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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DCC30093 : GEOTECHNICAL ENGINEERING

TARIKH   : 13 DISEMBER 2022
MASA   : 2.30 PM - 4.30 PM (2 JAM)

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

Bahagian A: Struktur (2 soalan)
Bahagian B: Esei (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS

BAHAGIAN A : 50 MARKAH

INSTRUCTION:

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

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C2

(a) Based on the original formation method, rocks can be divided into three basic types which is igneous, sedimentary and metamorphic. Explain any **TWO (2)** basic types of rocks mentioned.

*Berdasarkan kaedah pembentukan asal, batuan boleh dibahagikan kepada tiga jenis utama iaitu batuan igneus, bataun enapan dan batuan metamorfisis. Terangkan mana-mana **DUA (2)** daripada jenis-jenis utama batuan tersebut.*

[7 marks]

[*7 markah*]

CLO1
C2

(b) Explain clearly about residual soil, transported soil and organic soil.

Terangkan dengan jelas mengenai tanah baki, tanah terangkut dan tanah organik.

[8 marks]

[*8 markah*]

CLO1
C3

(c) Site investigation is an important component of any development project. Explain clearly **FIVE (5)** main purposes of site investigation.

*Kerja penyiasatan tapak merupakan komponen yang penting dalam sesuatu projek pembangunan. Terangkan dengan jelas **LIMA (5)** tujuan utama penyiasatan tapak dilakukan.*
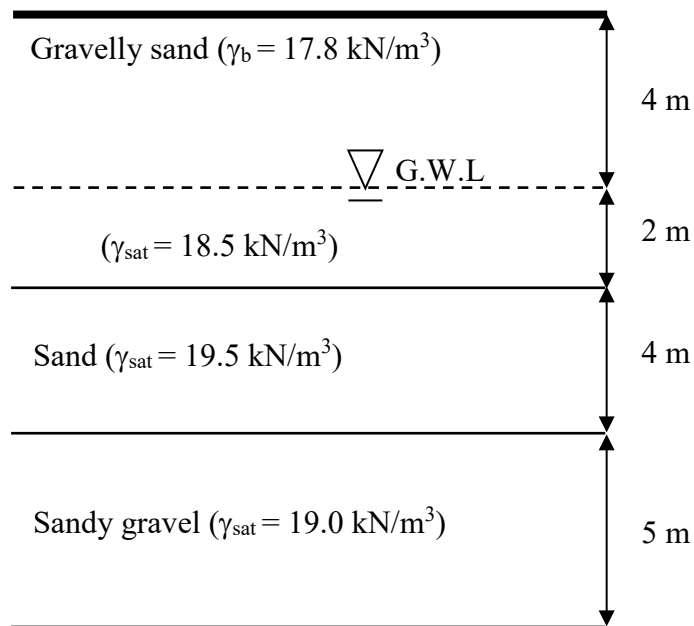
[10 marks]

[*10 markah*]

QUESTION 2
SOALAN 2

CLO2
C3

(a)   Illustrate the stress distribution diagram of normal stress, effective stress and pore water pressure with depth for the soil profile shown in **Figure A2(a)**.

*Lakarkan gambarajah taburan tegasan bagi tegasan normal, tegasan berkesan dan tekanan air liang bagi profail tanah dalam **Rajah A2(a)** di bawah.*

Gravelly sand ($\gamma_b = 17.8$ kN/m³)

4 m

▽ G.W.L

($\gamma_{sat} = 18.5$ kN/m³)

2 m

Sand ($\gamma_{sat} = 19.5$ kN/m³)

