

SULIT



First Semester Examination
Academic Session 2018/2019

December 2018/January 2019

**EAG345 – Geotechnical Analysis
(Analisis Geoteknik)**

Duration : 3 hours
(Masa : 3 jam)

Please check that this examination paper consists of **TEN (10)** pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEPULUH (10)** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

Instructions : This paper consists of **SIX (6)** questions. Answer **FIVE (5)** questions.

Arahan : Kertas ini mengandungi **ENAM (6)** soalan. Jawab **LIMA (5)** soalan.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

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- (1). A soil element in the field may go through various complicated stress path during the lifetime of a geotechnical structure. You are involved in an elevated highway construction project near Pantai Jerejak, Penang. In order for you to design the abutment, you are required to determine the shear strength of the soil underneath. A disturbed soil sample is taken 1 m below the groundwater level from the site and classified as silty sand.

Suatu elemen tanah di tapak mungkin melalui pelbagai laluan tegasan yang rumit sepanjang hayat suatu struktur geoteknik. Anda terlibat dalam suatu projek pembinaan lebuh raya bertingkat berdekatan Pantai Jerejak, Pulau Pinang. Bagi membolehkan anda merekabentuk penampan, anda diperlukan untuk menentukan kekuatan ricih tanah dibawahnya. Suatu sampel terganggu diambil 1 m di bawah aras air tanah dari tapak dan diklasifikasikan sebagai pasir berkelodak.

- (a). Define the Mohr – Coulomb failure criterion
Takrifkan kriteria kegagalan Mohr-Coulomb

[2 marks/markah]

- (b). Determine the suitable shear strength test for the soil. Explain the reason.

Tentukan ujian kekuatan ricih yang sesuai bagi tanah berkenaan. Jelaskan alasan.

[3 marks/markah]

- (c). Using a simple plot of shear stress against shear displacement (under strain-controlled condition), describe the variation of resisting shear stress with shear displacement. The soil condition can either be loose or dense silty sand.

Menggunakan suatu plot mudah bagi tegasan ricih melawan sesaran ricih (dibawah keadaan kawalan-terikan), terangkan variasi rintangan tegasan ricih bersama sesaran ricih. Keadaan tanah boleh berada dalam keadaan pasir berkelodak longgar ataupun padat.

[5 marks/markah]

- (d). A direct shear test result for a compacted sand sample is as follow:
Keputusan ujian ricih terus untuk pasir yang termampat adalah seperti berikut:

Determine the friction angle for sand:

- (i). In dense condition.
Dalam keadaan termampat.
- (ii). In loose condition.
Dalam keadaan longgar.

Normal stress / Tegasan normal (kN/m ²)	Shear Stress/ Tegasan Ricih (kN/m ²)	
	Peak value / Nilai puncak	Ultimate value / Nilai muktamad
35	29	23
70	58	45
105	87	67

[10 marks/markah]

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- (2). A soil investigation program is necessary to provide information for design, construction and for environmental assessment. The purposes of a soil investigation include evaluation on the general suitability of the site for the proposed project and to ensure adequate and economical design to be made.

Program penyiasatan tanah adalah perlu bagi memberikan maklumat rekabentuk, pembinaan dan bagi penilaian alam sekitar. Tujuan penyiasatan tanah termasuklah penilaian bagi kesesuaian umum tapak projek yang di usulkan dan memastikan rekabentuk yang dibuat mencukupi dan ekonomikal.

- (a). List important primary objectives in soil investigation that need to be conducted for every development.

Senaraikan objektif-objektif penting bagi penyiasatan tanah yang perlu dilakukan bagi setiap pembangunan.

[6 marks/markah]

- (b). Describe detail soils exploration program that should be carried out in a soil investigation.

Terangkan program eksplorasi tanah terperinci yang perlu dilakukan bagi penyiasatan tanah.

[10 marks/markah]

- (c). Compare the advantages and disadvantages of test pits versus soil borings for obtaining information on subsurface conditions.

Bandingkan kelebihan dan kekurangan lubang ujian dan lubang jara bagi memperolehi maklumat keadaan bawah tanah.

[4 marks/markah]

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- (3). (a). Name the **THREE (3)** lateral stress distributions of soil as given in the diagram (**Figure 1**) and sketch their distributions.

