

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 II : 2025/2026

DCC30093 : GEOTECHNICAL ENGINEERING

TARIKH : 08 MEI 2026

MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.

Bahagian A: Subjektif (2 soalan)

Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 50 MARKS**BAHAGIAN A : 50 MARKAH****INSTRUCTION:**

This section consists of **TWO (2)** subjective questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan subjektif. Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

- | | |
|------|---|
| CLO1 | (a) Briefly explain the process of soil formation.
<i>Terangkan secara ringkas proses pembentukan tanah.</i>
<div style="text-align: right; margin-top: 10px;">[4 marks]
[4 markah]</div> |
| CLO1 | (b) Rock formation is usually the result of weathering, compaction, crystallization, adhesion and erosion sculpting the existing rock. Illustrate the process of rock formation in the form of the rocks cycle.
<i>Pembentukan batuan biasanya hasil daripada luluhawa, pemadatan, penghabluran, pelekatan dan hakisan. Gambarkan proses pembentukan batuan dalam bentuk kitaran batuan.</i>
<div style="text-align: right; margin-top: 10px;">[9 marks]
[9 markah]</div> |

- CLO1 (c) In geotechnical site investigation, the hand auger method is commonly used to determine subsurface soil conditions. This method involves collecting two types of soil samples, namely disturbed and undisturbed. Determine **TWO (2)** differences between disturbed and undisturbed soil samples obtained from construction sites.
- Dalam penyiasatan tapak geoteknik, kaedah auger tangan lazim digunakan untuk mengenal pasti keadaan tanah di bawah permukaan. Kaedah ini melibatkan pengambilan dua jenis sampel tanah, iaitu terganggu dan tidak terganggu. Tentukan **DUA (2)** perbezaan antara sampel tanah terganggu dan tidak terganggu yang diperolehi dari tapak pembinaan.*

[12 marks]

[12 markah]

QUESTION 2**SOALAN 2**

- CLO1 (a) Identify **FOUR (4)** properties of soil resulting from the combination of minerals which is particles, organic matter, water and air
Kenal pasti EMPAT (4) sifat tanah yang terhasil dari gabungan zarah mineral, bahan organik, air dan udara.
[4 marks]
[4 markah]
- CLO1 (b) Soil cohesion refers to the bonding between solid soil particles that tend to remain together without the application of any external force. When a load is applied to the soil, interparticle friction occurs, and this friction gives rise to an angle of internal friction. Illustrate the following **THREE (3)** soil strength characteristics: non-cohesive soil, cohesive soil and sandy clay silt soil.
Kejelekitan tanah merujuk kepada ikatan antara butiran pepejal tanah yang membolehkan ia kekal bersatu tanpa dikenakan sebarang daya luar. Apabila beban dikenakan ke atas tanah, geseran antara butiran akan berlaku dan menghasilkan sudut geseran dalaman. Lakarkan TIGA (3) ciri kekuatan tanah berikut: tanah tidak jelek, tanah jelek, dan tanah liat berpasir–kelodak.
[9 marks]
[9 markah]
- CLO1 (c) Sketch **TWO (2)** soil shear failure modes with a brief explanation.
Lakarkan DUA (2) jenis mod kegagalan ricih tanah dengan penerangan ringkas.
[12 marks]
[12 markah]

SECTION B : 50 MARKS**BAHAGIAN B : 50 MARKAH****INSTRUCTION:**

This section consists of **FOUR (4)** subjective questions. Answer **TWO (2)** questions only.

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan subjektif. Jawab DUA (2) soalan sahaja.

QUESTION 1**SOALAN 1**

CLO2

- (a) A sample of soil was taken from below the groundwater table. The moisture contents of soil were determined to be 23% while the dry unit weight was 16.19 kN/m^3 . Determine the specific gravity, void ratio and porosity.

Satu sampel tanah telah diambil dari bawah paras air bawah tanah. Kandungan lembapan tanah tersebut ditentukan sebanyak 23% manakala berat unit kering ialah 16.19 kN/m^3 . Tentukan graviti tentu, nisbah lompang dan keliangan.

