



**UNIVERSITI TUN HUSSEIN ONN  
MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESI 2016/2017**

COURSE NAME : GEOTECHNICAL ENGINEERING  
COURSE CODE : DAC 21103  
PROGRAMME CODE : DAA  
EXAMINATION DATE : JUNE 2017  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER **TWO (2)** QUESTIONS  
IN PART A AND **TWO (2)**  
QUESTIONS IN PART B

**TERBUKA**

THIS QUESTION PAPER CONSISTS OF **TWENTY FIVE (25)** PAGES

## SOALAN DALAM BAHASA MELAYU

## BAHAGIAN A

- S1 (a) Satu bekas sampel tanah kosong yang ditimbang didapati berjisim 25.61g. Jisim bekas bersama tanah lembap ialah 52.35g. Selepas dikeringkan selama 24 jam, jisim baru dicatat sebagai 46.48g. Kirakan kandungan air sampel tanah tersebut. (3 markah)

- (b) Satu ujikaji pemadatan ke atas contoh tanah dari projek pembinaan jalanraya. **Jadual 1** menunjukkan keputusan ujikaji.

**Jadual 1** : Kandungan lembapan melawan ketumpatan kering

Kandungan lembapan, (%)	9.4	11.8	13.8	16.1	18.2	21.4
Ketumpatan kering, Mg/m <sup>3</sup>	1.7	1.81	1.85	1.84	1.8	1.72

- (i) Lakarkan lengkung pemadatan untuk ketumpatan kering melawan kandungan lembapan. (4 markah)
- (ii) Berdasarkan lengkung yang terhasil nilaikan yang berikut :
- Ketumpatan kering maksimum
  - Kandungan air optima
  - Had atas kelembapan untuk 95% pemadatan
  - Had bawah kelembapan untuk 95% pemadatan
- (4 markah)
- (iii) Dari lengkung tersebut, kirakan peratus lompang udara sifar pada ketumpatan kering maksimum dan kandungan air optima,  $A_v$  jika diberi graviti tentu tanah sebagai 2.68 dan ketumpatan air ialah 1Mg/m<sup>3</sup>. (3 markah)

- (c) Satu ujikaji ricih vane telah dijalankan ke atas tanah liat marin dari kampus UTHM, dimensi alat dan kriteria tanah liat adalah seperti berikut :

$d=100\text{mm}$ ,  $h=200\text{mm}$ ,  $LL=85\%$ ,  $PL=28\%$  dan  $\text{torque} = 120\text{N}\cdot\text{m}$ .

Kirakan yang berikut :

- (i) Kekuatan ricih tak tersalir,  $S_{uv}$  tanah liat tersebut.
- (ii) Indeks keplastikan, PI.
- (iii) Nilai faktor pembetulan  $\mu$ .
- (iv) Kekuatan ricih tak tersalir yang diperbetulkan,  $S_{uv(\text{corr})}$  tanah liat tersebut. (5 markah)
- (d) Berikan justifikasi gangguan ke atas contoh tanah jika diameter luar pensampel ialah 50 mm dan ketebalan pensampel ialah 2.5mm (6 markah)

**TERBUKA**

- S2 (a) Keputusan dari satu ujikaji terkukuh tak tersalir (CU) pada masa kegagalan untuk tanah liat marin tepu di RECESS UTHM seperti yang ditunjukkan dalam **Jadual 2(a)** dan **(b)**.
- (i) Kirakan kesemua parameter CU untuk ujikaji itu. (2 markah)
  - (ii) Bina bulatan Mohr untuk parameter berkesan,  $\sigma'_3$  dan  $\sigma'_1$ . Tunjukkan kesemua garisan-garisan pembinaan. (3 markah)
  - (iii) Nilaikan dari rajah untuk  $c'$  dan  $\phi'$ . (2 markah)
- (b) Sampel tanah dari cerun gagal dibawa ke makmal dan diayak, keputusan ujikaji ayakan adalah seperti yang ditunjukkan dalam **Jadual 3**.
- Selesaikan yang berikut :
- (i) Lakarkan lengkung taburan saiz zarah bagi tanah tersebut. (4 markah)
  - (ii) Nilaikan yang berikut :  $D_{10}$ ,  $D_{30}$ ,  $D_{60}$ ,  $C_u$  dan  $C_c$ . (5 markah)
  - (iii) Kelaskan tanah tersebut. (2 markah)
  - (iv) Cadangkan kaedah penstabilan cerun yang sesuai. (2 markah)
- (c) Satu ujian pengepaman telah dijalankan di sebuah akuifer tidak terkurung untuk menganggarkan nilai pekali ketelapan tanah di akuifer tersebut. Setelah aliran air mencapai keseimbangan, data berikut telah diperolehi :
1. Pengeluaran air seimbang dari telaga,  $q = 0.0125\text{m}^3/\text{s}$
  2. Aras air  $h_1 = 4.5\text{m}$  dan  $h_2 = 8\text{m}$  pada jarak  $r_1 = 10\text{m}$  dan  $r_2 = 75\text{m}$ .
- Paras air tanah sebelum pengepaman dibuat ialah 2m
- (i) Jelaskan dengan gambarajah dan labelkan permasalahan di atas secara tanpa skala (3 markah)
  - (ii) Kirakan nilai  $k$  (2 markah)

**TERBUKA**

- S3** (a) **Rajah S3(a)** menunjukkan lengkung bacaan tolok (*dial gauge*) melawan  $\sqrt{t}$  :
- (i) Nilaikan  $t_{90}$  untuk contoh tanah yang diberi. Tunjukkan semua garisan pembinaan yang diperlukan. (4 markah)
  - (ii) Kira nilai bagi pekali pengukuhan,  $c_v$  jika ketebalan purata diambil sebagai 30 mm. Gunakan nilai  $t_{90}$  dari **S3(a)(i)**. (2 markah)
- (b) Sebuah asas pad dibina seperti **Rajah S3(b)(i)**, menanggung beban sebanyak 2000kN yang termasuk berat struktur, asas dan tanah timbun di atas asas. Jika dimensi penapaknya ialah 2.2m x 3.4m, nisbah lompong disitu,  $e_0$  untuk lapisan liat boleh mampat sebagai 1.38. Index mampatan,  $C_c$  untuk lapisan liat ialah 0.72.
- Nilaikan yang berikut :
- (i) Tekanan tanggungan atas berkesan,  $p_0$  (di tengah-tengah lapisan liat) (2 markah)
  - (ii) Berat berkesan dari penggalian,  $W_e$  (1 markah)
  - (iii) Tekanan pengukuhan net pada penapak asas,  $q_{net}$  (1 markah)
  - (iv) Pengiraan pekali pengaruh tekanan  $m$  dan  $n$ : (2 markah)
  - (v) Tekanan pengukuhan net di tengah-tengah lapisan liat dipusat asas,  $\Delta p$  (2 markah)
  - (vi) Tekanan akhir ditengah-tengah lapisan liat,  $p$  (1 markah)
  - (vii) Jumlah enapan pengukuhan primer,  $S$   
Dimana :  $C_c=0.72$  (diberi);  $H=6m$ ;  $e_0=1.38$  (diberi) (2 markah)
- (c) Sebuah menara jam akan dibina di atas kawasan bulat dengan beban sekata sebanyak  $150kN/m^2$  di atas permukaan tanah. Jika jejari bulatan itu ialah 3.5m.
- Anggarkan kenaikan tegasan di lokasi berikut :
- (i) Pada kedalaman 1.5 m dan di garis tengah penapak
  - (ii) Pada kedalaman 2.5 m dan 2.0 m dari garisan tengah penapak
- (d) Nyatakan **dua (2)** faktor yang mempengaruhi rekabentuk dan saiz asas. (2 markah)