4 m

Sandy gravel ($\gamma_{sat} = 19.0$ kN/m³)
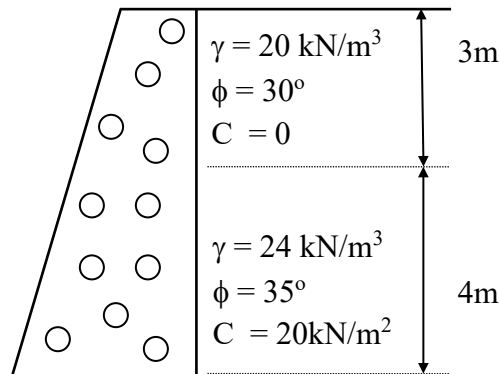
5 m

Figure A1(a) / *Rajah A1(a)*

[12 marks]

[*12 markah*]

CLO2
C4

(b) A retaining wall was built during the excavation as shown in **Figure A2(b)** to bear two soil layers behind it. Analyse the magnitude and location of soil active thrust acting on the rear wall using Rankine theory by excluding passive pressure in front of the retaining wall.

*Sebuah tembok penahan di bina semasa kerja pengorekan dijalankan seperti dalam **Rajah A2(b)** untuk menampung dua lapisan tanah di belakangnya. Analisis magnitud dan kedudukan tujah aktif tanah yang bertindak di belakang tembok menggunakan teori Rankine dengan mengabaikan tekanan pasif dihadapan tembok penahan tersebut.*

Layer 1: $\gamma = 20$ kN/m³, $\phi = 30°$, $C = 0$, depth 3m

Layer 2: $\gamma = 24$ kN/m³, $\phi = 35°$, $C = 20$ kN/m², depth 4m

Figure A2(b) / *Rajah A2(b)*

[13 marks]

[*13 markah*]

SECTION B : 50 MARKS

BAHAGIAN B : 50 MARKAH

INSTRUCTION:

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

ARAHAN :

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

QUESTION 1

SOALAN 1

CLO1
C3

(a)   The value of void ratio, moisture content and specific gravity for a soil sample are e = 0.75, w = 21.5% and Gs = 2.71 respectively. Calculate bulk unit weight (γ_b), dry unit weight (γ_d) and degree of saturation (Sr%).

Satu sampel tanah mempunyai nilai nisbah lompang, kandungan lembapan dan graviti tentu seperti berikut; e = 0.75, w = 21.5% and Gs = 2.71. Kirakan berat unit pukal (γ_b), berat unit kering (γ_d) dan darjah ketepuan (Sr%).

[10 marks]

[*10 markah*]

(b)   A standard proctor compaction is tested to the soil sample. The result is shown in **Table B1(b)** below:

*Ujikaji pemadatan proctor piawai telah dijalankan ke atas satu sampel tanah. Keputusan ujikaji ditunjukkan dalam **Jadual B1(b)** seperti di bawah:*

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

Bulk Density, *Ketumpatan pukal, ρb* (kg/m³)	1595	2122	2450	2010	1416
Moisture Content *Kandungan lembapan, m* (%)	10	12	14	16	18

CLO2
C3

    i.   Draw a curve of dry density versus moisture content.

        Lukiskan lengkung ketumpatan kering melawan kandungan lembapan.

[10 marks]

[10 *markah*]

CLO2
C4

    ii.   Evaluate the maximum dry density ($\rho_{d\,max}$) and optimum moisture content, ($w_{optimum}$) from the graph in (i).

        Nilaikan ketumpatan kering maksima ($\rho_{d\,maks}$) dan kandungan lembapan optimum (w_{optima}) daripada graf (i),

[5 marks]

[5 *markah*]

QUESTION 2
SOALAN 2

CLO1
C3

(a)   Identify the work procedure in site investigation.

        Kenal pasti prosedur kerja yang terlibat dalam penyiasatan tapak.

[10 marks]

[10 *markah*]

(b)   Consolidated, undrained triaxial tests was carried out on three samples. The failure test result is summarised as shown in **Table B2(b)**.

        Ujian ricih tiga paksi terkukuh tak tersalir telah dijalankan ke atas tiga sampel tanah. Hasil ujian pada masa sampel gagal adalah seperti di **Jadual B2(b)**.