*Namakan **TIGA (3)** agihan tekanan tanah mendatar seperti yang di berikan dalam gambarajah (**Rajah 1**) dan lakarkan agihan tersebut.*

[5 marks/markah]

- (b). Calculate the lateral stresses for each of the cases, considering the soil is under at rest, active and passive conditions.

Kira agihan tekanan mendatar dengan mengambil kira keadaan dalam diam, aktif dan pasif.

[15 marks/markah]

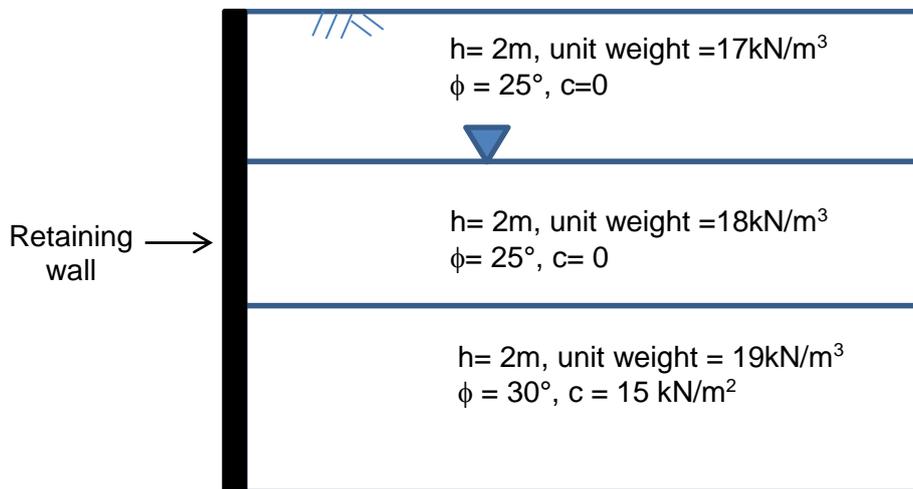


Figure 1/ Rajah 1

- (4). (a). Describe in detail with the aid of sketches the **THREE (3)** main factors influencing the failure of the retaining wall.

*Terangkan secara terperinci dengan bantuan lakaran **TIGA (3)** faktor utama yang mempengaruhi kegagalan tembok penahan.*

[5 marks/markah]

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- (b). Design a retaining wall of your choice and check all stabilities accordingly.

Rekabentuk tembok penahan mengikut pilihan anda dan semak semua kestabilan yang sewajarnya.

[15 marks/markah]

- (5). (a). A slope can be natural or man-made. It can fail in various modes and one of the common slope failure is circular failure.

Suatu cerun boleh dijadikan secara semulajadi atau buatan manusia. Ia boleh gagal dalam pelbagai mod dan salah satu kegagalan cerun yang biasa adalah kegagalan bulatan.

- (i). Using suitable sketch, describe common modes of failure for finite slope failure.

Menggunakan lakaran bersesuaian, terangkan mod kegagalan biasa bagi kegagalan cerun terhad.

[4 marks/markah]

- (ii). Describe the differences between Mass Procedure and Method of Slices.

Terangkan perbezaan di antara Prosedur Jisim dan Kaedah Hirisan.

[4 marks/markah]

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- (b). An infinite slope is shown as **Figure 2**. Given $\beta = 30^\circ$, $\gamma = 18.5 \text{ kN/m}^3$, $\phi' = 21.5^\circ$ and $c' = 14.5 \text{ kN/m}^3$.

*Suatu cerun tidak terhad ditunjukkan seperti **Rajah 2**. Diberikan $\beta = 30^\circ$, $\gamma = 18.5 \text{ kN/m}^3$, $\phi' = 21.5^\circ$ and $c' = 14.5 \text{ kN/m}^3$.*

- (i). Determine the height, H , for critical equilibrium.
Tentukan ketinggian, H bagi keseimbangan kritikal.

[6 marks/markah]

- (ii). If seepage through the soil occurs and flowing downwards and the groundwater coincides the ground surface, what is the factor of safety, given $H = 2.8 \text{ m}$ and $\gamma = 18.6 \text{ kN/m}^3$.

Jika resapan berlaku di dalam tanah dan mengalir ke bawah dan air tanah mengenai permukaan tanah, apakah faktor keselamatan, diberikan $H = 2.8 \text{ m}$ dan $\gamma = 18.6 \text{ kN/m}^3$.