**TERBUKA**

## BAHAGIAN B

- S4** (a) Lakarkan dan terangkan **tiga (3)** jenis kegagalan keupayaan galas (*types of bearing capacity failure*).  
(5 markah)

- (b) Diberi tapak bersaiz 1.5m x 1.5m diletakkan di bawah permukaan tanah sedalam 1.5m. Tapak ditindaki oleh beban sipi sebanyak 400kN seperti dalam **Rajah S4(b)(i)** dan **S4(b)(ii)**. Sub-tanah mempunyai ketebalan endapan tanah berjelekit dengan  $q_u = 200\text{kN/m}^2$  dan  $\gamma = 20.4\text{kN/m}^3$ . Air bumi berada pada kedalaman yang baik dan kesannya terhadap keupayaan galas boleh diabaikan.

Tentukan Faktor keselamatan (F.S) terhadap kegagalan keupayaan galas:

- (i) Dengan menggunakan kaedah kelebaran berguna.  
(ii) Menggunakan faktor pengurangan (*Reduction Factor*).

(10 markah)

- (c) Satu tapak segiempat sama yang ditunjukkan dalam **Rajah S4(c)(i)** diletakkan 1.2m dibawah permukaan tanah dan menyokong beban sebanyak 450kN. Aras air bumi adalah terletak 1.2m dari permukaan bumi. Subtanah terdiri daripada endapan seragam tanah liat kukuh. Keputusan ujkaji makmal adalah seperti dalam **Rajah S4(c)(i)**. Rujuk **Rajah S4(c)(ii)** untuk mendapatkan faktor keupayaan galas Terzaghi. Jika Faktor Keselamatan (FS) ialah 3.

Tentukan :

- i) Keupayaan galas muktamad ( $q_{ult}$ ).  
ii) Keupayaan galas yang dibenarkan ( $q_{all}$ ).  
iii) Saiz tapak segiempatsama (BxB).

(10 markah)

- S5** (a) Dengan bantuan gambarajah, terangkan bagaimana ujian beban cerucuk dijalankan.  
(5 markah)

- (b) Diberi cerucuk konkrit telah dipacu ke dalam medium tumpat hingga pasir tumpat. Air bawah tanah terletak 3m di bawah permukaan tanah. Diameter cerucuk ialah 30cm dan panjang cerucuk yang tertanam ialah 7m. Keadaan tanah adalah seperti yang ditunjukkan dalam **Rajah S5(b)(i)** dan **Rajah S5(b)(ii)**. Pekali tekanan sisi bumi (K) adalah 0.93 ,  $\tan \delta$  adalah 0.45 dan faktor keselamatan ialah 2.0.

Tentukan yang berikut:

- (i) Kedalaman kritikal cerucuk dan lakaran tekanan menegak berkesan (**Pv**) lawan kedalam.  
(ii) Beban cerucuk muktamad ( $Q_{muktamad}$ ).  
(iii) Beban cerucuk rekabentuk ( $Q_{rekabentuk}$ ).

(10 markah)

**TERBUKA**

- (c) Diberi cerucuk konkrit berdiameter 0.45m dipacu kedalam tanah liat dekat tapak seperti **Rajah S5(c)(i)**. Rujuk **Rajah S5(c)(ii)** untuk mendapatkan nilai  $\alpha$ . Dengan menggunakan faktor keselamatan 2.

Tentukan :

- i) Beban muktamad cerucuk ( $Q_{\text{Muktamad}}$ ).
- ii) Beban rekabentuk cerucuk ( $Q_{\text{Rekabentuk}}$ ).

(10 markah)

- S6** (a) Senaraikan dan huraikan **dua (2)** jenis tembok penahan.

(6 markah)

- (b) Diberi tembok penahan seperti dalam **Rajah S6 (b)** yang bercerun sebanyak  $15^\circ$  dibelakangnya. Dengan menggunakan teori rankine,

Tentukan :

- i) Jumlah tekanan aktif tanah per meter ( $P_a$ ).
- ii) Titik tindakannya ( $y$ )

(6 markah)

- (c) Diberi sebuah cerun seperti yang ditunjukkan dalam **Rajah S6(c)**. Parameter tanah adalah seperti berikut:

$$\gamma = 19.08 \text{ kN/m}^3$$

$$c = 20.2 \text{ kN/m}^2$$

$$\phi = 23^\circ$$

$$\alpha = 35^\circ$$

$$\beta = 75^\circ$$

Tentukan:

- i) Jejari lengkung permukaan kegagalan cerun ( $R$ ).
- ii) Faktor keselamatan cerun sepanjang permukaan ini ( $FS$ ).

(13 markah)

**TERBUKA**

**QUESTION IN ENGLISH**

**PART A**

**Q1** (a) *A can sampler weighed 25.61g. The mass of can with the moist soil sample found to be 52.35g. After being dried for 24 hours, the new weight is recorded as 46.48g.*

*Calculate the water content of the soil sample.*

*( 3 marks)*

(b) *A compaction test was conducted on a soil sample from road construction project. Table 1 shows the result from the test.*

**Table 1 : Moisture content versus dry density**

Moisture content, (%)	9.4	11.8	13.8	16.1	18.2	21.4
Dry density, Mg/m <sup>3</sup>	1.7	1.81	1.85	1.84	1.8	1.72

(i) *Sketch a compaction curve of dry density versus moisture content.*

*(4 marks)*

(ii) *Based on the curve evaluate the following :*

- *Maksimum dry density*
- *Optimum moisture content*
- *Upper limit moisture content for 95% compaction*
- *Lower limit moisture content for 95% compaction*

*(4 marks)*

(iii) *From the curve, calculate percent zero air-void at maximum dry density and optimum water content,  $A_v$  if given the specific gravity for the soil is 2.68 and water density is 1Mg/m<sup>3</sup>.*

