6

SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI DISEMBER 2017

DCC3103: GEOTECHNICAL ENGINEERING

TARIKH : 13 APRIL 2018 (JUMAAT)
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : **1. Formula Bearing Capacity Factors**
2. Formula Geotechnics
3. Formula Foundation Taylor
Stabilization Chart

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)** structured questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 C1 (a) List the types of rocks and explain **ONE (1)** of them.

*Senaraikan jenis-jenis batuan dan terangkan **SATU (1)** daripadanya.*

[6 marks]

[*6 markah*]

CLO1 C2 (b) Explain clearly about residual, transported and organic soil.

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

[9 marks]

[*9 markah*]

CLO2 C3 (c) The result of Three Axial Flow Series Test for soil sample is shown in **Table 1c**. Calculate the value of **c** and **Ø** for this soil.

*Keputusan Ujian Tiga Paksi untuk sampel tanah adalah seperti **Jadual 1c**. Kirakan nilai c dan Ø untuk tanah tersebut.*

	A	B	C	D
Minor normal stress σ'_3 (kN/m²)	100	200	350	500
Deviator stress $\sigma'_1 - \sigma'_3$ (kN/m²)	286	374	513	652
Major normal stress σ'_1 (kN/m²)	386	574	863	1152

Table 1c / *Jadual 1c*

[10 marks]

[10 *markah*]

QUESTION 2

SOALAN 2

CLO1 C2

(a) Explain **FOUR (4)** factors in selection of a foundation.

*Terangkan **EMPAT (4)** faktor yang diambilkira dalam pemilihan asas.*

[8 marks]

[8 *markah*]

CLO2 C3

(b) The strip foundation was built at a depth of 3m underground to carry the load from a structure. Site investigation was conducted and found that the soil has the following data:

Sebuah asas jalur dibina pada kedalaman 3m di dalam tanah bagi menanggung beban yang dikenakan dari struktur. Satu penyiasatan tapak telah dijalankan di sekitar kawasan pembinaan dan mendapati tanah tersebut mempunyai ciri-ciri seperti berikut:

Unit weight of soil *Berat unit tanah*	= 19 kN/m^3
Unit weight of saturated soil *Berat unit tepu*	= 21 kN/m^3
Cohesion of soil *Kejelekitan tanah*	= 55 kN/m^2
Friction angle of soil *Sudut geseran tanah*	= 15^o
Ground water level *Aras air bumi*	= at the surface of soil *di permukaan tanah*

Calculate the ultimate bearing capacity of the soil.

Kirakan keupayaan galas muktamad tanah tersebut.

[9 marks]

[*9 markah*]

CLO2
C4

(c) Determine the size needed if square foundation is being used. Given design load = 500kN and factor of safety = 2.9.

Tentukan saiz yang diperlukan sekiranya asas berbentuk segiempat sama digunakan. Diberi beban rekabentuk = 500 kN dan faktor keselamatan = 2.9.

[8 marks]
[*8 markah*]

SECTION B: 50 MARKS

BAHAGIAN B: 50 MARKAH

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO2
C3

(a) A soil sample has a mass of 48 kg and the volume is 0.026 m^3. After drying it in an oven for 24 hours, the mass reduced to 39 kg. The specific gravity is 2.65. Calculate:

Satu sampel tanah mempunyai berat 48 kg dan isipadu sebanyak 0.026 m^3. Selepas dikeringkan di dalam oven selama 24 jam, beratnya menurun menjadi 39 kg. Diberi nilai GS sebanyak 2.65. Kirakan:

i. Moisture content, m
Kandungan lembapan, m

ii. Dry density, ρ_d
Ketumpatan kering, ρ_d

iii. Void ratio, e
Nisbah lompang, e

[13 marks]
[*13 markah*]

CLO2
C4

(b) A standard proctor compaction is tested to the soil sample. A result is shown below:

Ujikaji pemadatan proctor piawai telah dijalankan ke atas satu sampel tanah. Keputusan ujikaji ditunjukkan di bawah :

Bulk Density, ***Ketumpatan pukal, ρb*** **(kg/m^3)**	2040	2122	2450	2010	2020
Moisture Content ***Kandungan lembapan, m*** **(%)**	10	12	14	16	18

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

i. Draw a curve of dry density versus moisture content

Lukiskan lengkung ketumpatan kering melawan kandungan lembapan

[8 marks]

[*8 markah*]

ii. Determine the value of maximum dried density ($\rho_{d\,max}$) and optimum moisture content, ($w_{optimum}$) from the graph.