[10 marks]

[10 markah]

CLO2

- (b) A standard proctor compaction test is conducted on the soil sample. A result is shown in Table B1(b). Based on the data, calculate maximum dry density and optimum moisture content from the graph of dry unit weight against moisture content.

Satu ujikaji pepadatan proktor piawai telah dijalankan ke atas satu sampel tanah. Keputusan ujikaji ditunjukkan pada Jadual B1(b). Berdasarkan kepada data tersebut, kirakan ketumpatan kering maksimum dan kandungan lembapan optimum daripada graf ketumpatan kering melawan kandungan lembapan.

Table B1(b) / Jadual B1(b)

Moisture Content (%) / Kandungan Lembapan (%)	10	13	16.5	20	24.4	29
Bulk Unit Weight, γ_b (kN/m ³) / Berat Unit Pukul, γ_b (kN/m ³)	16.5	17.8	19.90	19.8	18.50	18

[15 marks]

[15 markah]

QUESTION 2**SOALAN 2**

CLO2

- (a) A direct shear test was performed on dry and sandy soil. The size of specimen was 50 mm x 50 mm x 20 mm. Test results were given in Table B2(a). Determine the parameters of shear strength for all of the soil samples.

Satu ujian ricih terus dijalankan ke atas sampel tanah kering dan berpasir. Saiz spesimen adalah 50 mm x 50 mm x 20 mm. Keputusan seperti ditunjukkan dalam Jadual B2(a). Tentukan parameter-parameter kekuatan ricih sampel - sampel tanah tersebut.

Table B2(a) / Jadual B2(a)

Samples / Sampel	S1	S2	S3	S4
Normal force, (kN) / <i>Daya normal (kN),</i>	0.09	0.135	0.315	0.450
Shear stress at failure, t_f (kN/m ²) / <i>Tegasan ricih semasa gagal, t_f (kN/m²)</i>	21.6	32.9	75.8	108.2

[10 marks]

[10 markah]

CLO2

- (b) The results of the Three Axial Flow Series Test for soil sample are shown in Table B2(b). Calculate the value of c and ϕ for the soil.

Keputusan Ujian Tiga Paksi untuk sampel tanah adalah seperti Jadual B2(b).

Kirakan nilai c' dan ϕ' untuk tanah tersebut.

Table B2(b) / Jadual B2(b)

Samples / Sampel	A	B	C
Minor normal stress, σ_3 (kN/m ²) / <i>Tegasan normal minor, σ_3 (kN/m²)</i>	150	300	450
Deviator stress, $\sigma_1 - \sigma_3$ (kN/m ²) / <i>Tegasan sisih, $\sigma_1 - \sigma_3$ (kN/m²)</i>	192	341	504
Pore water pressure, u (kN/m ²) / <i>Tekanan air liang, u (kN/m²)</i>	80	154	222

[15 marks]

[15 markah]

QUESTION 3

SOALAN 3

CLO2

- (a) A soil profile is shown in Figure B3(a). Calculate the total stress, pore water pressure and effective stress for each soil layer.

Profil tanah ditunjukkan dalam Rajah B3(a). Kirakan jumlah tegasan, tekanan air liang dan tegasan berkesan bagi setiap lapisan tanah tersebut.

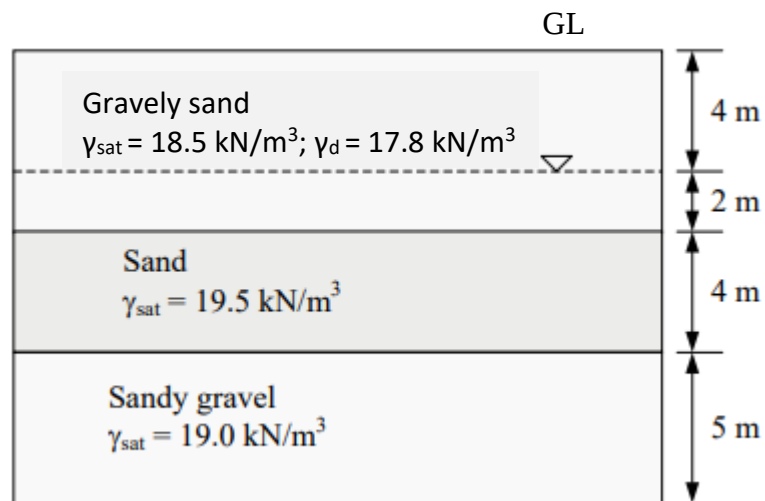


Figure B3(a)/ Rajah B3(a)