*(3 marks)*

(c) *A vane shear test was conducted on a clay sample and the dimensions of equipment as well as the clay criteria is as follows :*

*$d=100\text{mm}$ ,  $h=200\text{mm}$ ,  $LL=85\%$ ,  $PL=28\%$  dan torque = 120N-m.*

*Calculate the following :*

- (i) *Undrained shear strength,  $s_{uv}$  for the clay.*
- (ii) *Plasticity index, PI*
- (iii) *Correction factor  $\mu$*
- (iv) *Corrected un-drained shear strength, for the clay,  $s_{uv(corr)}$ .*

*( 5 marks)*

(d) *Justify the disturbances of soil sample if the external diameter of the sampler is 50 mm and the thickness of the sampler is 2.5mm*

*( 6 marks)*



- Q2** (a) *Results of consolidated undrained (CU) at failure for saturated marine clay at RECESS in UTHM is shown in Table 2(a) and (b).*
- (i) *Calculate all the CU parameters for the test.* (2 marks)
- (ii) *Construct Mohr's circle for the effective parameter,  $\sigma'_3$  and  $\sigma'_1$ . Show all necessary construction lines.* (3 marks)
- (iii) *Evaluate the values for  $c'$  and  $\phi'$ .* (2 marks)
- (b) *Soil sample from collapse slope were taken to laboratory and conducted a sieve test on them, the result is shown in Table 3.*
- Determine the following :*
- (i) *Sketch the soil particle distribution curve* (4 marks)
- (ii) *From the graph; evaluate the following values :  $D_{10}$  ;  $D_{30}$  ;  $D_{60}$  ;  $C_u$  and  $C_c$*  (5 marks)
- (iii) *Classify the soil* (2 marks)
- (iv) *Recommend the type of slope stabilization method and state your reason.* (2 marks)
- (c) *A pumping test was conducted on a unconfined aquifer in estimating the coefficient of permeability of the soil. After it reached the state of equilibrium, the following data were obtained :*
- *Discharge of water from tube well,  $q = 0.0125\text{m}^3/\text{s}$*
  - *Water level at  $h_1 = 4.5\text{m}$ ,  $h_2 = 8\text{m}$  at distance of  $r_1 = 10\text{m}$ ,  $r_2 = 75\text{m}$ .*
  - *Original ground water level was at 2m*
- (i) *Sketch and label the unscaled figure of the problem* (3 marks)
- (ii) *Calculate the value of  $k$*  (2 marks)

**TERBUKA**



- Q3** (a) **Figure Q3(a)** shows the curve of dial gauge reading versus  $\sqrt{t}$  :
- (i) Evaluate the value of  $t_{90}$  for the given soil sample. Show all necessary construction lines. (4 marks)
  - (ii) Calculate the value of coefficient of consolidation,  $c_v$  if the average thickness of sample taken to be 30mm. Use value of  $t_{90}$  from **Q3(a)(i)**. (2 marks)
- (b) A pad foundation constructed as shown in **Figure Q3(b)(i)**, sustain a load of 1800kN including structure weight, footing pedestal and backfill on the footing. If the dimension of the pad is 2.4m x 3.8m, insitu void ratio,  $e_0$  is 1.36 and compression index,  $C_c$  for the clay layer is 0.69.
- Evaluate the following :
- (i) Overburden pressure,  $p_0$  (at middle of clay layer) (2 marks)
  - (ii) Effective weight from excavation,  $W_e$  (1 mark)
  - (iii) Net consolidation pressure on footing base,  $q_{net}$  (1 mark)
  - (iv) Calculation of influence factor of  $m$  and  $n$  (2 marks)
  - (v) Net consolidation pressure due to load at the mid-height of clay layer at center of footing,  $\Delta p$  (2 marks)
  - (vi) Final pressure at the mid-height of clay layer,  $p$  (1 mark)
  - (vii) Total primary consolidation settlement,  $S$   
Where :  $C_c=0.69$  (given);  $H=8m$ ;  $e_0=1.36$  (given) (2 marks)
- (c) A clock tower is to be built on a circular area with a load of  $150kN/m^2$  is on a ground surface. If the radius of the circle is 3.5m. Estimate the stress increase at the following locations :
- Use **Figure Q3(c)** in estimating the value of  $I_w$ .
- (i) depth of 1.5m at the middle of the footing (3 marks)
  - (ii) depth of 2.5 m and 2.0m away from the centerline (3 marks)
- (d) State two (2) factors that influence in the design and size of foundation (2 marks)

**TERBUKA**

**PART B**

**Q4** (a) Sketch and explain **three (3)** type of bearing capacity failure. (5 marks)

(b) Given a 1.5m x 1.5m footing is located 1.5m below the ground surface. The footing is subjected to an eccentric load of 400kN as shown in **Figure Q4(b)(i)** and **Q4(b)(ii)**. Sub-soil soil consists of a thick deposit of cohesive soil with  $q_u = 200 \text{ kN/m}^2$  and  $\gamma = 20.4 \text{ kN/m}^3$ . Water table is at a great depth, and its effect on bearing capacity can be ignored.

Determine safety factor (F.S) against bearing capacity failure:

- (i) By the concept of useful width.
- (ii) Using reduction factor.

(10 marks)

(c) A square footing shown in **Figure Q4(c)(i)** is located 1.2 m below the ground surface and supports a load of 450kN. The water table is located 1.2 m from the ground surface. Subsoil consists of a uniform deposit of hard clay. The laboratory test results are shown in **Figure Q4(c)(i)**. Refer to **Figure Q4(c)(ii)** to obtain Terzaghi bearing capacity factors. If the factor of safety (FS) is 3.

Determine:

- (i) Ultimate bearing capacity ( $q_{ult}$ )
- (ii) Allowable bearing capacity ( $q_{all}$ )
- (iii) The size of the square footing (BxB)

(10 marks)

**TERBUKA**

**S5** (a) With the aid of a diagram, explain how to run the pile load tests.

(5 marks)

(b) Given concrete piles were driven into the medium dense to dense sand. Groundwater is located 3m below ground surface. Pile diameter is 30cm and the length of pile embedded is 7m depth. Soil conditions are shown in **Figure Q5(b)(i)** and **Q5(b)(ii)**. coefficient of lateral earth pressure ( $K$ ) is 0.93,  $\tan \delta$  is 0.45 and the safety factor is 2.0

Determine the following:

- (i) The critical depth ( $D_c$ ) of the pile and sketches effective vertical pressure ( $P_v$ ) versus Depth.
- (ii) The ultimate pile load ( $Q_{ultimate}$ ).
- (iii) The pile design load ( $Q_{design}$ ).