Daripada graf, tentukan nilai ketumpatan kering maksima ($\rho_{d\,max}$) dan kandungan lembapan optimum

[4 marks]

[*4 markah*]

QUESTION 2

SOALAN 2

CLO2
C3

(a) A retaining wall has a height of 8m serves to hold the sand. Given the weight of sand and stress coefficients of each horizon is 26 kN / m^3 and 0.27. Interpret:

Satu tembok penahan mempunyai ketinggian 8m berfungsi untuk menahan tanah pasir. Diberi berat unit tanah pasir dan pekali tegasan ufuknya masing-masing adalah 26 kN/m^3 dan 0.27. Nilaikan:

i. Total thrust of sand on the wall.
Jumlah tujahan tanah pasir ke atas tembok penahan.

[4 marks]
[*4 markah*]

ii. Total thrust of sand on the wall, if there is groundwater level 3m below the sand surface and sand saturated unit weight is 30 kN/m^3.

Jumlah tujahan tanah pasir ke atas tembok penahan sekiranya terdapat air bumi di paras 3m di bawah permukaan pasir dan berat unit tepu tanah pasir ialah 30 kN/m^3.

[9 marks]
[*9 markah*]

CLO2
C4

(b) A retaining wall is built during the excavation activity as shown in **Figure B2(b)** to bear two soil layers behind it. Despite of passive pressure in front of the retaining wall.

Sebuah tembok penahan dibina semasa kerja pengorekan dijalankan seperti dalam ***Rajah B2(b)*** *untuk menanggung dua lapisan tanah di belakangnya. Dengan mengabaikan tekanan pasif di hadapan tembok penahan tersebut.*

i. Draw the active side pressure that acting on the rear wall.
Lukiskan tekanan sisi aktif yang bertindak di belakang tembok.

[2 marks]
[*2 markah*]

ii. Analyze the magnitude and location of the active thrust of land behind the wall based on Rankine theory.

Analisis magnitud dan kedudukan tujah aktif tanah di belakang tembok tersebut berdasarkan teori Rankine.

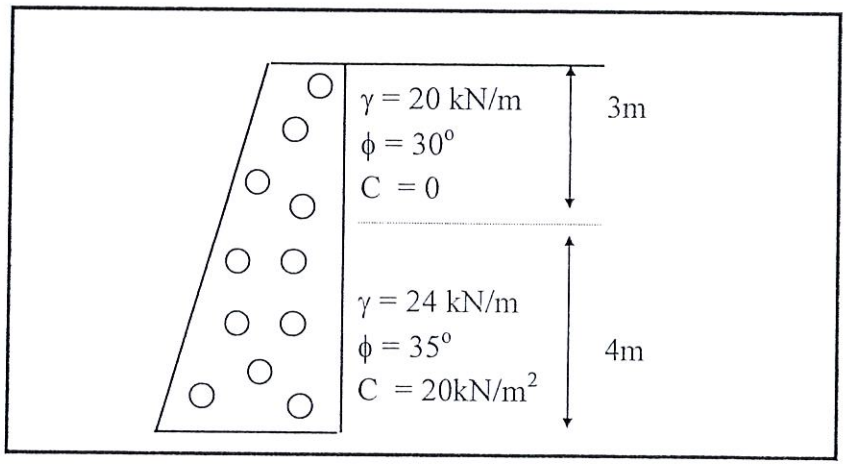

Figure B2 (b) /*Rajah B2 (b)*

[10 marks]
[*10 markah*]

