

**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**

**DCC30093 : GEOTECHNICAL ENGINEERING**

**TARIKH : 08 DISEMBER 2025**

**MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)**

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

Bahagian A: Subjektif (2 soalan)

Bahagian B: Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf & Formula

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**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) Describe the soil mechanics in general.  
*Huraikan mekanik tanah secara umum.*
- [4 marks]  
[4 markah]
- CLO1 (b) Explain clearly about organic topsoil, residual soil dan transported soil.  
*Terangkan dengan jelas mengenai tanah organik, tanah baki dan tanah terangkut.*
- [9 marks]  
[9 markah]
- CLO1 (c) Site Investigation is an important part of any construction project. Explain **FOUR (4)** objectives of site investigation.  
*Penyiasatan tapak merupakan bahagian penting dalam mana-mana projek pembinaan. Terangkan **EMPAT (4)** objektif penyiasatan tapak.*
- [12 marks]  
[12 markah]

**QUESTION 2****SOALAN 2**

- CLO1 (a) Soil compaction must be done according to good engineering practices. Describe **FOUR (4)** main purposes of soil compaction.  
*Pemadatan tanah mesti dilakukan mengikut amalan kejuruteraan yang baik. Huraikan **EMPAT (4)** tujuan utama pemadatan tanah.*
- [4 marks]  
[4 markah]
- CLO1 (b) Explain **TWO (2)** parameters of soil shear strength.  
*Terangkan **DUA (2)** parameter kekuatan ricih tanah.*
- [9 marks]  
[9 markah]
- CLO1 (c) A well design foundation transfers building loads safely into the soil while preventing settlement, cracks or collapse. Explain **FOUR (4)** factors affecting the selection of foundation for a building.  
*Asas yang direkabentuk dengan baik dapat memindahkan beban bangunan dengan selamat ke dalam tanah serta mengelakkan berlakunya pemendapan, retakan atau runtuhan. Terangkan **EMPAT (4)** faktor yang mempengaruhi pemilihan jenis asas bagi sesuatu bangunan.*
- [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) sahaja.*

**QUESTION 1*****SOALAN 1***

CLO2

- (a) A sample of undisturbed soil has a mass of 0.178 kg. The total volume of the soil sample is  $8.552 \times 10^{-5} \text{ m}^3$ . After dried in oven for 24 hours, the mass is 0.154 kg. Calculate the moisture content ( $w$ ), bulk unit weight ( $\gamma_b$ ) and dry unit weight ( $\gamma_d$ ) for the soil sample.

*Satu sampel tanah tidak terganggu mempunyai berat 0.178 kg. Isipadu tanah tersebut adalah  $8.552 \times 10^{-5} \text{ m}^3$ . Selepas dikeringkan di dalam oven selama 24 jam, beratnya ialah 0.154 kg. Kirakan kandungan lembapan ( $w$ ), berat unit pukal ( $\gamma_b$ ) dan berat unit kering ( $\gamma_d$ ) bagi sampel tanah tersebut.*

[10 marks]

[10 markah]

- CLO2 (b) A data of a standard proctor compaction test conducted on a soil sample is shown in Table B1(b). With the aid of suitable graph, specify the maximum dry density and the optimum moisture content of the soil.

*Data dari ujikaji standard piawai yang dijalankan keatas satu sampel tanah ditunjukkan di dalam Jadual B1(b). Dengan bantuan graf yang sesuai, nyatakan nilai ketumpatan kering maksima dan kelembapan optimum tanah tersebut.*

Table B1 (b) / *Jadual B1(b)*

Bulk density <i>Ketumpatan Pukul</i> (kg/m <sup>3</sup> )	1980	2329	2400	2304	2100
Moisture Content <i>Kandungan Lembapan</i> (%)	10	13	15	17	19

[15 marks]

[15 markah]

**QUESTION 2****SOALAN 2**

- CLO2 (a) A shear box test was conducted on a soil sample. Determine the shear strength parameter of the soil sample based on data in Table B2(a):