[10 marks]

[10 markah]

- CLO2 (b) Figure B3(b) shows a 8 m high retaining wall. By using the Rankine theory, Calculate the magnitude and position of active thrust that acts behind the wall. *Rajah B3(b) menunjukkan dinding penahan setinggi 8 m. Dengan menggunakan teori Rankine, kirakan magnitud dan kedudukan daya aktif yang bertindak di belakang dinding.*

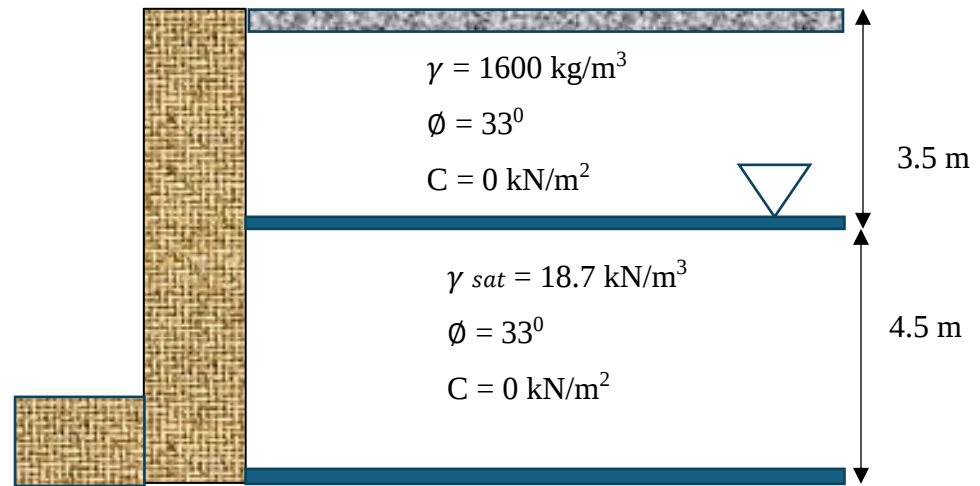


Figure B3(b)/Rajah B3(b)

[15 marks]

[15 markah]

QUESTION 4

SOALAN 4

- CLO2 (a) A concrete dam has base length of 11 m and retains 5 m of water as shown on Figure B4(a). The water level on the downstream side as 1 m above the ground surface. Beneath the dam, there is a 9.5 m thick layer isotropic permeable soil layer with the k values as shown on figure. Calculate the flow rate under the concrete dam Q , in $\text{m}^3/\text{day}/\text{m}$ length.

Sebuah empangan konkrit mempunyai panjang tapak 11 m dan menyimpan 5 m air seperti yang ditunjukkan pada Rajah B4(a). Paras air di bahagian hilir setinggi 1 m di atas permukaan tanah. Di bawah empangan terdapat lapisan tanah telap isotropik setebal 9.5 m dengan nilai k seperti yang ditunjukkan pada rajah. Kirakan kadar alir di bawah empangan konkrit Q , dalam $\text{m}^3/\text{hari}/\text{m}$ panjang.