[6 marks/markah]

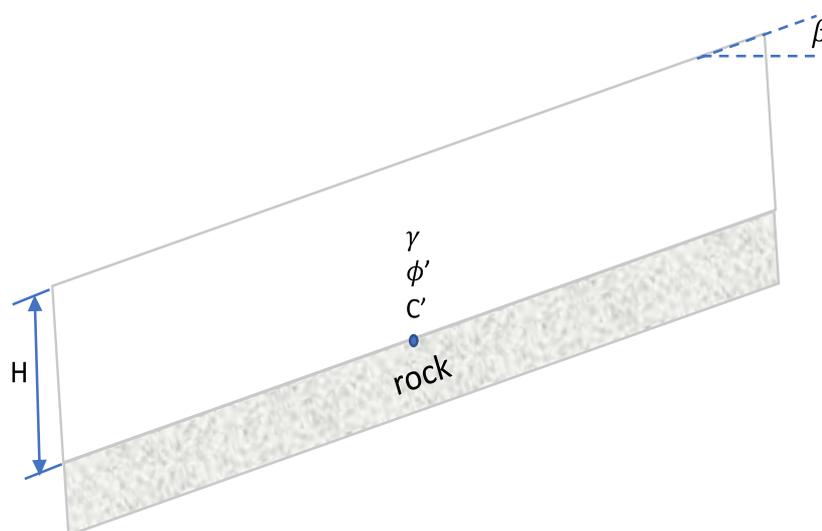


Figure 2/Rajah 2

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- (6). **Figure 3** shows a 300 mm concrete spun pile driven into clays and rested on sand. The soil parameters are as given. Additional parameter values can be obtained from **Figure 4** and **Figure 5**.

***Rajah 3** menunjukkan suatu cerucuk konkrit dengan garis pusat 300 mm yang telah dipacu melewati lapisan-lapisan lempung dan berdiri di dalam pasir. Nilai-nilai parameter tanah diberi di **Rajah 3**. Nilai-nilai parameter tambahan boleh didapati dari **Rajah 4** dan **Rajah 5**.*

- (a). Determine the pile bearing capacity by using the α -method for the shaft friction and Meyerhof's method for the end bearing.

Tentukan kekuatan gelas cerucuk menggunakan kaedah- α dalam menentukan geseran batang dan kaedah Meyerhof dalam menentukan kekuatan gelas hujung.

[10 marks/markah]

- (b). A test carried on the pile indicates that the ultimate capacity is 1500 kN. Determine the average adhesion value for the clay-pile interaction if the end bearing value from (a) is considered correct. Provide a short comment on the new adhesion value and how it differs from the ones determined in (a).

Ujian yang dijalankan mendapati bahawa kekuatan gelas cerucuk adalah 1500 kN. Tentukan nilai purata rekatan (adhesion) bagi interaksi lempung-cerucuk sekiranya nilai gelas hujung dari (a) dianggap tepat. Berikan sedikit komen tentang nilai rekatan yang baru ini dan bagaimana ianya berbeza dengan nilai-nilai yang ditentukan di (a).

[10 marks/markah]

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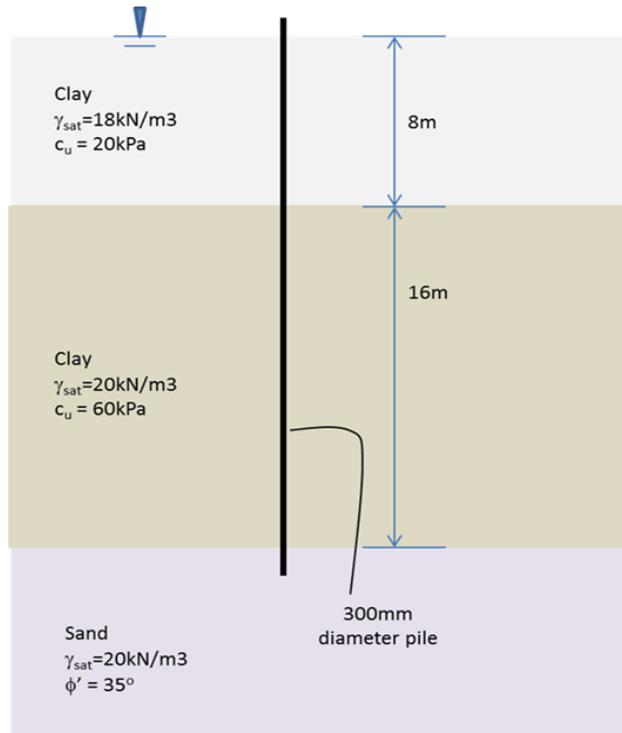