(10 marks)

- (c) Given concrete piles 0.45m diameter were driven into the clay at site as shown in **Figure Q5 (c)(i)**. Refer **Figure Q5(c)(ii)** to obtain the value of  $\alpha$ . Using a safety factor of 2.

Determine:

- (i) The ultimate pile load ( $Q_{ultimate}$ ).  
 (ii) The pile design load ( $Q_{design}$ ).

(10 marks)

- S6** (a) List and describe the **two (2)** types of retaining walls

(6 markah)

- (b) Given the retaining wall as shown in **Figure S6 (b)**, with slopes of  $15^\circ$  (degrees) behind it. Using the theory rankine.

Determine:

- i) Total active pressure per meter ( $P_a$ )  
 ii) The point of application ( $y$ )

(6 markah)

- (c) Given a slope as shown in **Figure S6 (c)**. The soil parameter is as follows:

$$\gamma = 19.08 \text{ kN/m}^3$$

$$c = 20.2 \text{ kN/m}^2$$

$$\phi = 23^\circ$$

$$\alpha = 35^\circ$$

$$\beta = 75^\circ$$

TERBUKA

Determine:

- (i) The radius of curvature of the surface slope failure ( $R$ ).  
 (ii) Factor of safety of the slope ( $FS$ ).

(13 markah)

-END OF QUESTIONS -

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

**FORMULAE FOR PART A :**

$$Q1 : w = \frac{M_w}{M_s} ; \rho_d = \frac{G_s \rho_w}{1 + w G_s} (1 - A_v) \quad c = \frac{T}{\pi \left[ \left( \frac{d^2 h}{2} \right) + \left( \frac{d^3}{6} \right) \right]} \quad PI = LL - PL ; c_{corr} = \mu c ;$$

$$A_r = \left( \frac{D_{ext}^2 - D_{int}^2}{D_{int}^2} \right) \times 100\%$$

$$Q2 : C_u = \frac{D_{60}}{D_{10}} ; C_c = \frac{(D_{30})^2}{(D_{60})(D_{10})} ; k = \frac{q \ln \left( \frac{r_2}{r_1} \right)}{\pi (h_2^2 - h_1^2)} \text{ or } k = \frac{2.303 q \log_{10} \left( \frac{r_2}{r_1} \right)}{\pi (h_2^2 - h_1^2)} ;$$

$$Q3 : c_v = \frac{0.848 H_{l(av)}^2}{4 t_{90}} ; p_0 = \gamma' z ; W_e = \gamma' z ; q_{net} = \frac{P}{A X B} - W_e ; \Delta p = 4 (I_p) (w) ; p = p_0 + \Delta p ;$$

$$S = C_c \left( \frac{H}{1 + e_0} \right) \log \frac{p}{p_0}$$

**FORMULAE FOR PART B :**

1.  $q_{ult} = 1.2cN_c + \gamma_1 D_f N_q + 0.4\gamma_2 B N_\gamma$  (for square footing)
2. Case I ; If  $0 \leq D_1 \leq D_f$  ;  $q = D_1 \gamma + D_2 (\gamma_{sat} - \gamma_w)$  ; also  $\gamma$  at last term replaced by  $\gamma' = \gamma_{sat} - \gamma_w$
3. Case II ; If  $0 \leq d \leq B$  ;  $q = \gamma D_f$  ;  $\gamma_{sat} = \gamma$  ; and  $\gamma$  at last term replaced by  $\bar{\gamma} = \gamma' + \frac{d}{B} (\gamma - \gamma')$
4. Case III ; when the water table is located so that  $d \geq B$ , the water will have no effect on ultimate bearing capacity.

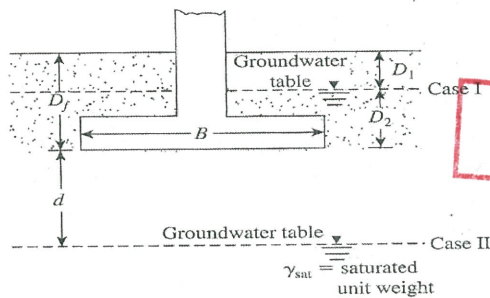


Figure F(i): Effect Of Water Table On Bearing Capacity

5.

$$Q_{ultimate} = f \cdot A_{Surface} + q \cdot A_{tip}$$

$$f \cdot A_{Surface} = (\text{Circumference of pile})(\text{Area of } p_v)(K)(\tan \delta)$$

$$\text{Circumference of pile} = \pi d$$

$$q_{tip} = p_v N_q^*, \quad A_{tip} = \frac{\pi d^2}{4}, \quad Q_{design} = \frac{Q_{ultimate}}{F.S}$$

$$6. \quad Q_{ultimate} = \alpha c A_{Surface} + c N_c A_{tip}; \quad \alpha c A_{Surface} = \alpha_1 c_1 A_{Surface 1} + \alpha_2 c_2 A_{Surface 2}$$

$$A_{Surface 1} = (\pi d)(L_1), \quad q_{tip} = c N_c$$

$$7. \quad p_a = \frac{1}{2} \gamma H^2 K_a$$

8.

$$K_a = K_o \cos \beta \cdot \frac{(\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \phi})}{(\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \phi})}$$

$$9. \quad F_s = \frac{R \theta c + (\sum W_n \cos \alpha_n) \tan \phi'}{\sum W_n \sin \alpha_n}$$

TERBUKA

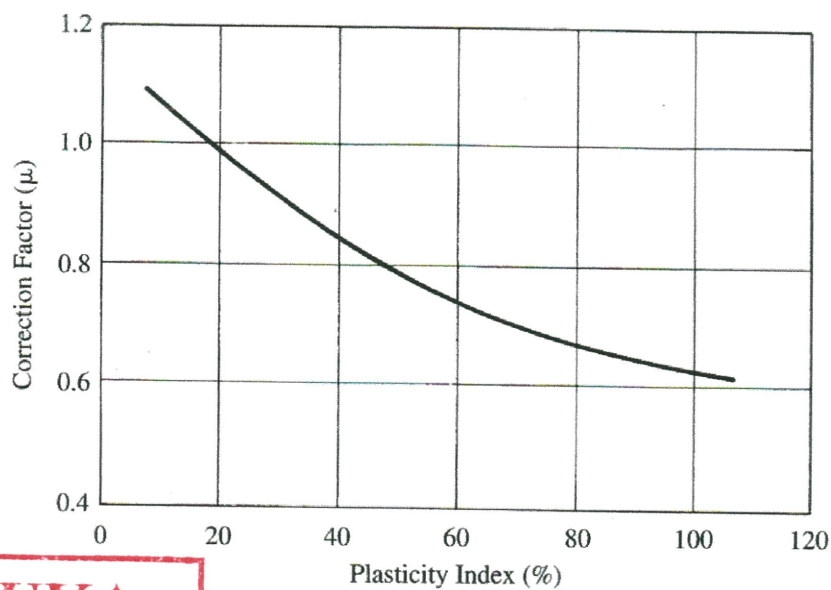
**CONFIDENTIAL****FINAL EXAMINATION**

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

**Table 1 : Moisture content versus dry density**  
**Jadual 1 : Kandungan lembapan melawan ketumpatan kering**

Moisture content, (%)	9.4	11.8	13.8	16.1	18.2	21.4
Dry density, $\rho$ (Mg/m <sup>3</sup> )	1.7	1.81	1.85	1.84	1.8	1.72

