UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	SOIL MECHANICS
COURSE CODE	:	BPD 20502
PROGRAM ME	:	2 BPC
EXAMINATION DATE	:	DECEMBER 2012 / JANUARY 2013
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 The mass (M) of soil sample in its original form is 2.3kg and its volume (V) is 1.15×10^{-3} m^3. After the soil being dried in the oven, the mass of the sample becomes 2.03kg. The value of Gs is 2.5.

Calculate (a) to (f) below, by using formula of phase relationship given in **Appendix I**.

(a) Water content (w)   (4 marks)

(b) Void ratio (e)   (6 marks)

(c) Porosity (n)   (3 marks)

(d) Bulk density (ρ)   (4 marks)

(e) Saturation degree (Sr)   (4 marks)

(f) Air content (A)   (4 marks)

Q2 Compaction is a process to increase the density of the soil by which the solid particles are packed more closely together and lessen the air voids without critical changes to the soil water volume.

(a) Explain each method of laboratory testing below;

(i) Proctor test

(ii) AASHTO modified test

(15 marks)

(b) Explain in detail the definition of 'Optimum Moisture Content'.

(10 marks)

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Q3   Soil sieving can be performed in either wet or dry condition.

(a)   State the smallest and largest mesh openings for determining grain size distribution?

(4 marks)

(b)   Explain the purpose of grain size analysis to be accomplished.

(7 marks)

(c)   Discuss the conditions of the soil whether to use wet sieving or dry sieving.

(7 marks)

(d)   Discuss whether it is possible to carry out a sieve analysis on a sample of clay and explain its methodology.

(7 marks)

Q4   Soil bearing capacity is a soil capacity to support overall foundation and structure weights.

(a)   Explain the differences between ultimate bearing capacity and allowable bearing capacity.

(4 marks)

(b)   Explain earth water impact toward soil bearing capacity.

(6 marks)

(c)   A square footing with 1.2m in dimension is located 1.5m in below stable cohesive soil surface as shown in **Figure Q4(a)** in **Appendix II**.

Calculate ultimate bearing capacity of the soil, by using **Graph Q4(b)** in **Appendix II**.

(15 marks)

- **END OF QUESTION** -

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Phase Relationship Formula;

Water ratio, $\quad\quad$ $w \quad = \dfrac{Mw}{Ms}$

Saturation degree, $\quad$ $Sr \quad = \dfrac{Vw}{Vv}$

Void ratio, $\quad\quad$ $e \quad = \dfrac{Vv}{Vs}$

Porosity, $\quad\quad$ $n \quad = \dfrac{Vv}{V}$

$\quad\quad\quad\quad\quad\quad\quad e \quad = \dfrac{n}{1-n}$

$\quad\quad\quad\quad\quad\quad\quad n \quad = \dfrac{e}{1+e}$

Volume (v), $\quad\quad$ $v \quad = 1 + e$

Air content (A), $\quad\quad$ $A \quad = \dfrac{Va}{V}$

Soil density (ρ), $\quad\quad$ $\rho \quad = \dfrac{M}{V}$

Specific gravity of the soil grains (Gs), $\quad$ $Gs \quad = \dfrac{Ms}{Vs\, \rho_w}$

Saturation degree (Sr), $\quad\quad$ $Sr \quad = \dfrac{wGs}{e}$

If soil saturated , Sr=1 , and; $\quad$ void ratio, $e \quad = wGs$

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Phase RelationshipFormula (cont.):

Air content (A)

$$A = \frac{e - wGs}{1 + e}$$

@

$$A = n(1 - Sr)$$

Soil density (ρ) for any degree of saturation;

$$\rho = \frac{Gs(1 + w)}{1 + e} \rho_w$$

@

$$\rho = \frac{(Gs + Sre)}{1 + e} \rho_w$$

If the soil is saturated, Sr=1;

$$\rho_{sat} = \frac{Gs + e}{1 + e} \rho_w$$

If the soil is dry, Sr=0;