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

Cell pressure (kN/m²) *Tegasan Sel (kN/m²)*	Principal stress difference at failure (kN/m²) *Tegasan normal semasa gagal (kN/m²)*	Pore water pressure at failure (kN/m²) *Tekanan air liang semasa gagal (kN/m²)*
150	192	80
300	341	154
450	504	222

CLO2
C3

i.   Draw the Mohr circles using graph paper and a suitable scale.

Lukiskan bulatan Mohr dengan menggunakan kertas graf dan skala yang sesuai,

[10 marks]

[*10 markah*]

CLO2
C4

ii.   Evaluate the shear strength parameters in term of soil effective stresses.

Nilaikan parameter kekuatan ricih tanah berdasarkan nilai tegasan berkesan tanah.

[5 marks]

[*5 markah*]

QUESTION 3
SOALAN 3

CLO1
C3

(a)   Explain clearly about the equipotential (N_e) and flow lines (N_f) in a flow net of a concrete dam with a help of a sketch.

Terangkan dengan jelas mengenai garis sama upaya (N_e) dan garis aliran (N_f) di dalam jaringan aliran bagi empangan konkrit menggunakan lakaran yang sesuai.

[10 marks]

[*10 markah*]

(b)   Based on the flow net sketch in **Figure B3(b)**:

*Berdasarkan lakaran jaringan aliran dalam **Rajah B3(b)**:*

CLO2
C3

i.   Calculate the quantity of seepage, Q in m^3/ hour/ m length. Given coefficient of permeability, k = 2.15 x 10^{-3} mm/s.

Kirakan kadar alir resapan, Q dalam m^3/ hour/ m panjang. Diberi pekali kebolehtelapan, k = 2.15 x 10^{-3} mm/s.

[10 marks]

[*10 markah*]

CLO2
C4

ii.   Calculate pore water pressure at point Y.

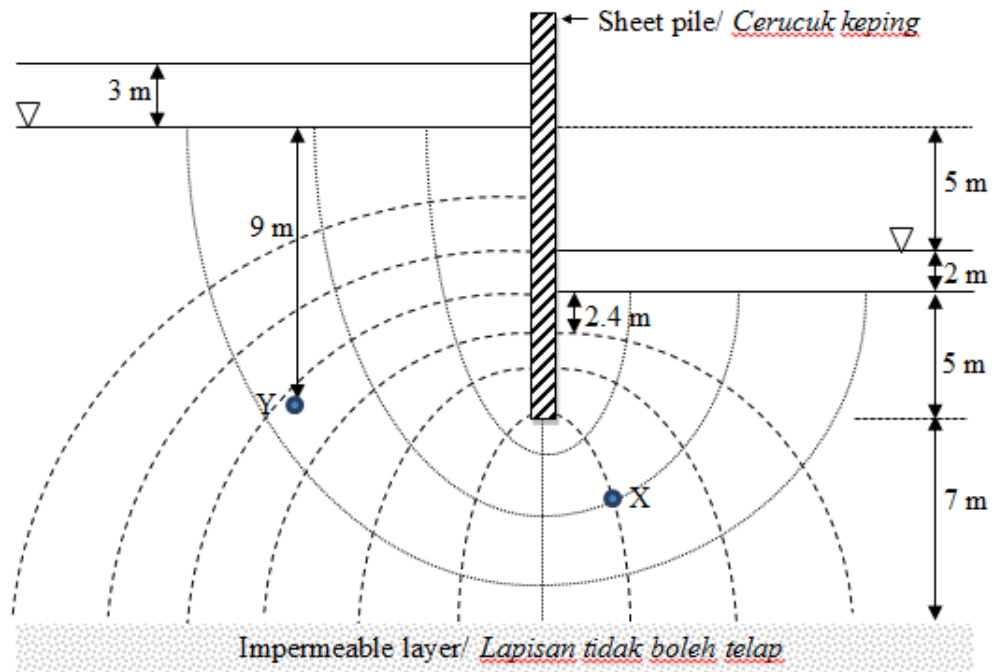*Kira tekanan air liang pada titik Y.*

[5 marks]

[5 markah]

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

QUESTION 4
SOALAN 4

CLO1
C3

(a)   Calculate the slope safety factor shown in **Figure B4(a)** using Total Stress Analysis method. Given $\gamma = 16$ kN/m³ and c = 24.6 kN/m².

