SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2025/2026

DCC30362: GEOTECHNICAL ENGINEERING

TARIKH : 03 DISEMBER 2025
MASA : 2.30 – 4.30 PETANG (2 JAM)

Kertas soalan ini mengandungi **SEPULUH (10)** halaman bercetak.

Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Formula & Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Site Investigation (SI) involves thorough investigation into the process of the geological and soil condition below the surface. Explain **TWO (2)** types of in-situ soil testing.

*Penyiasatan Tapak adalah proses penyiasatan menyeluruh tentang keadaan geologi dan tanah di bawah permukaan bumi. Jelaskan **DUA (2)** jenis ujian tanah di tapak.*

[5 marks]

[*5 markah*]

CLO1 (b) Site Investigation (SI) needs to be resolved before the design stage of project implementation. The SI planning depends on the type of structure that is being proposed for the site. Explain **FIVE (5)** stages involved in SI.

*Penyiasatan Tapak perlu diselesaikan sebelum peringkat reka bentuk projek dilaksanakan. Perancangan Penyiasatan Tapak bergantung kepada jenis struktur yang dicadangkan untuk sesebuah tapak bina. Terangkan **LIMA (5)** peringkat yang terlibat dalam Penyiasatan Tapak.*

[10 marks]

[*10 markah*]

CLO1 (c) A 10.5 m gravity wall is constructed to support a layer of sand. Calculate the resultant active thrust for the gravity wall given in Figure 1(c).

Sebuah tembok graviti yang mempunyai ketinggian 10.5 m dibina untuk menyokong lapisan pasir. Kirakan tujahan aktif yang dihasilkan bagi tembok graviti yang diberikan dalam Rajah 1(c).

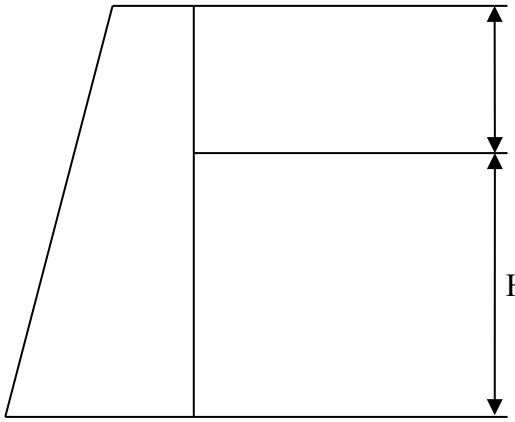


Figure 1(c) / *Rajah 1(c)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Figure 2(a) shows cross-section of a line of sheet-piling driven to a depth of 9.0 m into stratum of homogeneous sandy soil which has a thickness of 12.0 m and is underlain by impermeable layer. Sketch a flow net for seepage condition.

Rajah 2(a) menunjukkan keratan rentas bagi sebaris cerucuk keping yang dipacu pada kedalaman 9.0 m ke dalam lapisan tanah berpasir homogen yang mempunyai ketebalan 12.0 m dan terdapat lapisan tidak telap di bawahnya. Lakarkan jaringan aliran bagi keadaan resipan.