$$\rho_d = \frac{Gs}{1 + e} \rho_w$$

Bulk unit weight (γ),

$$\gamma = \frac{W}{V} = \frac{Mg}{V}$$

@

$$= \frac{Gs(1 + w)}{1 + e} \gamma_w$$

@

$$= \frac{Gs + Sre}{1 + e} \gamma_w$$

Dry unit weight (γ'),

$$\gamma' = \frac{Gs\gamma_w - \gamma_w}{1 + e} = \frac{Gs - 1}{1 + e}\gamma_w$$

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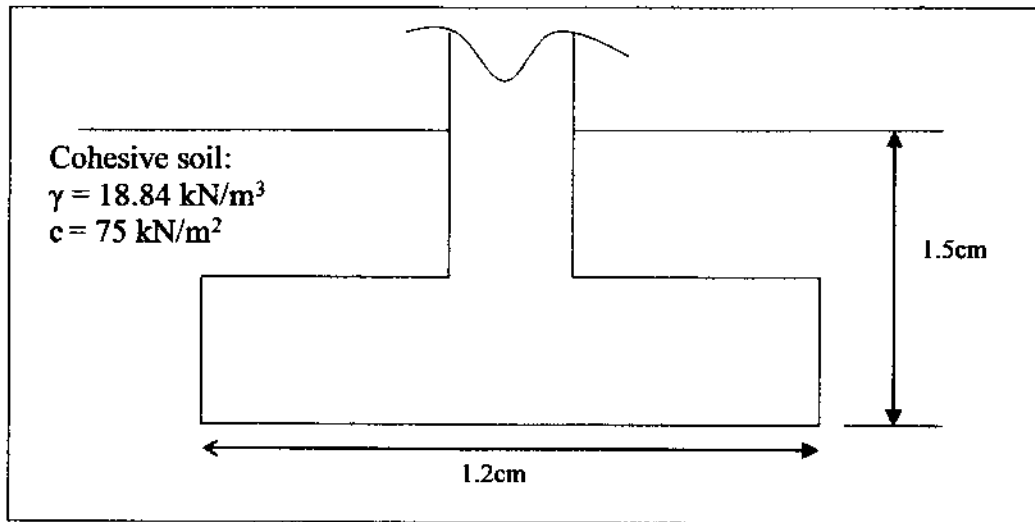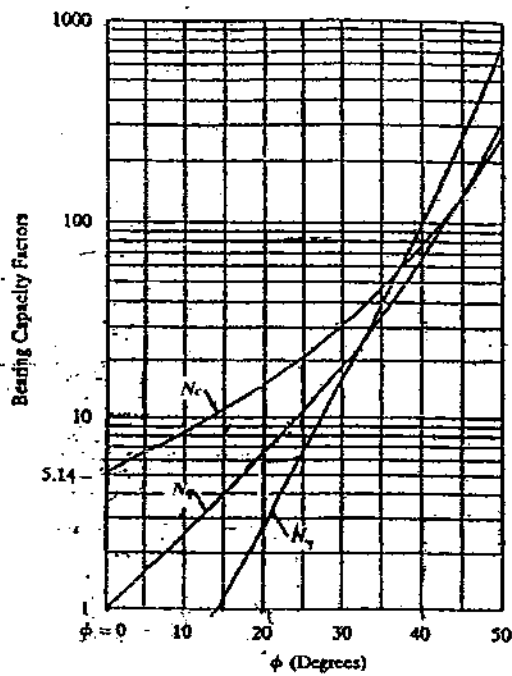COURSE   : SOIL MECHANICS   COURSE CODE   : BPD 20502

Cohesive soil:
$\gamma = 18.84$ kN/m^3
$c = 75$ kN/m^2

1.5cm

1.2cm

Figure Q4 (a) : Square Footing

Graph Q4 (b): The Relation of Bearing Capacity Factor and Ø

S1 Satu sampel tanah di dalam keadaan semulajadi mempunyai jisim (M) 2.3kg dan isipadu (V) 1.15×10^{-3} m³. Setelah dikeringkan dengan sempuma di dalam ketuhar, jisim sampel (Ms) menjadi 2.03kg. Nilai Gs untuk tanah ialah 2.5.

