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 **THREE (3)** types of soil.

*Jelaskan **TIGA (3)** jenis tanah.*

[9 marks]

[*9 markah*]

CLO1 (c) Site investigation involves thorough investigation process of the geological and soil condition below the surface. Explain **FOUR (4)** types of in-situ soil testing.

*Penyiasatan tapak adalah proses penyiasatan menyeluruh tentang keadaan geologi dan tanah di bawah permukaan bumi. Jelaskan **EMPAT (4)** jenis ujian tanah in-situ.*

[12 marks]

[*12 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Illustrate a three-phase soil composition that is normally used to represent the relationship of volumes and masses.

Ilustrasikan komposisi tanah tiga fasa yang biasa digunakan untuk mewakili hubungan isipadu dan jisim.

[4 marks]

[*4 markah*]

CLO1 (b) Generally, soil fails in shear. Illustrate the criteria of Mohr failure for granular soil, cohesion soil and granular-cohesion soil.

Secara amnya tanah gagal secara ricih. Ilustrasikan kriteria kegagalan Mohr pada tanah berbutir, tanah jelekit dan tanah berbutir-jelekit.

[9 marks]

[*9 markah*]

CLO1 (c) The main purpose of the foundation is to hold the above structure and keep it upright. Explain **SIX (6)** factors affecting the requirement of the foundation.

*Tujuan utama pembinaan asas adalah untuk memegang struktur yang berada di atasnya serta memastikan struktur tersebut tegak. Jelaskan **ENAM (6)** faktor yang mempengaruhi keperluan sesuatu asas.*

[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) Calculate the bulk and dry density of a soil sample with a porosity of 0.35 and moisture content of 30 % (Gs = 2.70).

Kirakan ketumpatan pukal dan kering bagi sampel tanah dengan keliangan 0.35 dan kandungan lembapan 30 % (Gs = 2.70).

[10 marks]

[*10 markah*]

CLO2

(b) The result of a standard proctor compaction test has been performed on a soil sample as given in Table B1(b). Using suitable graph, specify the maximum dry density ($\rho_{d\ max}$) and optimum water content (w_{opt}) of the soil.

Keputusan ujian pemadatan proctor piawai telah dilakukan ke atas sampel tanah dan ditunjukkan dalam Jadual B1(b). Menggunakan graf yang sesuai, tentukan ketumpatan kering maksimum ($\rho_{d\ max}$) dan kandungan lembapan optimum (w_{opt}) tanah.

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

Test no. *No. ujian*	Bulk density (kg/m^3) *Ketumpatan pukal (kg/m^3)*	Water content (%) *Kandungan air (%)*
1	1798.9	7.7
2	2000.0	11.5
3	2148.2	14.6
4	2105.8	17.5
5	2074.1	19.7
6	2031.7	21.2

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO2 (a) Table B2(a) shows the results of direct shear test conducted on samples of compacted sand. The shear box dimension is 60 mm x 60 mm. Calculate normal stress (σ_n) and shear stress at failure (τ_f) in kN/m^2.

Jadual B2(a) menunjukkan keputusan bagi ujian ricih terus ke atas sampel pasir padat. Ukuran kotak ricih adalah 60 mm x 60 mm. Kirakan tegasan normal (σ_n) dan tegasan ricih pada masa kegagalan (τ_f) dalam kN/m^2.

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

Test No. / *No. Ujian*	Normal load (N) / *Daya normal (N)*	Shear load at failure (N) / *Daya ricih pada masa gagal (N)*
1	84	46
2	133	95
3	225	195
4	340	294

[10 marks]

[*10 markah*]

CLO2 (b) The following results in Table B2(b) were obtained at the failure in a series of consolidated-undrained test, with pore pressure measurement on specimens of saturated clay. Using Mohr circles, specify the shear strength parameters, (C' and Ø') of soil.

Keputusan diperolehi dalam Jadual B2(b) adalah daripada kegagalan dalam satu siri ujian terkukuh-tak tersalir dengan pengukuran tekanan liang pada spesimen tanah liat tepu. Menggunakan bulatan Mohr, tentukan parameter kekuatan ricih (C' dan Ø') bagi tanah.