*Satu ujian kotak ricih telah dijalankan ke atas satu sample tanah. Tentukan parameter kekuatan ricih sampel tanah tersebut berdasarkan data di dalam Jadual B2(a):*

Table B2(a) / *Jadual B2(a)*

Sample Number <i>Nombor Sampel</i>	Normal Stress <i>Tekanan Normal</i> (kN/m <sup>2</sup> )	Shear Stress <i>Tekanan Ricih</i> (kN/m <sup>2</sup> )
1	100	82
2	270	160
3	387	216
4	520	280

[10 marks]

[10 markah]

- CLO2 (b) An undrained triaxial test was conducted on a clay soil sample. The result is shown in Table B2(b). Specify shear strength parameters  $c'$  and  $\phi'$ .

*Satu ujian tiga paksi tidak bersalir telah dijalankan ke atas sampel tanah liat. Keputusannya ditunjukkan dalam Jadual B2(b). Nyatakan parameter kekuatan ricih  $c'$  and  $\phi'$ .*

Table B2(b) / *Jadual B2(b)*

Cell Pressure (kN/m <sup>2</sup> ) <i>Tekanan Sel (kN/m<sup>2</sup>)</i>	100	200	300
Stress Difference at Failure (kN/m <sup>2</sup> ) <i>Perbezaan Tegasan semasa Gagal (kN/m<sup>2</sup>)</i>	170	260	360
Pore Water Pressure (kN/m <sup>2</sup> ) <i>Tekanan Air Liang (kN/m<sup>2</sup>)</i>	15	40	80

[15 marks]

[15 markah]

## QUESTION 3

## SOALAN 3

CLO2

- (a) A soil profile with a depth and unit weight is shown in Figure B3(a). Sketch the diagram of stress distribution based on vertical stress, pore water pressure and effective stress at the depth of 8 m.

*Satu profil tanah dengan kedalaman dan berat unit ditunjukkan dalam Rajah B3(a). Lakarkan gambar rajah agihan tegasan berdasarkan tegasan, tekanan air liang dan tegasan berkesan tanah pada kedalaman 8 m.*

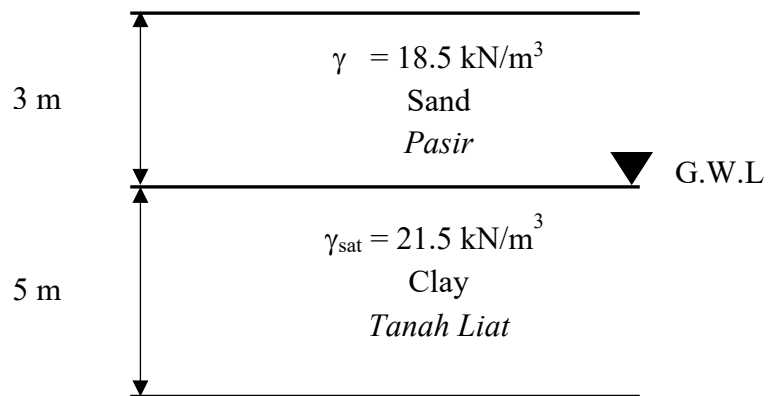


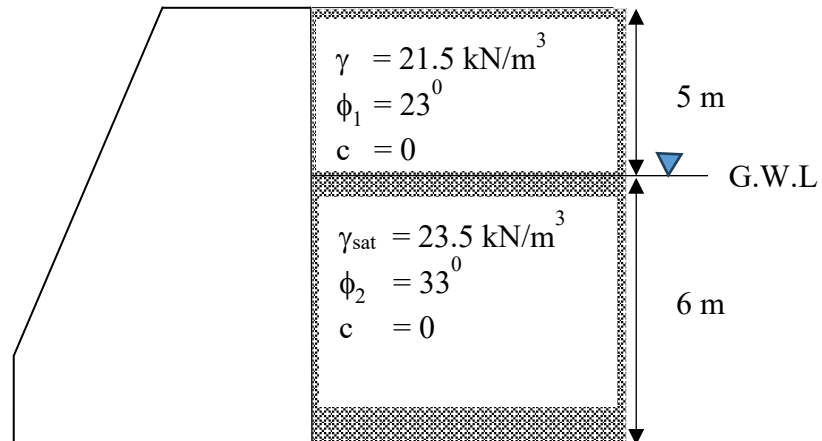
Figure B3(a) / Rajah B3(a)