QUESTION 3

SOALAN 3

CLO2
C3

(a) i. Choose **ONE (1)** factor that cause the failure of the slope.
*Pilih **SATU (1)** faktor yang menyebabkan kegagalan pada cerun.*

[4 marks]
[*4 markah*]

ii. Slope failures can be divided into several types. Sketch the following slope failures:
Kegagalan cerun boleh dibahagikan kepada beberapa jenis. Lakarkan kegagalan cerun jenis berikut:

-Flow slide
Gelangsar aliran

-Fall or collapse
Jatuh dan runtuh

-Translational slide
Gelangsar Translasi

[6 marks]
[*6 markah*]

CLO2
C4

(b) From Total Stress Analysis method, determine factor of safety based on **Figure B3(b).**

Daripada kaedah Analisis Tegasan Jumlah, dapatkan nilai faktor keselamatan berdasarkan ***Rajah B3(b).***

Given :

Diberi :

γ = 16 KN/m^3

c = 24.6 KN/m^2

W = B point

W = titik B

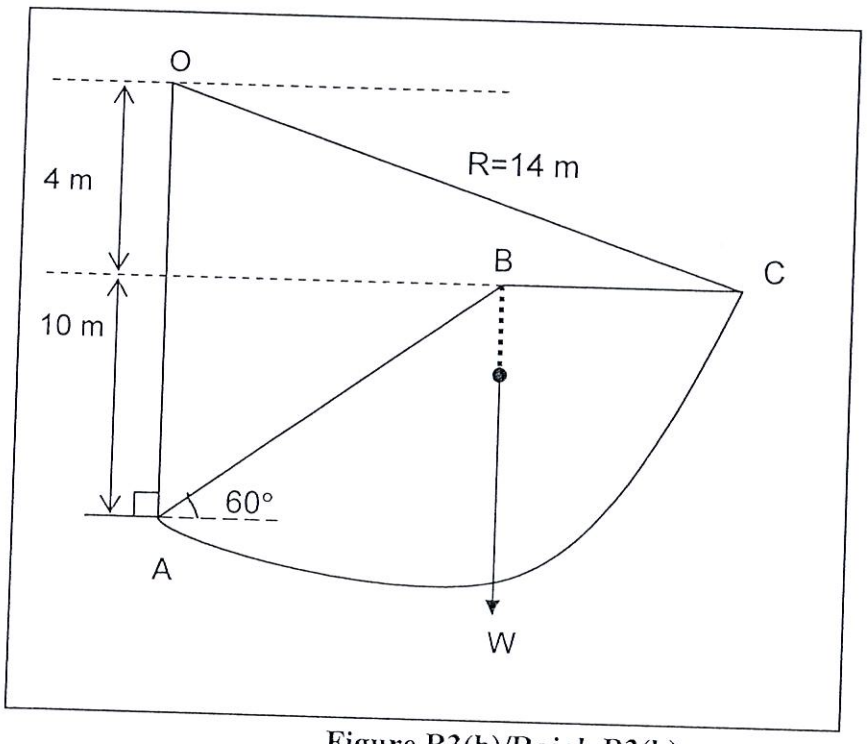

Figure B3(b)/Rajah B3(b)

[15 marks]

[*15 markah*]

QUESTION 4

SOALAN 4

CLO2
C3

(a)

i. Interprete flow net.

Tafsirkan maksud jaringan aliran.

[5 marks]

[*5 markah*]

ii. Sketch the flow net of concrete dam and explain clearly about the equipotential (N_e) and flow lines (N_f).

Lakarkan jaringan aliran bagi empangan konkrit dan terangkan dengan jelas mengenai garis sama upaya (N_e) dan garis aliran (N_f).

[10 marks]

[*10 markah*]

CLO2
C4

(a) **Figure B4(b)** below shows one dig of sheet piling on sandy soil. If the coefficient of permeability (k) is 7.3 x 10^{-3} mm/sec. Determine:

Rajah B4(b) *menunjukkan satu korekan cerucuk keping pada lapisan tanah pasir. Jika diberi pekali kebolehtelapan (k) tanah adalah 7.3 x 10^{-3} mm/s. Tentukan:*

i. The value of equipotential (N_e) and flow lines (N_f) from a flow net.