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

Test / *Ujian*	1	2	3
Cell pressure, σ_3 (kN/m^2) / *Tekanan sel, σ_3 (kN/m^2)*	150	300	450
Deviator stress at failure, $\Delta\sigma$ (kN/m^2) / *Tekanan deviator pada masa gagal, $\Delta\sigma$ (kN/m^2)*	192	341	504
Pore pressure, u_w (kN /m^2) / *Tekanan liang, u_w (kN /m^2)*	80	154	222

[15 marks]

[*15 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) A layer of sand is 4 m thick and overlays a 6 m thick clay. The ground water level is 2 m from the surface of the sand. The unit weight of sand above the ground water level is 16 kN/m^3, while the saturated weight of sand is 18 kN/m^3 and the saturated weight of clay is 20 kN/m^3. Calculate the total stress, pore water pressure and effective stress in 10 m deep.

*Satu lapisan pasir berketebalan 4 m berada di atas tanah liat setebal 6 m. Aras air bumi berada pada kedalaman 2 m dari permukaan pasir. Berat unit pasir di atas aras air bumi adalah 16 kN/m^3, manakala berat unit tepu pasir adalah 18 kN/*m^3 *dan berat unit tepu tanah liat adalah 20 kN/*m^3. *Kirakan jumlah tegasan, tekanan air liang dan tegasan berkesan pada kedalaman 10 m.*

[10 marks]

[*10 markah*]

CLO2 (b) Figure B3(b) shows a 6 m high retaining wall. Using the Rankine theory, calculate the magnitude and the position of active thrust that acts behind the wall.

Rajah B3(b) menunjukkan sebuah tembok penahan setinggi 6 m. Menggunakan teori Rankine, kirakan magnitud dan kedudukan tujahan aktif yang bertindak di belakang tembok.

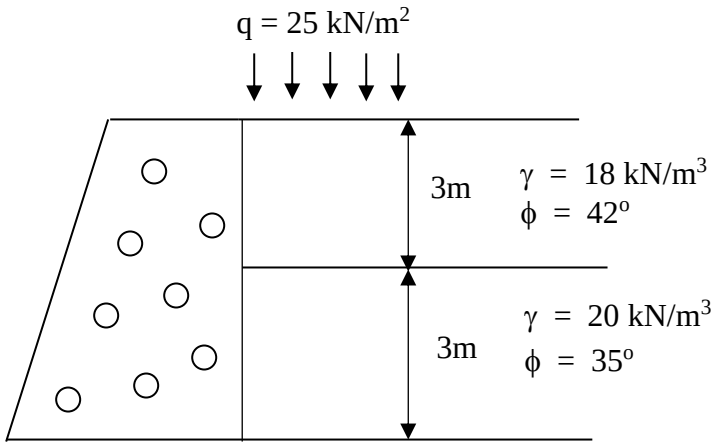

Figure B3(b) / *Rajah B3(b)*

[15 marks]

[*15 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Figure B4(a) shows one dig of sheet pile on sandy soil. If the coefficient of permeability, k is 7.2 x 10^{-3} mm/sec, calculate the quantity of seepage, Q in m^3/hour/m length.

Rajah B4(a) menunjukkan satu korekan cerucuk keping pada lapisan tanah pasir. Jika diberi pekali kebolehtelapan, k tanah adalah 7.2 x 10^{-3} mm/s, kirakan kadaralir resipan, Q dalam unit m^3/jam/m panjang.