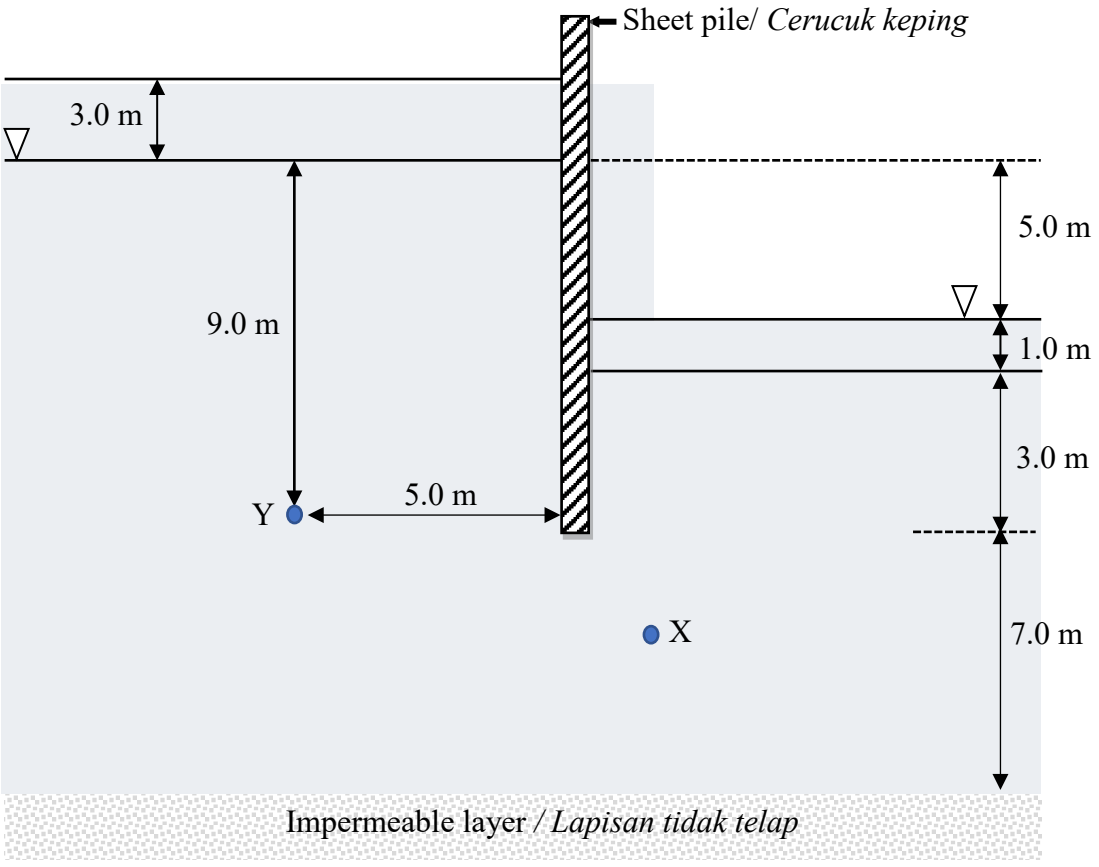


Figure 2(a) / *Rajah 2(a)*

[8 marks]

[*8 markah*]

CLO1 (b) Based on the answer (a), determine quantity of seepage, Q in m^3/hour/m length. Given coefficient of permeability, k = 7.2 x 10^{-3} mm/s.

Berdasarkan jawapan (a), tentukan kadar alir resipan, Q dalam unit m^3/jam/m panjang. Diberi pekali kebolehtelapan, k = 7.2 x 10^{-3} mm/s.

[8 marks]

[*8 markah*]

CLO1 (c) Figure 2(c) shows the cross-section of a proposed cutting in a homogenous clay soil having an undrained shear strength of 35.0 kN/m^2 and bulk unit weight of 19.0 kN/m^2. Analyze the factor of safety against shear failure along slip AB surface by ignoring the possibility of tension crack.

Rajah 2(c) menunjukkan keratan rentas bagi cerun yang dicadangkan mempunyai kekuatan ricih tak tersalir 35.0 kN/m^2 dan ketumpatan pukal 19.0 kN/m^2. Analisis faktor keselamatan terhadap kegagalan ricih pada permukaan AB dengan mengabaikan retak tegangan berlaku.