*Kira faktor keselamatan cerun seperti yang ditunjukkan dalam **Rajah B4(a)** menggunakan kaedah Analisis Tegasan Jumlah. Diberi $\gamma = 16$ kN/m³ and c =24.6 kN/m².*
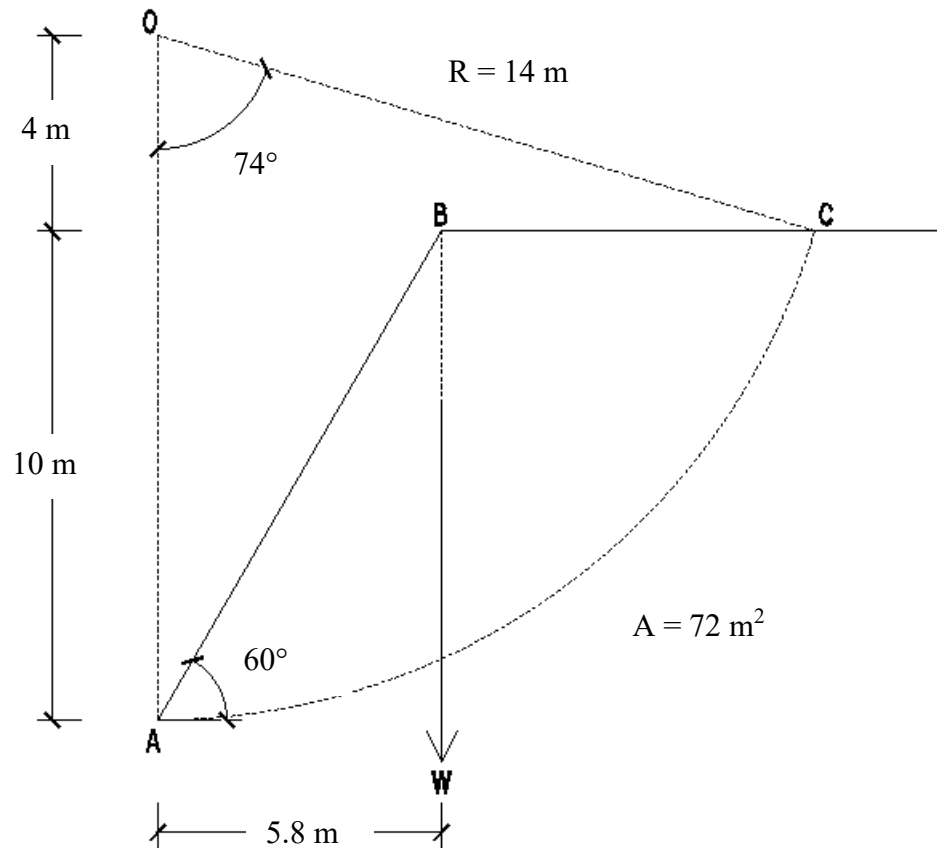
Figure B4(a) / *Rajah B4(a)*

[10 marks]

[*10 markah*]

(b)   A slope is divided into 4 slices all having identical width of b = 3 m. Meanwhile, average height, Z and angle, α are tabulated as in **Table B4(b)**. The soil properties are as follows:

γ = 19.23 kN/m^3, c = 6.75 kN/m^2 and ϕ = 17°.