**TERBUKA**

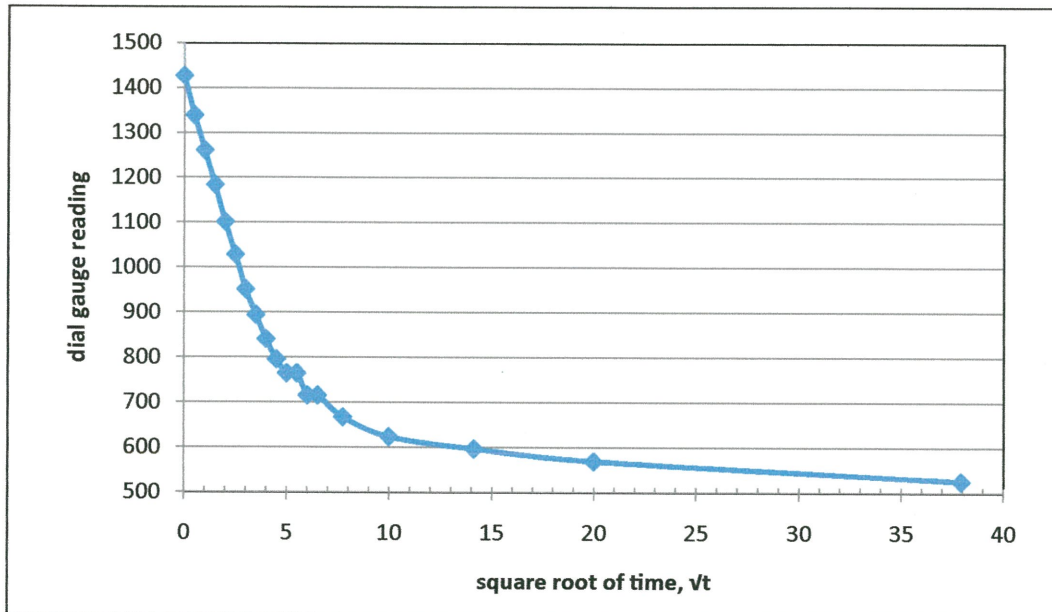
**Figure Q1(b) : Corection factor,  $\mu$  versus PI**  
**Rajah S1(b) : Faktor pembetulan  $\mu$  melawan PI**

**CONFIDENTIAL**

**CONFIDENTIAL****FINAL EXAMINATION**

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103



**Figure Q3(a) : Curve of dial gauge reading versus  $\sqrt{t}$  of a soil sample  
 from a consolidation test**

**Rajah S3(a) : Lengkuk bacaan dial gej melawan  $\sqrt{t}$  untuk contoh  
 tanah dari ujikaji pengukuhan**

**Instruction : Please detach this figure and tie up with your answer book**  
**Arahan : Sila tanggalkan rajah ini dan ikatkan bersama buku jawapan anda**

**TERBUKA**

**CONFIDENTIAL**

**CONFIDENTIAL****FINAL EXAMINATION**

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

**Table 2 : Value of surrounding stress, deviator stress and pore water pressure.**  
**Jadual 2 : Nilai tegasan keliling, tegasan sisih dan tekanan air liang**

Surrounding pressure, $\sigma_3$ (kN/m <sup>2</sup> )	Deviator stress, $\Delta\sigma_f$ (kN/m <sup>2</sup> )	Pore water pressure, u (kN/m <sup>2</sup> )
150	184	86
300	332	164
450	496	218

**Table 2(b) : CU parameters**  
**Jadual 2(b) : parameter-parameter CU**

$\sigma_3$	$\sigma_1$	$\sigma'_3$	$\sigma'_1$
150			248
300			468
450			728

**Table 3 : Sieve size versus percent passing for the slope soil sample**  
**Jadual 3 : Saiz ayakan melawan peratus melepasi bagi contoh tanah cerun**

Sieve size (mm)	3.35	2	1.18	0.6	0.425	0.3	0.212	0.15	0.063	Pan
% Finer	100	98.9	93.1	66.6	38	22.3	13.7	7.9	1.8	0

**TERBUKA**

**CONFIDENTIAL**



**CONFIDENTIAL**

**FINAL EXAMINATION**

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

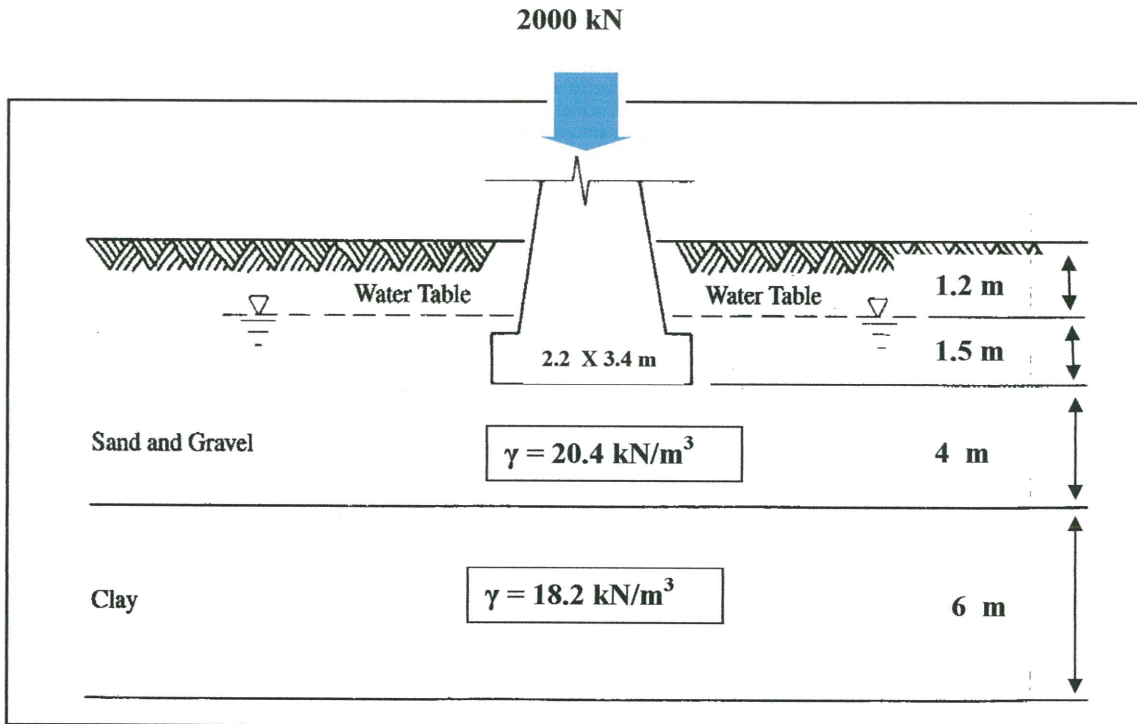


Figure Q3(b)(i) : Pad foundation on layered soil  
 Rajah S3(b)(i) : Asas pad di atas tanah berlapis