Nilai garis sama upaya (N_e) dan garis aliran (N_f) daripada jaringan aliran.

ii. The quantity of seepage, Q in m^3/hour/m length.

Kadaralir resipan, Q dalam unit m^3/jam/m panjang.

iii. The pore water pressure at point P.

Tekanan air liang pada titik P.

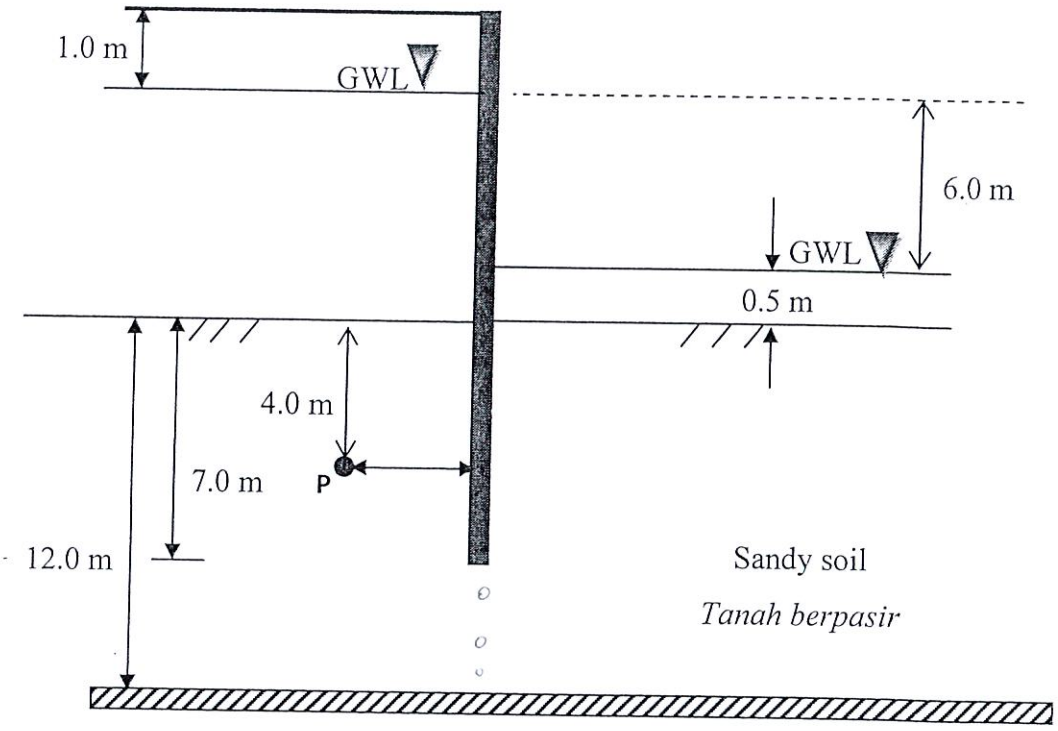

Figure B4(b)/*Rajah B4(b)*

[10 marks]

[*10 markah*]