[10 marks]

[10 markah]

CLO2

- (b) Figure B3(b) shows 11 m high retaining wall. Calculate the total resultant force pressure ( $\Sigma Pa$ ) at the depth of 11 m and the location of the resultant force ( $Y$ ).  
*Rajah B3(b) menunjukkan tembok penahan setinggi 11 m. Kirakan jumlah tekanan daya tujah ( $\Sigma Pa$ ) pada kedalaman 11 m dan lokasi daya tujah ( $Y$ ) tersebut.*

Figure B3(b) / *Rajah B3(b)*

[15 marks]

[15 markah]

## QUESTION 4

## SOALAN 4

CLO2

- (a) Figure B4(a) below shows a flow net of a concrete dam. Given the coefficient of permeability of the soil is  $2.4 \times 10^{-2}$  cm/s. Calculate the quantity of seepage,  $q$  in unit  $\text{m}^3/\text{hour}/\text{meter length}$  and the pore water pressure at point A.

*Rajah B4(a) di bawah menunjukkan jaringan aliran bagi empangan konkrit. Diberi pekali kebolehtelapan tanah ialah  $2.4 \times 10^{-2}$  cm/s. Kirakan kuantiti resipan,  $q$  dalam unit  $\text{m}^3/\text{jam}/\text{meter panjang}$  dan tekanan air liang di titik A.*

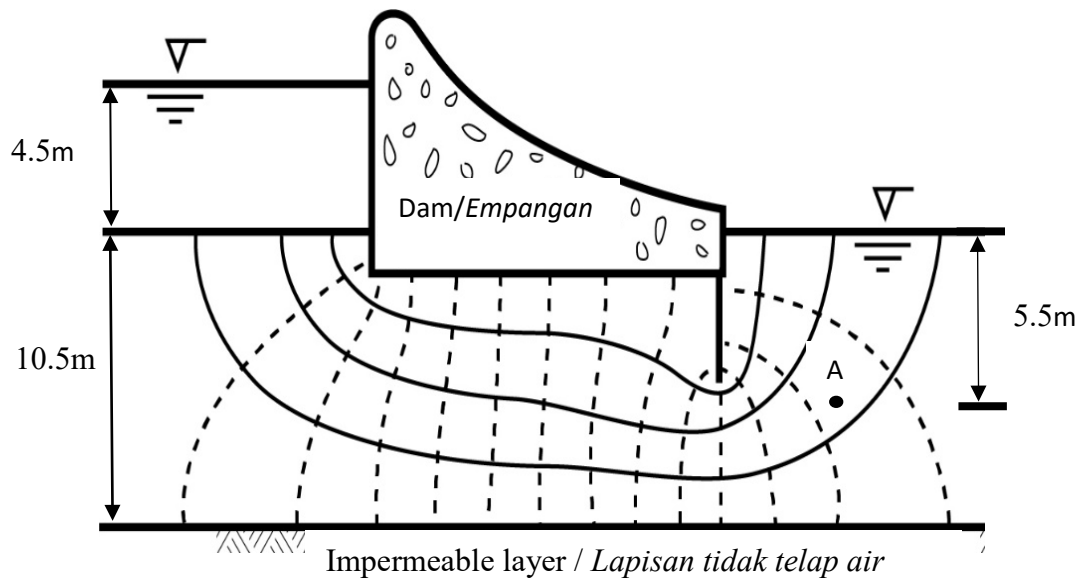


Figure B4(a) / Rajah B4(a)

[10 marks]

[10 markah]

CLO2

- (b) For the Figure B4(b) and Table B4(b), analyse the factor of safety for the slope by using Fellenius slices method.