Hitungkan nilai (a) hingga (f) di bawah, dengan menggunakan persamaan perhubungan fasa di dalam **Lampiran I**;

    (a)   Kandungan air(w)   (4 markah)

    (b)   Nisbah lompang(e)   (6 markah)

    (c)   Keliangan (n)   (3 markah)

    (d)   Ketumpatan pukal(ρ)   (4 markah)

    (e)   Darjah ketepuan(Sr)   (4 markah)

    (f)   Kandungan udara(A)   (4 markah)

S2 Pemadatan ialah satu proses meningkatkan ketumpatan sesuatu tanah dengan menyendatkan zarah-zarah tanah supaya rapat dan mengurangkan isipadu udara tanpa perubahan ketara pada isipadu air di dalam tanah.

    (a)   Jelaskan kaedah bagi setiap ujian makmal yang berikut;

        (i)   Ujian Proctor

        (ii)   Ujian terubahsuai AASHTO

                      (15 markah)

    (b)   Terangkan secara terperinci definisi 'Kandungan Lembapan Optimum'.
                      (10 markah)

S3 Ayakan tanah boleh dilakukan didalam keadaan basah ataupun kering.

(a) Apakah saiz bukaan terkecil dan terbesar yang digunakan untuk menentukan agihan saiz zarah?

(4 markah)

(b) Terangkan tujuan utama analisis saiz zarah dilaksanakan.

(7 markah)

(c) Bincangkan keadaan tanah yang memerlukan ayakan basah atau ayakan kering.

(7 markah)

(d) Bincangkan samada analisis ayakan boleh dilaksanakan bagi sampel tanah liat dan terangkan bagaimana ia dilaksanakan.

(7 markah)

S4 Keupayaan galas tanah merupakan keupayaan tanah untuk menyokong keseluruhan berat asas dan struktur.

(a) Terangkan perbezaan antara keupayaan galas muktamad dan keupayaan galas dibenarkan.

(4 markah)

(b) Terangkan kesan air bumi terhadap keupayaan galas bagi tanah.

(6 markah)

(c) Sebuah tapak segiempat sama bersaiz 1.2 m diletakkan 1.5 m di bawah permukaan tanah jeleket yang kukuh seperti ditunjukkan dalam **Rajah S4(a)** di **Lampiran II**.

Hitungkan keupayaan galas muktamad bagi tanah tersebut, dengan menggunakan **Jadual S4(b)** di **Lampiran II**.

(15 markah)

- SOALAN TAMAT -

PEPERIKSAAN AKHIR

SEMESTER/SESI   : I/2011/2012   KURSUS   : 2 BPC
MATA PELAJARAN   : MEKANIK TANAH   KOD MATA PELAJARAN : BPD 20502

Persamaan Kehubungan Fasa;

Kandungan air, $\qquad w = \dfrac{Mw}{Ms}$

Darjah ketepuan, $\qquad Sr = \dfrac{Vw}{Vv}$

Nisbah lompang, $\qquad e = \dfrac{Vv}{Vs}$

Keliangan, $\qquad n = \dfrac{Vv}{V}$

$\qquad\qquad\qquad e = \dfrac{n}{1-n}$

$\qquad\qquad\qquad n = \dfrac{e}{1+e}$

Isipadu tentu (v), $\qquad v = 1 + e$

Kandungan udara (A), A $\qquad = \dfrac{Va}{V}$

Ketumpatan pukal tanah(ρ), $\qquad \rho = \dfrac{M}{V}$

Berat tentu zarah pepejal tanah (Gs), $\qquad Gs = \dfrac{Ms}{Vs\,\rho_w}$

Darjah ketepuan (Sr), $\qquad Sr = \dfrac{wGs}{e}$

Sekiranya kes tanah tepu sepenuhnya, Sr=1, maka; nisbah lompang, e = wGs

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Persamaan Kehubungan Fasa (samb.);

Kandungan udara(A)

$$A = \frac{e - wGs}{1 + e}$$

@

$$A = n(1 - Sr)$$

Ketumpatan pukal(ρ) juga boleh dinyatakan sebagai; $\rho = \frac{Gs(1 + w)}{1 + e} \rho_w$

@

$$\rho = \frac{(Gs + Sre)}{1 + e} \rho_w$$

Bagi tanah yang tepu sepenuhnya (Sr=1); $\rho_{tepu} = \frac{Gs + e}{1 + e} \rho_w$