**TERBUKA**

**CONFIDENTIAL**

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
COURSES CODE : DAC 21103

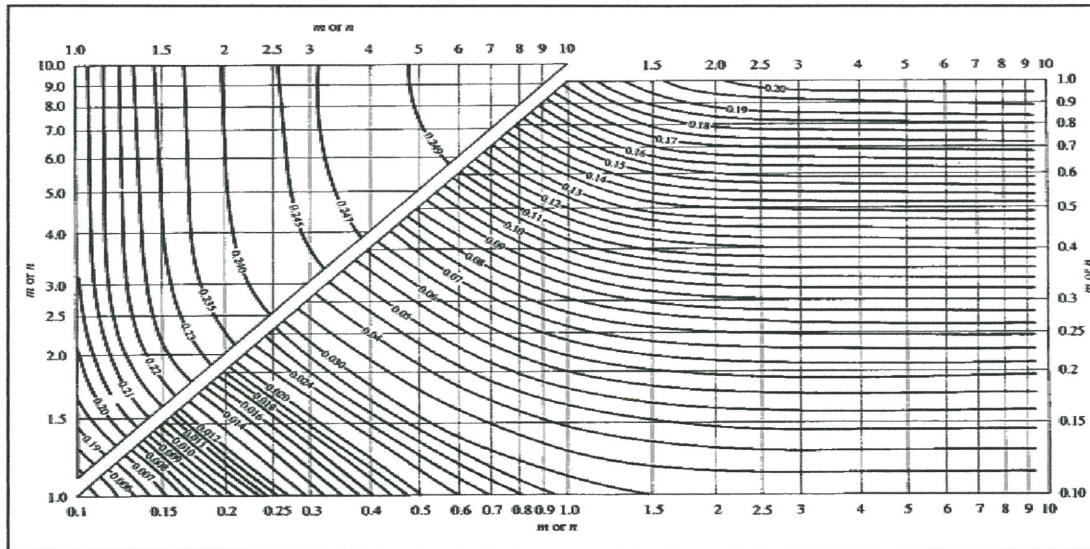


Figure Q3(b)(ii) : Chart for I influence coefficient value

Rajah S3(b)(ii) : Carta untuk nilai pekali pengaruh I

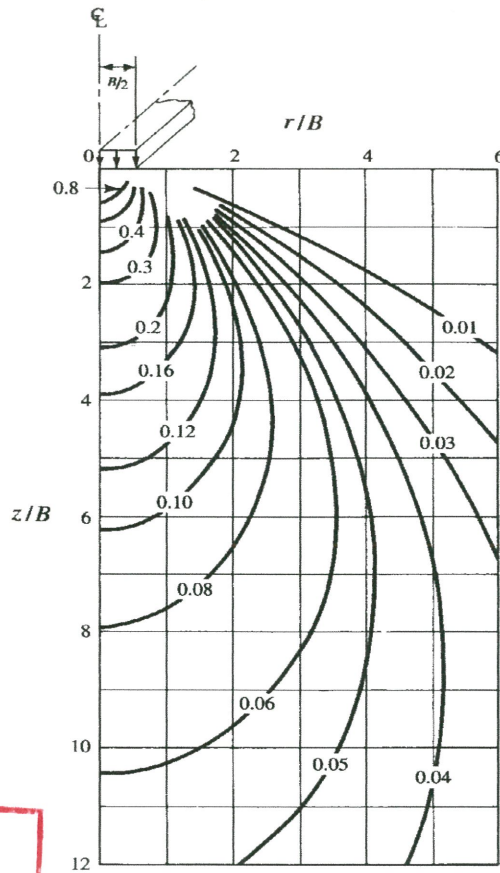
**TERBUKA**

*Faint handwritten notes at the bottom left corner of the page.*

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
COURSES CODE : DAC 21103



TERBUKA

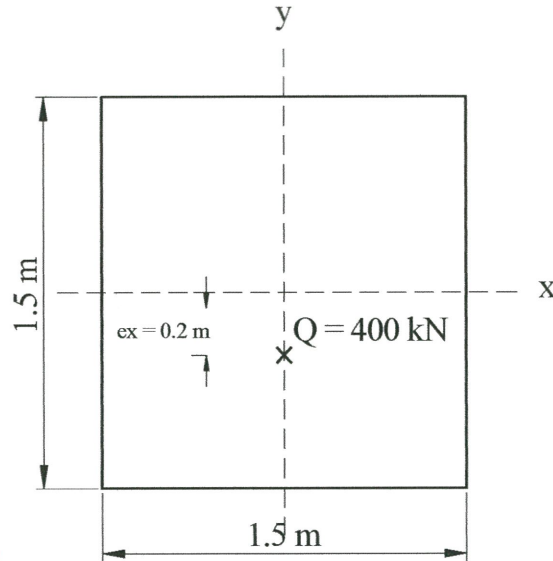
Figure Q3 (c) : Influence coefficient for uniformly loaded strip area  
Rajah S3 (c) : Pekali pengaruh untuk beban seragam selanjat



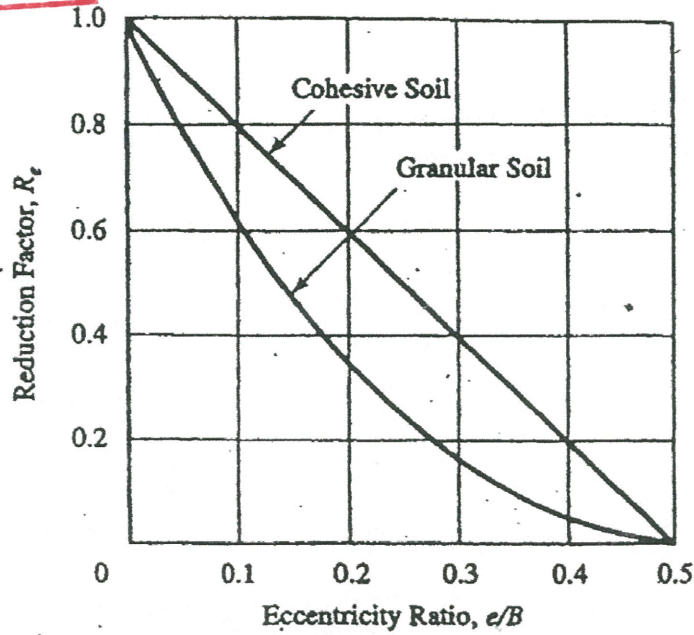
FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
COURSES CODE : DAC 21103