Figure 3/ Rajah 3

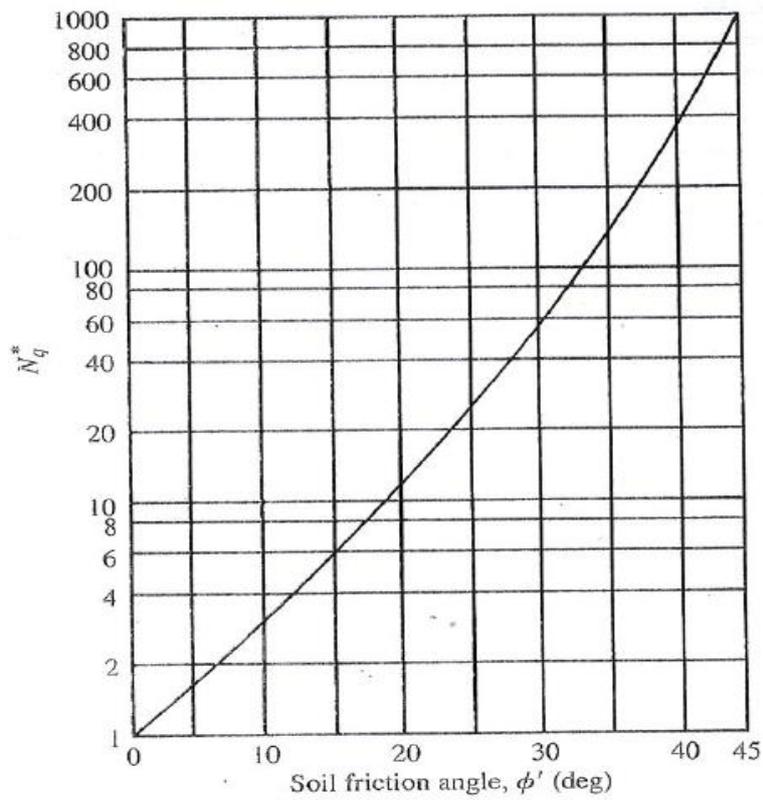


Figure 4/ Rajah 4

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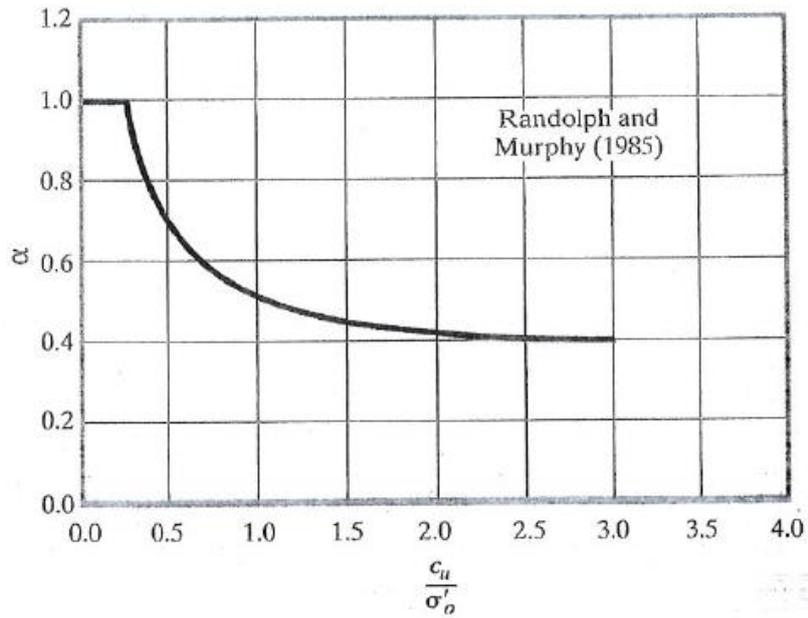


Figure 5/ Rajah 5

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