*Untuk Rajah B4(b) dan Jadual B4(b), analisis faktor keselamatan cerun dengan menggunakan kaedah hirisan Fellenius.*

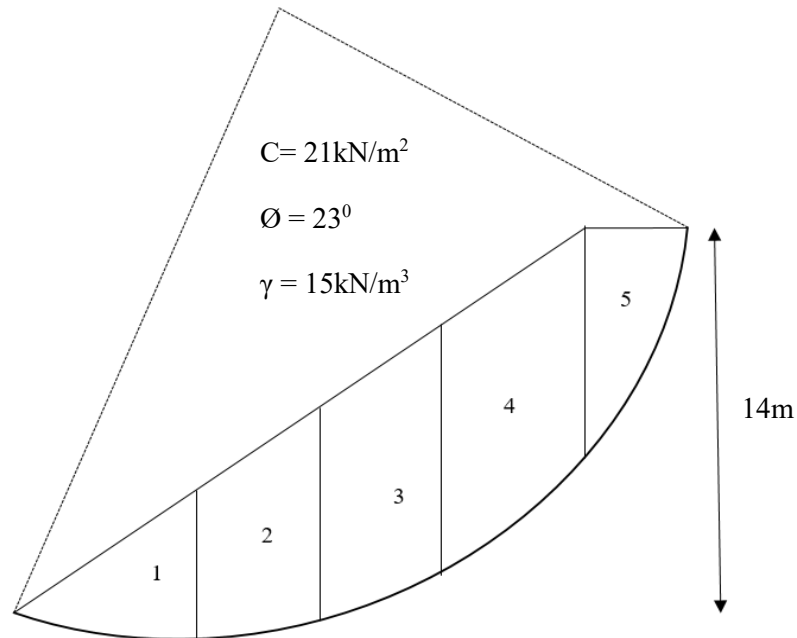


Figure B4(b) / *Rajah B4(b)*

Table B4(b) / *Jadual B4(b)*

Slices / <i>Hirisan</i>	b (m)	$\alpha^\circ$	z (m)
1	2.1	45	6.5
2	4.1	26	8.1
3	2.4	15	8.8
4	2.2	13	8.7
5	4.6	10	8.4

[15 marks]

[15 markah]

**SOALAN TAMAT**

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<b>FORMULA</b>
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$$G_s = \frac{M_s}{V_s \rho_w}$$

$$\rho_b = \frac{G_s \rho_w (1 + w)}{1 + e}$$

$$\rho_b = \frac{M_s (1 + w)}{V}$$

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

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

$$S = \frac{w G_s}{e}$$

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

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

$$PI = LL - PL$$

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

$$N_q = e^{\pi \tan \phi} \tan^2(45 + \phi / 2)$$

$$N_c = (N_q - 1) \cot \phi$$

$$N_\gamma = 2.0(N_q + 1) \tan \phi$$

$$q_u = C_u N_c + \gamma D N_q + 0.5 \gamma B N_\gamma$$

$$q_u = 1.3 C_u N_c + \gamma D N_q + 0.4 \gamma B N_\gamma$$

$$q_u = 1.3 C_u N_c + \gamma D N_q + 0.3 \gamma B N_\gamma$$

$$\sigma_v = \rho g h = \gamma h$$

$$u = \gamma_w h$$

$$\sigma_v = \sigma'_v + u$$

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

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

$$\sigma_a = k_a \gamma z$$

$$\sigma_a = 2C\sqrt{K_a}$$

$$P = \frac{R_v}{B} \left[ 1 \pm \frac{6e}{B} \right]$$

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

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

$$FOS = \frac{uR}{uT}$$

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<b>FORMULA</b>
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$$FOS = \frac{CR^2\theta}{Wd}$$

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

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

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

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

$$U_x = \gamma_w [h_x - (-z_x)]$$

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

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

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

$\alpha$	30	60	90	120	150	180
$\frac{\Delta a}{a + \Delta a}$	0.37	0.32	0.25	0.18	0.1	0

$$Z_c = \frac{2c}{\gamma} \sqrt{\frac{1}{K_a}}$$