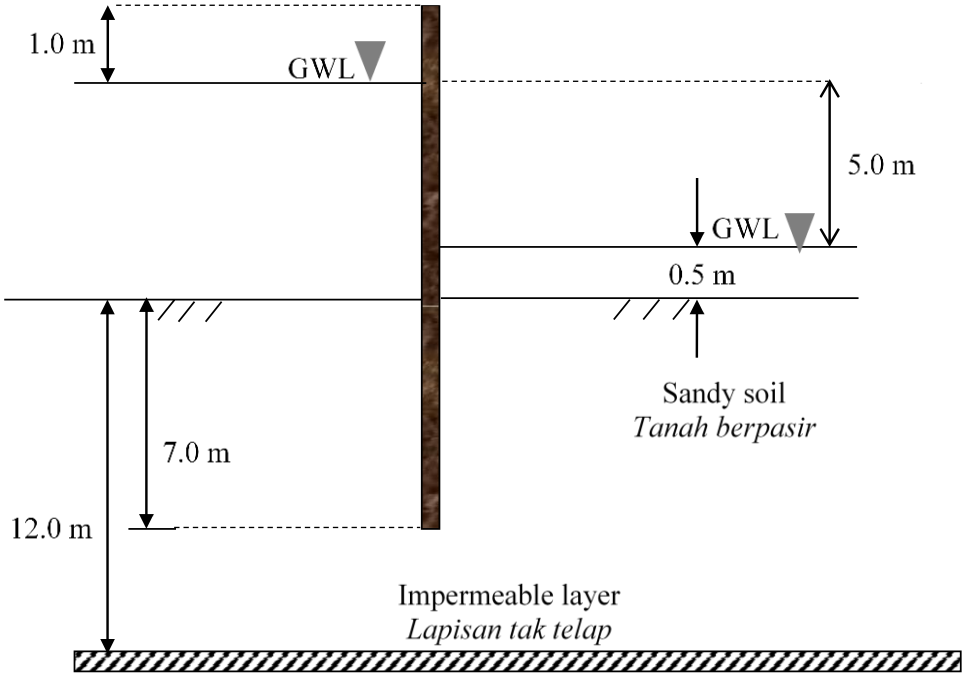

Figure B4(a) / *Rajah B4(a)*

[10 marks]

[*10 markah*]

CLO2 (b) Refer to Figure B4(b) and Table B4(b), evaluate safety factor of the slope by using Fellenius slices method.

Merujuk kepada Rajah B4 (b) dan Jadual B4 (b), nilaikan faktor keselamatan bagi cerun dengan menggunakan kaedah hirisan Fellenius.

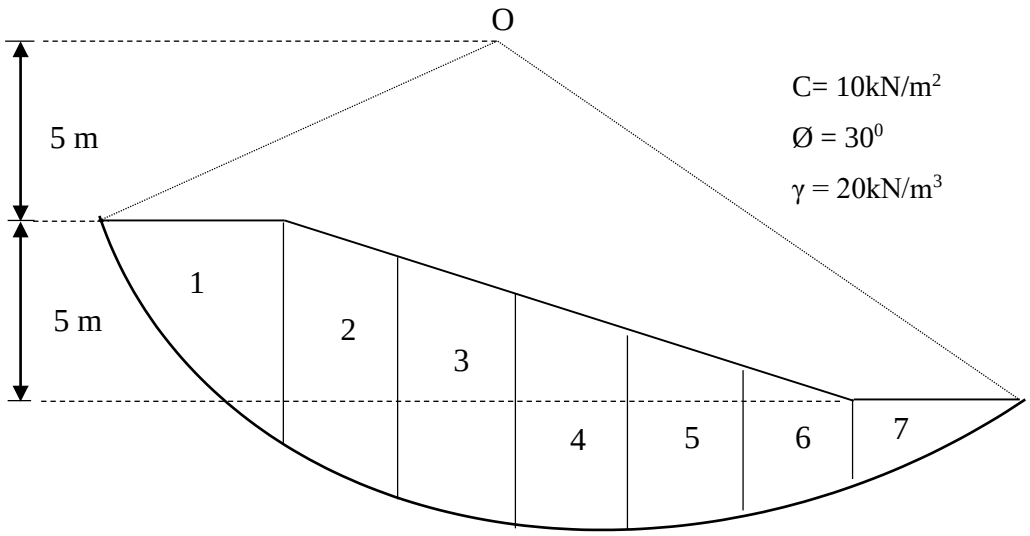

Figure B4(b) / *Rajah B4(b)*

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

Slices / *Hirisan*	b (m)	α°	z (m)
1	2.0	51	1.65
2	2.0	36	3.65
3	1.3	28	4.15
4	0.7	24	3.90
5	2.0	15	3.50
6	2.0	2	2.50
7	2.0	-5	1.20

[15 marks]

[*15 markah*]

SOALAN TAMAT

LIST OF FORMULA FOR DCC30093 GEOTECHNICAL ENGINEERING

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

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

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

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

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

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

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

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

$$PI = LL - PL$$

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

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

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

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

$$q_u = CuN_C + \gamma D N_q + 0.5 \gamma B N_\gamma$$

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

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

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

$$u = \gamma_\omega h$$

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

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

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

$$\sigma_a = k_a \gamma z$$

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

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

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

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

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

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

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

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

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

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

$$Zc = \frac{2C}{\gamma}\sqrt{\frac{1}{K_a}}$$

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

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

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

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

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