Bagi tanah yang kering sepenuhnya (Sr=0); $\rho_d = \frac{Gs}{1 + e} \rho_w$

Bagi tanah yang tepu sepenuhnya (Sr=1); $\rho_{tepu} = \frac{Gs + e}{1 + e} \rho_w$

Bagi tanah yang kering sepenuhnya (Sr=0); $\rho_d = \frac{Gs}{1 + e} \rho_w$

Berat unit (γ),

$$\gamma = \frac{W}{V} = \frac{Mg}{V}$$

@

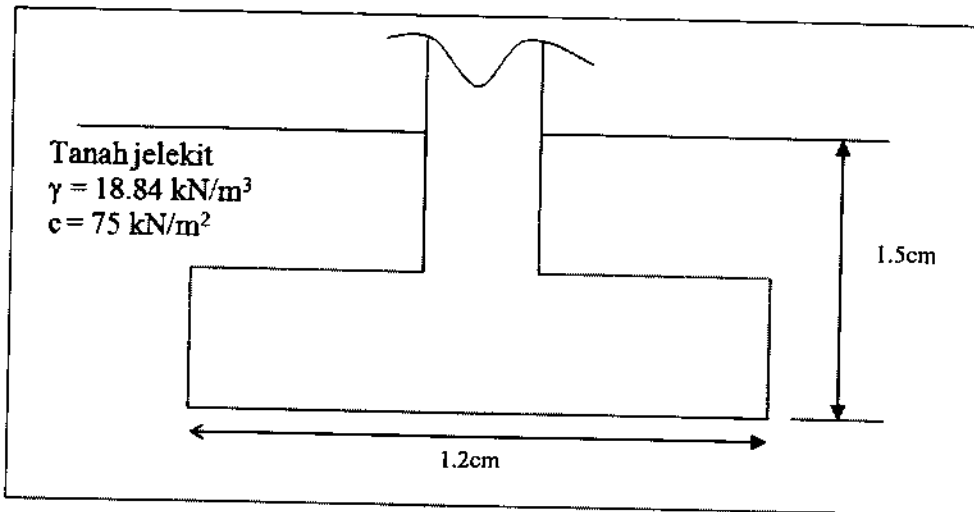$$\gamma = \frac{Gs(1 + w)}{1 + e} \gamma_w$$

@

$$\gamma = \frac{Gs + Sre}{1 + e} \gamma_w$$

Berat unit apungan (γ'),

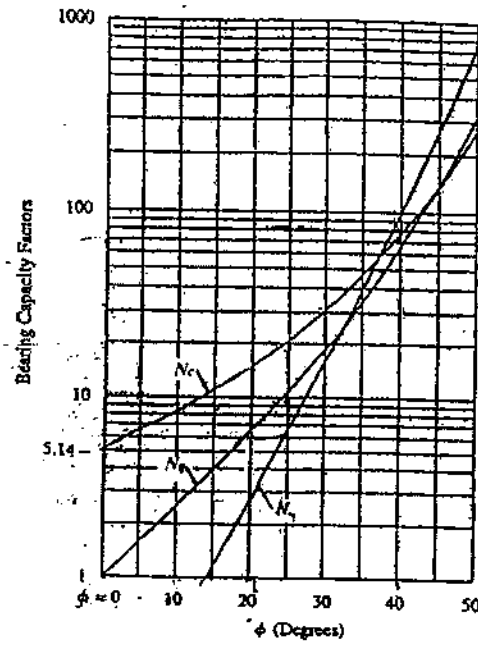$$\gamma' = \frac{Gs\gamma_w - \gamma_w}{1 + e} = \frac{Gs - 1}{1 + e} \gamma_w$$

PEPERIKSAAN AKHIR

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MATA PELAJARAN : MEKANIK TANAH   KOD MATA PELAJARAN : BPD 20502

Tanah jelekit
$\gamma = 18.84$ kN/m^3
$c = 75$ kN/m^2

1.5cm

1.2cm

Rajah S4(a) : Asas Segiempat Sama

Graf S4(b): Carta Perkaitan Faktor Keupayaan Galas dan $\varnothing$