_a = \frac{1}{2}\left(H - \frac{2c'}{\gamma\sqrt{k_a}}\right)\left(\gamma H^2 k_a - 2c'H\sqrt{k_a}\right)$$

$$k_a = \tan^2\left(45^\circ - \frac{\phi}{2}\right) = \frac{1-\sin\phi}{1+\sin\phi}$$

$$k_a = \cos\alpha\,\frac{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi'}}{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi'}}$$

$$k_a = \frac{\sin^2(\beta+\phi')}{\sin^2\beta\sin(\beta-\delta')\left[1+\sqrt{\dfrac{\sin(\phi'+\delta')\sin(\phi'-\alpha)}{\sin(\beta-\delta')\sin(\alpha+\beta)}}\right]^2}$$

$$k_p = \tan^2\left(45^\circ + \frac{\phi}{2}\right) = \frac{1+\sin\phi}{1-\sin\phi} = \frac{1}{k_a}$$

$$k_p = \cos\alpha\,\frac{\cos\alpha + \sqrt{\cos^2\alpha - \cos^2\phi'}}{\cos\alpha - \sqrt{\cos^2\alpha - \cos^2\phi'}}$$

$$k_p = \frac{\sin^2(\beta-\phi')}{\sin^2\beta\sin(\beta+\delta')\left[1-\sqrt{\dfrac{\sin(\phi'+\delta')\sin(\phi'+\alpha)}{\sin(\beta+\delta')\sin(\alpha+\beta)}}\right]^2}$$

Formulae

Slope Stability

$$FS = \frac{\sum_{n=1}^{n=p}\left[c'b_n + W_n\tan\phi'\right]\frac{1}{m_{\alpha(n)}}}{\sum_{n=1}^{n=p}W_n\sin\alpha_n}$$

$$FS = \frac{\sum_{n=1}^{n=p}\left[c'\Delta L_n + W_n\cos\alpha_n\tan\phi'\right]}{\sum_{n=1}^{n=p}W_n\sin\alpha_n}$$