TERBUKA



Rajah S4(b)(i) : Faktor pengurangan beban sipi  
Figure Q4(b)(i) : Eccentricity reducing load factor

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

Figure Q4(c) :  
 Shallow foundation

Rajah S4(c) : Asas  
 cetek

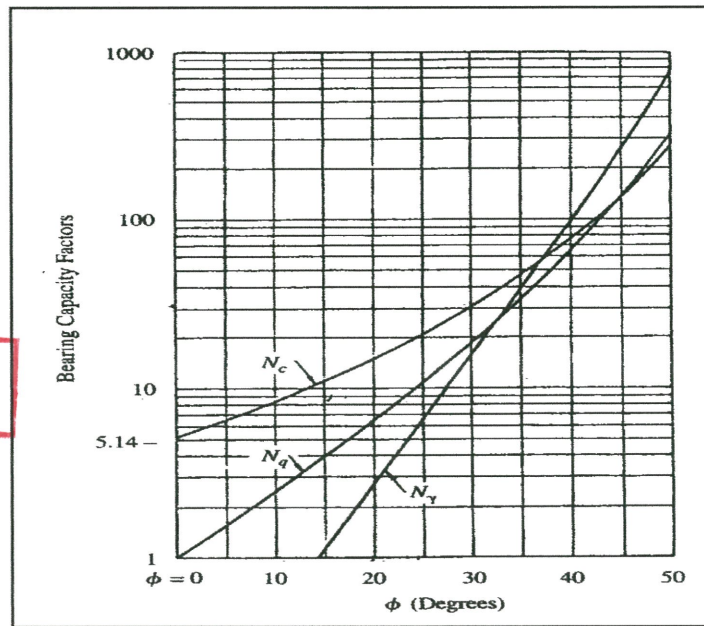
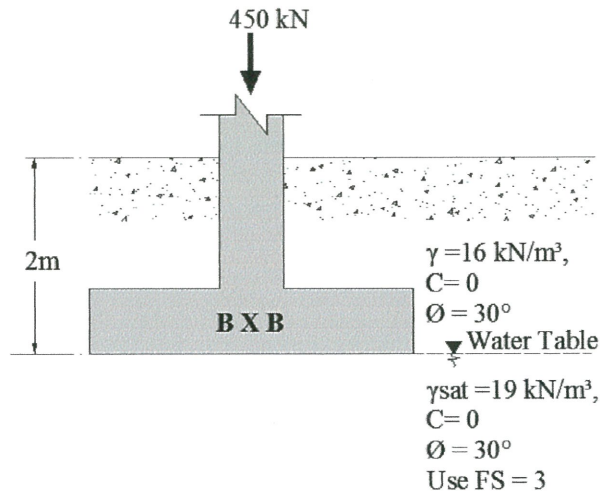


Figure Q4(c)(ii) : Chart shows correlation between bearing capacity factors  $N_c$ ,  $N_q$ ,  $N_\gamma$  and  $\phi$   
 Rajah S4(c)(ii) : Carta yang menunjukkan perkaitan antarafaktor keupayaan galas

$N_c$ ,  $N_q$ ,  $N_\gamma$  dengan  $\phi$

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

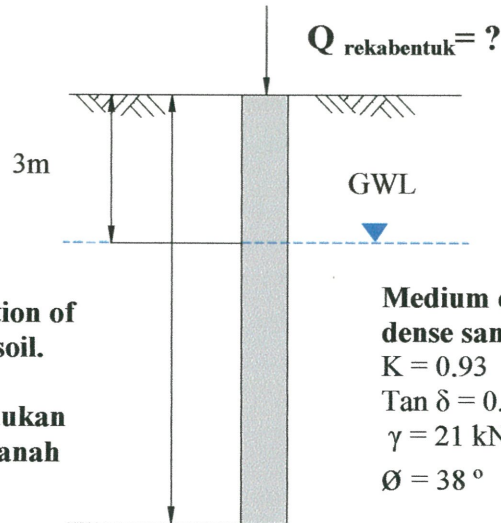


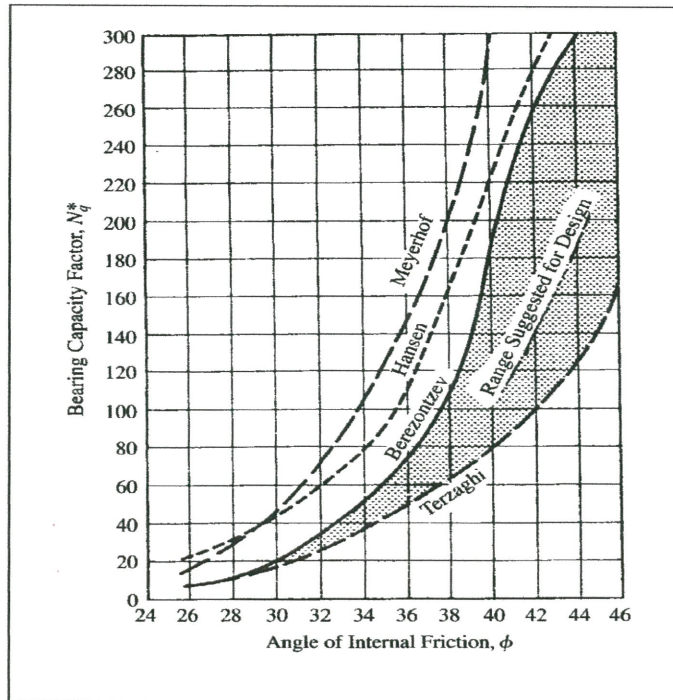
Figure Q5(b)(i): Location of circular pile in sandy soil.

Rajah S5(b)(i): Kedudukan cerucuk bulat dalam tanah pasir.