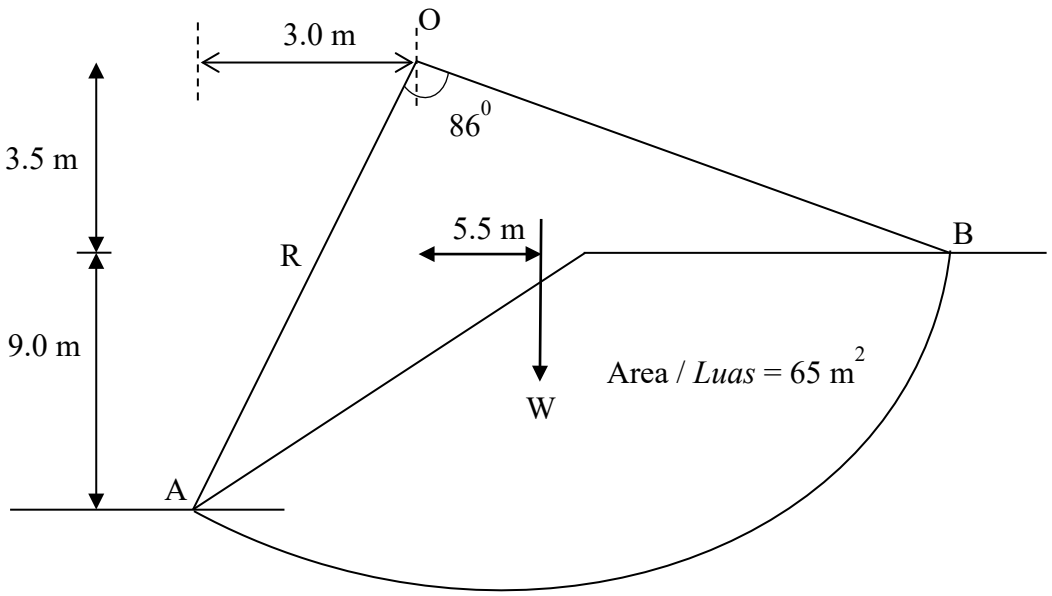


Figure 2(c) / *Rajah 2(c)*

[9 marks]

[*9 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Slope failure is also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational forces. Explain **FOUR (4)** causes of slope failure.

*Kegagalan cerun juga dirujuk sebagai pembaziran jisim, ialah pergerakan menuruni cerun yang melibatkan serpihan batuan dan tanah akibat tindakan daya graviti. Terangkan **EMPAT (4)** punca berlakunya kegagalan cerun.*

[8 marks]

[*8 markah*]

CLO1 (b) Determine the stability of the slope as shown in Figure 3(b) using the Fellenius slices based on data in Table 3(b).

Tentukan kestabilan cerun yang ditunjukkan dalam Rajah 3(b) menggunakan Kaedah Hirisan Fellenius berdasarkan data di dalam Jadual 3(b).

Table 3(b) / *Jadual 3(b)*

Slices / *Hirisan*	α^0	Z (m)	b (m)
1	-10	1.3	3
2	0	3.0	2
3	10	4.0	2
4	19	4.7	2
5	30	4.9	2
6	50	3.0	3.9

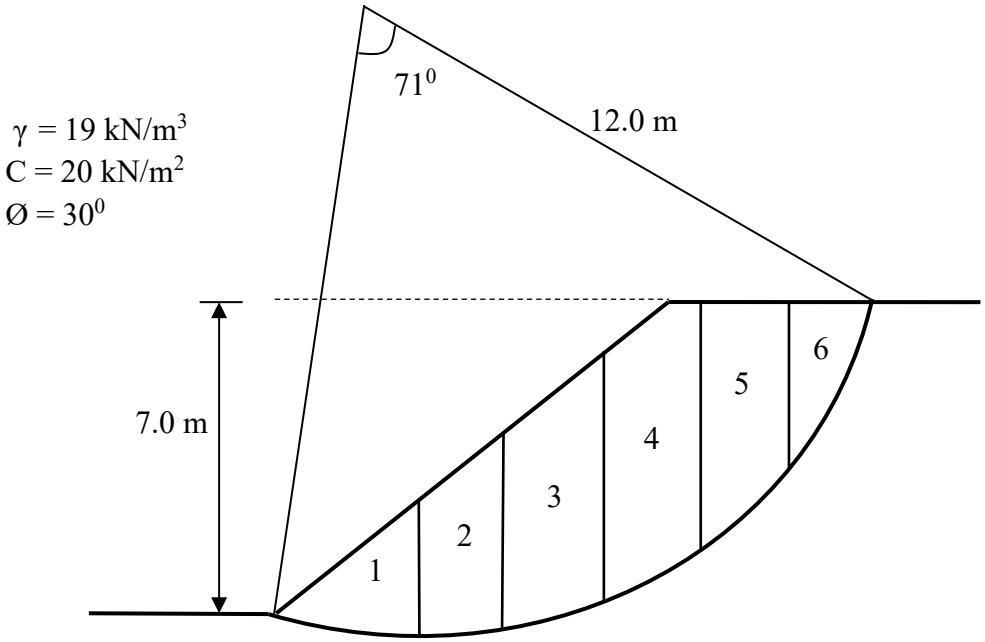


Figure 3(b) / *Rajah 3(b)*

[11 marks]

[*11 markah*]

CLO1

(c) A retaining wall that has a soft, saturated clay backfill shown in Figure 3(c). Calculate the resultant active thrust after the tensile crack occurs for the undrained condition ($\theta = 0$) of the backfill. Given the maximum depth of the tensile crack is 1.94 m.