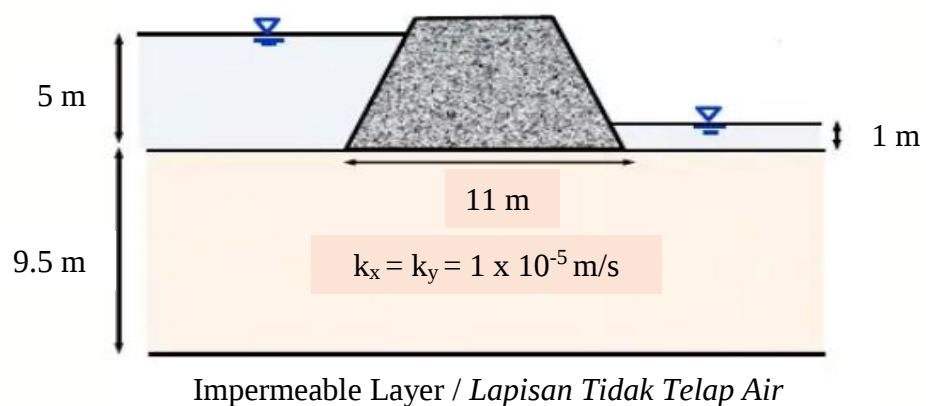


Figure B4(a)/ Rajah B4(a)

[10 marks]

[10 markah]

- CLO2 (b) Table B4(b), shows some data obtained from the slope stability analysis. Given: $\gamma = 1850 \text{ kg/m}^3$, $c = 6.8 \text{ kN/m}^2$ and $\theta = 18^\circ$. Analyze the factor of safety against slip failure for the slope.

Jadual B4(b) menunjukkan sabahagian data yang diperolehi hasil daripada analisis kestabilan cerun. Diberi nilai untuk ; $\gamma = 1850 \text{ kg/m}^3$, $c = 6.8 \text{ kN/m}^2$ and $\theta = 18^\circ$. Analisis faktor keselamatan cerun tersebut.

Table B4(b)/ Jadual B4(b)

Slices / Hirisan	α	Z (m)	b (m)
1	-25	1.8	3
2	8.5	3.7	3
3	11	4.6	3
4	30	5.2	3
5	52	2.5	3

[15 marks]

[15 markah]

SOALAN TAMAT

LIST OF FORMULAS
DCC30093 GEOTECHNICAL ENGINEERING

$$Q = k H \frac{N_f}{N_e}$$

$$I = \frac{\Delta h}{\Delta s}$$

$$u_x = u_w \left(\frac{N_x}{N_e} \cdot \Delta H - (-Z_x) \right)$$

$$K_a = \frac{1 - \sin \phi}{1 + \sin \phi}$$

$$K_p = \frac{1 + \sin \phi}{1 - \sin \phi}$$

$$\rho_b = \frac{M_T}{V_T}$$

$$PI = LL - PL$$

$$LI = \frac{w - PL}{PI}$$

$$Z_c = \frac{2C}{\gamma} \sqrt{\frac{1}{Ka}}$$

$$\sigma_a = ka [\gamma Z + q] + 2C\sqrt{Ka}$$

$$Z_c = \frac{2C}{\gamma} \sqrt{\frac{1}{Ka}}$$

Correction Table $\frac{\Delta a}{a + \Delta a}$ Earth Dam (Non Filter)

$$FOS = \frac{CR^2\theta}{Wd}$$

$$FOS = \frac{C_A R^2 \theta_A + C_B R^2 \theta_B}{Wd}$$

$$p = \frac{Rv}{B} \left(1 \pm \frac{6e}{B} \right)$$

$$FOS = \frac{Rv \tan \delta}{RH}$$

$$e = B/2 - \bar{X}$$

$$FOS = \frac{\mu R}{\mu T}$$

$$Q = kH \frac{N_f}{N_e}$$

$$u_x = \gamma_w [h_x - (-Z_x)]$$

$$FOS = \frac{Cu}{N\gamma Z}$$

$$FOS = \frac{\sum CL' + w \cos \alpha \tan \phi}{\sum w \sin \alpha}$$

$$FOS = \frac{\sum CL' (W \cos \alpha - \mu L')}{\sum W \sin \alpha}$$

$$FOS = \frac{CR^2\theta'}{Wd + PwYc}$$

$$G_s = \frac{M_s}{V_s \rho_w}$$

$$\rho_d = \frac{\rho_b}{1 + w}$$

$$e = \frac{n}{1 - n}$$