*Suatu cerun telah dibahagikan kepada 4 hirisan yang sama besar dengan lebar, b = 3 m. Manakala nilai tinggi purata hirisan, Z dan sudut, α adalah seperti yang ditunjukkan di dalam **Jadual B4(b)**. Ciri-ciri tanah adalah seperti berikut:*

γ *= 19.23 kN/m^3, c = 6.75 kN/m^2 and* ϕ *= 17°.*

Table B4(b) / Jadual B4(b)

Slices / Hirisan	α	Z(m)	b(m)
1	-23^0	1.6	3.0
2	0^0	3.7	3.0
3	23^0	4.6	3.0
4	51^0	3.0	3.0

CLO2
C3

i. Calculate the slope slices data using Fellenius method.

Kira data hirisan cerun menggunakan kaedah Fellenius.

[10 marks]

[*10 markah*]

CLO2
C4

ii. Calculate the slope safety factor.

Kira faktor keselamatan cerun tersebut.

[5 marks]

[*5 markah*]

Notes

Assessment items for this course have covered elements of the Dublin
Problem: DP1, DP2 and DP3 as mention in FEIST.

SOALAN TAMAT

SENARAI FORMULA DCC30093

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

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

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

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

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

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

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

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

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

$$u = \gamma_\omega h$$

$$\sigma_v = \sigma_v' + u$$

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

$$N_c = (N_q - 1) \, kot \, \phi$$

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

Strip Foundation

$$q_u = Cu N_C + \gamma D N_q + 0.5 \gamma B N_\gamma$$

Square Foundation

$$q_u = 1.3 Cu N_C + \gamma D N_q + 0.4 \gamma B N_\gamma$$

Circle Foundation

$$q_u = 1.3 Cu N_C + \gamma D N_q + 0.3 \gamma B N_\gamma$$

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

$$\sigma_a = k_a \gamma z$$

$$\sigma_a = 2C \sqrt{K} a$$

$$Q = kH \frac{Nf}{Ne}$$

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

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

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

Table 16.2 Bearing-Capacity Factors N_c, N_q, and N_γ [Eqs. (16.25), (16.27) and (16.29)]

ϕ' (deg)	N_c	N_q	N_γ	ϕ' (deg)	N_c	N_q	N_γ
0	5.14	1.00	0.00	26	22.25	11.85	12.54
1	5.38	1.09	0.07	27	23.94	13.20	14.47
2	5.63	1.20	0.15	28	25.80	14.72	16.72
3	5.90	1.31	0.24	29	27.86	16.44	19.34
4	6.19	1.43	0.34	30	30.14	18.40	22.40
5	6.49	1.57	0.45	31	32.67	20.63	25.99
6	6.81	1.72	0.57	32	35.49	23.18	30.22
7	7.16	1.88	0.71	33	38.64	26.09	35.19
8	7.53	2.06	0.86	34	42.16	29.44	41.06
9	7.92	2.25	1.03	35	46.12	33.30	48.03
10	8.35	2.47	1.22	36	50.59	37.75	56.31
11	8.80	2.71	1.44	37	55.63	42.92	66.19
12	9.28	2.97	1.69	38	61.35	48.93	78.03
13	9.81	3.26	1.97	39	67.87	55.96	92.25
14	10.37	3.59	2.29	40	75.31	64.20	109.41
15	10.98	3.94	2.65	41	83.86	73.90	130.22
16	11.63	4.34	3.06	42	93.71	85.38	155.55
17	12.34	4.77	3.53	43	105.11	99.02	186.54
18	13.10	5.26	4.07	44	118.37	115.31	224.64
19	13.93	5.80	4.68	45	133.88	134.88	271.76
20	14.83	6.40	5.39	46	152.10	158.51	330.35
21	15.82	7.07	6.20	47	173.64	187.21	403.67
22	16.88	7.82	7.13	48	199.26	222.31	496.01
23	18.05	8.66	8.20	49	229.93	265.51	613.16
24	19.32	9.60	9.44	50	266.89	319.07	762.89
25	20.72	10.66	10.88				