Sebuah tembok penahan dengan timbunan tanah liat lembut tepu ditunjukkan di dalam Rajah 3(c). Kirakan daya tujah aktif selepas berlakunya retak tegangan dengan mengambil kira keadaan tidak bersalir ($\theta = 0$). Diberi kedalaman retak tegangan maksimum adalah 1.94 m.

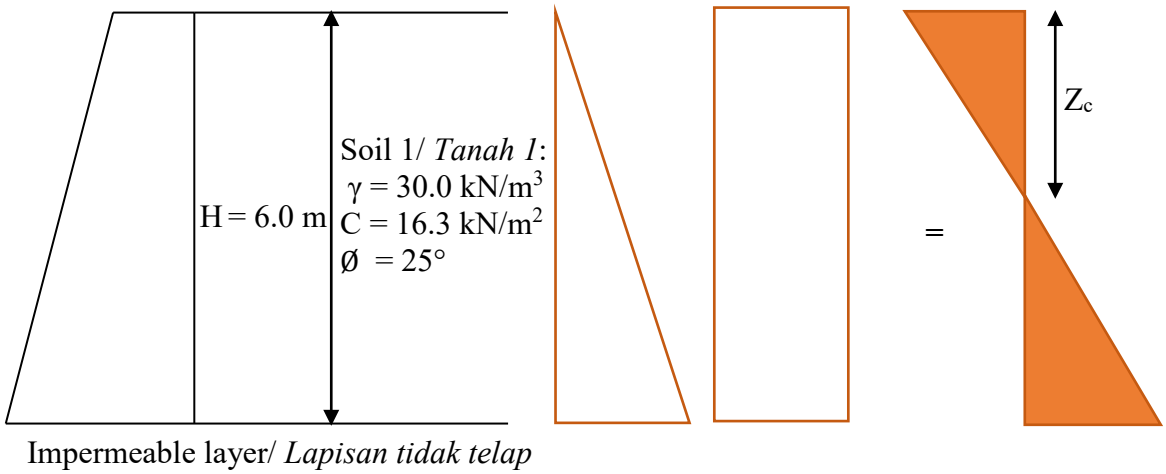


Figure 3(c) / *Rajah 3(c)*

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Rankine (1857) developed a theory to calculate the lateral active and passive pressure. Identify **FOUR (4)** assumptions from Rankine Theory.

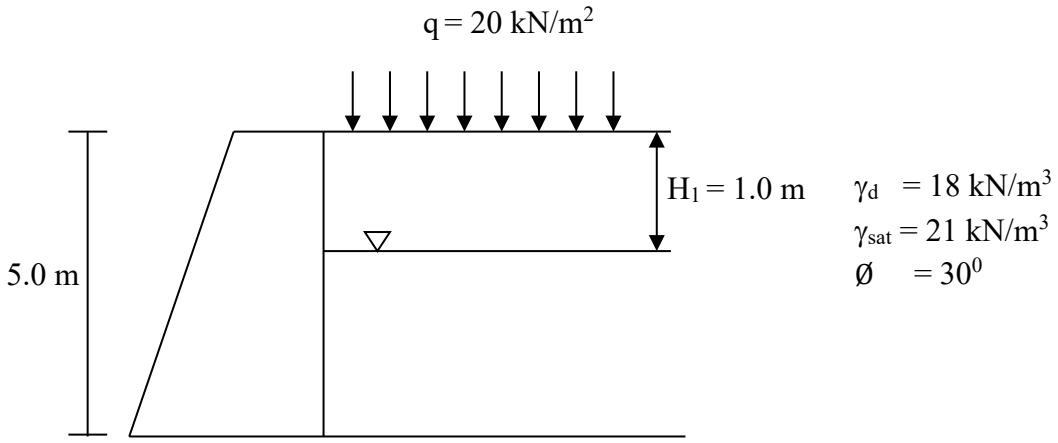
*Rankine (1875) telah membangunkan teori untuk mengira tekanan aktif dan pasif sisi tanah. Kenal pasti **EMPAT (4)** andaian daripada Teori Rankine.*

[8 marks]

[*8 markah*]

CLO1 (b) A retaining wall that has a smooth vertical back of height of 5.0 m retains granular soil as shown in Figure 4(b). An extensive uniform surcharge of 20 kN/m^2 is placed on the surface. The water table is 1.0 m below the soil surface. Determine the magnitude and position of the resultant active thrust.