Medium dense to dense sand  
 $K = 0.93$   
 $\tan \delta = 0.45$   
 $\gamma = 21 \text{ kN/m}^3$   
 $\phi = 38^\circ$

Figure Q5(b)(ii): Value of  $N_q^*$  for pile in sand

Rajah S5(b)(ii): Nilai  $N_q^*$  Bagi cerucuk dalam pasir



TERBUKA

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103

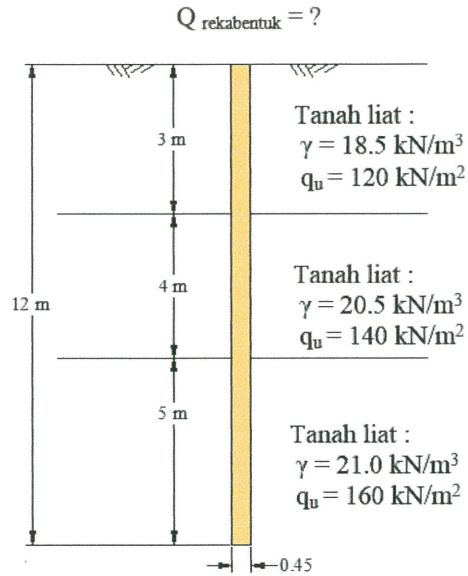


Figure Q5(c)(i): Pile in clay  
 Rajah S5(c)(i): Cerucuk dalam tanah liat

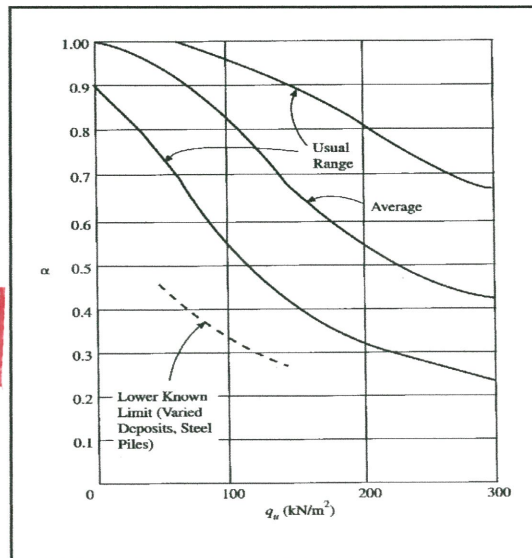


Figure Q5(c)(ii): Values of  $\alpha$  and  $q_u$  for piles in clay  
 Rajah S5(c)(ii): Nilai  $\alpha$  dan  $q_u$  bagi cerucuk dalam tanah liat

TERBUKA

This document is the property of the University of Malaya. It is to be used only for the purpose for which it is issued. It is not to be distributed, copied, or otherwise used without the written permission of the University of Malaya.

FINAL EXAMINATION

SEMESTER / SESSION : SEM 2 / 2016/2017  
COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
COURSES CODE : DAC 21103

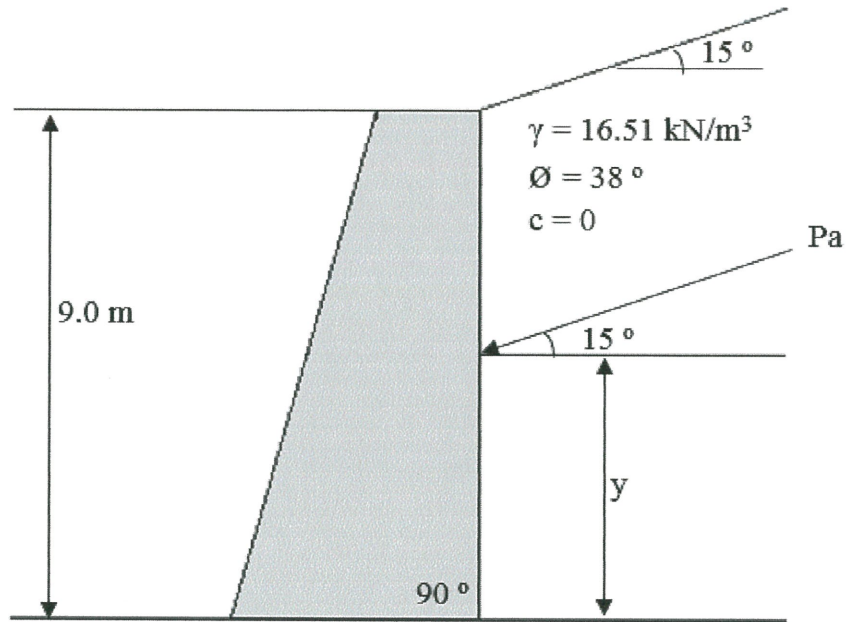


Figure Q6(b): Retaining Wall  
Rajah S6(b): Tembok Penahan

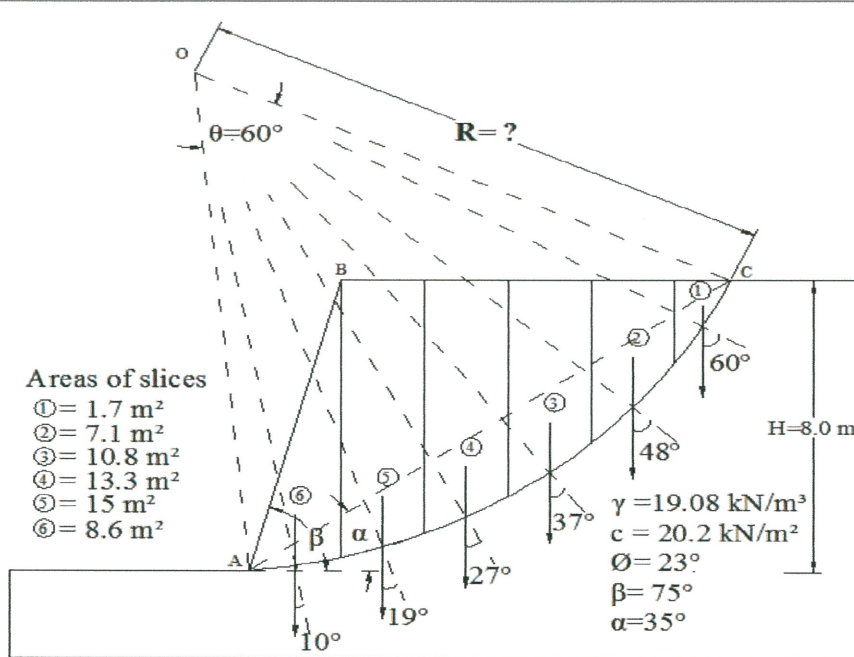
TERBUKA



**FINAL EXAMINATION**

SEMESTER / SESSION : SEM 2 / 2016/2017  
 COURSES : GEOTECHNIC ENGINEERING

PROGRAMME : 2 DAA  
 COURSES CODE : DAC 21103



**Figure Q6(c): Slope analysis  
 Rajah S6(c): Analisis cerun**

No.	Slice Area of slices	Weight of slice $W_n = A \times \gamma$ (kN/m)	$\alpha_n$ (deg)	$W_n \cos \alpha_n$ (kN/m)	$W_n \sin \alpha_n$ (kN/m)
1					
2					
3					
4					
5					
6					
Total				$\Sigma =$	$\Sigma =$

**TERBUKA**