SOALAN TAMAT

BEARING CAPACITY FACTORS FOR GENERAL SHEAR

ANGLE OF FRICTION ϕ (DEGREES)	TERZAGHI			MEYERHOF			HANSEN		
	N_c	N_q	N_γ	N_c	N_q	N_γ	N_c	N_q	N_γ
0	5.70	1.00	0.00	5.10	1.00	0.00	5.10	1.00	0.00
2	6.30	1.22	0.18	5.63	1.20	0.01	5.63	1.20	0.01
4	6.97	1.49	0.38	6.19	1.43	0.04	6.19	1.43	0.05
5	7.34	1.64	0.50	6.49	1.57	0.07	6.49	1.57	0.07
6	7.73	1.81	0.62	6.81	1.72	0.11	6.81	1.72	0.11
8	8.60	2.21	0.91	7.53	2.06	0.21	7.53	2.06	0.22
10	9.60	2.69	1.21	8.34	2.47	0.37	8.34	2.47	0.39
12	10.76	3.29	1.70	9.28	2.97	0.60	9.28	2.97	0.63
14	12.11	4.02	2.23	10.37	3.59	0.92	10.37	3.59	0.97
15	12.86	4.45	2.50	10.98	3.94	1.13	10.98	3.94	1.18
16	13.68	4.92	2.94	11.63	4.34	1.37	11.63	4.34	1.43
18	15.52	6.04	3.87	13.10	5.26	2.00	13.10	5.26	2.08
20	17.69	7.44	4.97	14.83	6.40	2.87	14.83	6.40	2.95
22	20.27	9.19	6.61	16.88	7.82	4.07	16.88	7.82	4.13
24	23.36	11.40	8.58	19.32	9.60	5.72	19.32	9.60	5.75
25	25.13	12.72	9.70	20.72	10.66	6.77	20.72	10.66	6.76
26	27.09	14.21	11.35	22.25	11.85	8.00	22.25	11.85	7.94
28	31.61	17.81	15.15	25.80	14.72	11.19	25.80	14.72	10.94
30	37.16	22.46	19.73	30.14	18.40	15.67	30.14	18.40	15.07
32	44.04	28.52	27.49	35.49	23.18	22.02	35.49	23.18	20.79
34	52.64	36.50	36.96	42.16	29.44	31.15	42.16	29.44	28.77
35	57.75	41.44	42.40	46.12	33.30	37.15	46.12	33.30	33.92
36	63.53	47.16	51.70	50.59	37.75	44.43	50.59	37.75	40.05
38	77.50	61.55	73.47	61.35	48.93	64.07	61.35	48.93	56.17
40	95.66	81.27	100.39	75.31	64.20	93.69	75.31	64.20	79.54
42	119.67	108.75	165.69	93.71	85.37	139.32	93.71	85.37	113.96
44	151.95	147.74	248.29	118.37	115.31	211.41	118.37	115.31	165.58
45	172.29	173.29	294.50	133.87	134.87	262.74	133.87	134.87	200.81
46	196.22	204.19	426.96	152.10	158.50	328.73	152.10	158.50	244.65
48	258.29	287.85	742.61	199.26	222.30	526.45	199.26	222.30	368.67
50	347.51	415.15	1153.15	266.88	319.06	873.86	266.88	319.06	568.57

LAMPIRAN FORMULA (CC502 – GEOTECHNICS 2)

$Q = k\,H\,\frac{Nf}{Ne}$

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

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

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

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

$K_a = \cos\beta\,.\,\frac{\cos\beta - \sqrt{(\cos^2\beta - \cos^2\phi)}}{\cos\beta + \sqrt{(\cos^2\beta - \cos^2\phi)}}$

$K_a = \frac{\sin^2(\alpha+\phi)\cos\delta}{\sin\alpha\sin(\alpha-\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\alpha-\delta)\sin\alpha+\beta)}}\right]^2}$

$K_a = \left[\frac{\sin\phi}{1+\sqrt{\frac{\sin(\phi+\delta)\sin\phi}{\cos\delta}}}\right]^2$

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

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

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

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

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

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

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

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

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

$FOS = \frac{N_c C_u}{\gamma Z}$

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

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

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

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

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

Slope, α	30	6	90	120	150	180
$\frac{\Delta a}{a+\Delta a}$	0.37	0.32	0.25	0.18	0.10	0

STRIP FOUNDATION

$$q_u = c_u N_c + \gamma DNq + 0.5 \gamma BN_\gamma$$

CIRCLE FOUNDATION

$$q_u = 1.3 c_u N_c + \gamma DNq + 0.3 \gamma BN_\gamma$$

SQUARE SPREAD FOUNDATION

$$q_u = 1.3 c_u N_c + \gamma DNq + 0.4 \gamma BN_\gamma$$

RECTANGLE SPERAD FOUNDATION

$$q_u = c_u N_c [1 + 0.3 (B/L) + \gamma DNq + 0.5 \gamma BN_\gamma [1-0.2 (B/L)]$$

Taylor Stabilization Chart