Tembok penahan yang mempunyai permukaan tanah mendatar yang licin pada kedalaman 5.0 m menahan tanah berbutir seperti ditunjukkan dalam Rajah 4(b). Beban tambahan dengan keamatan 20 kN/m^2 dikenakan ke atas tanah tersebut. Paras air bumi berada 1.0 m di bawah permukaan tanah. Tentukan magnitud dan daya tujah aktif yang bertindak di belakang tembok.



Impermeable layer / *Lapisan tidak telap*

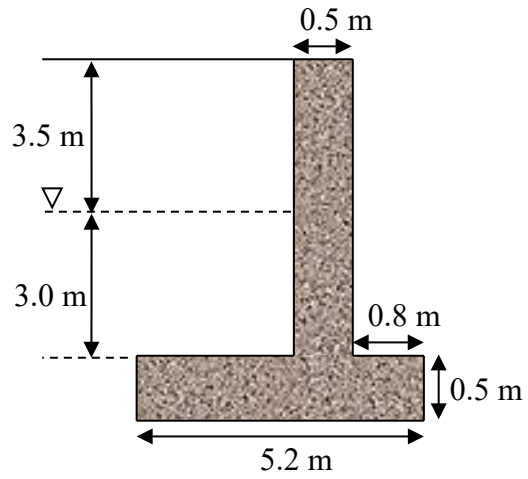
Figure 4(b) / *Rajah 4(b)*

[11 marks]

[*11 markah*]

CLO1 (c) Analyze the safety factor of the maximum bearing capacity for the cantilever retaining wall as shown in Figure 4(c).

Analisis faktor keselamatan terhadap keupayaan galas maksimum bagi dinding penahan julur seperti ditunjukkan dalam Rajah 4(c).



Given / *Diberi*:
Soil bearing capacity / *Keupayaan galas tanah* = 215 kN/m^2
Eccentricity / *Kesipian* = 0.83
$\gamma_{concrete}$ = 24 kN/m^3
μ = 0.70
γ = 19 kN/m^3
γ_{sat} = 15.7 kN/m^3
Ø = 20^0

Figure 4(c) / *Rajah 4(c)*

[6 marks]

[*6 markah*]

SOALAN TAMAT

LAMPIRAN FORMULA DCC30362 : GEOTECHNICAL ENGINEERING

$Q = kh\frac{Nf}{Ne}$	$FOS = \frac{CR^2\ \theta}{Wd}$	$\sigma_a = k_a \gamma z$
$hx = \frac{ne}{Ne}H$	$FOS = \frac{\sum CL' + W\cos\alpha\tan\theta}{\sum W\sin\alpha}$	$\sigma_v = \sigma'_v + u$
$U_x = \gamma_w [\ h_x - (\ z_x)\ ]$	$K_a = \frac{1-sin\,\emptyset}{1+sin\,\emptyset}$	$\sigma_a = 2C\sqrt{Ka}$
$i = \frac{\Delta h}{\Delta s}$	$K_p = \frac{1+sin\,\emptyset}{1-sin\,\emptyset}$	$Zc = \frac{2c}{\gamma}\sqrt{\frac{1}{Ka}}$
$\mu = \gamma_w h$	$Pv_{mak} = \frac{Q_V}{B}\left(1+\frac{6e}{B}\right)$	$Fos(sliding) = \frac{Q_V \mu}{Q_H}$
$Fos(overturning) = \frac{\mu R}{\mu T} = \frac{Qv \times X`}{Q_H \times y}$	$Fos(BC) = \frac{\text{Bearing Capacity}}{\text{Pv max}}$	$X` = B - \overline{X}$