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 : 2024/2025

DCC20332 : SOIL MECHANICS

TARIKH : 24 MEI 2025
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Formula & Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This section consists of **FOUR (4)** subjective questions. Answer **ALL** questions.

ARAHAN :

*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Based on the original formation method, rocks can be divided into three basic types of rock which are igneous, sedimentary and metamorphic. Explain the formation process of **TWO (2)** types of rocks.

*Berdasarkan kaedah pembentukan asal, batuan boleh diagihkan kepada tiga jenis batuan utama iaitu batuan igneus, endapan dan metamorfisis. Terangkan proses pembentukan **DUA (2)** jenis batuan tersebut.*

[5 marks]

[*5 markah*]

CLO1 (b) Soil is the uppermost layer of the earth's surface, composed a mixture of minerals, organic matter, water, air and living organisms.

Tanah merupakan lapisan paling atas permukaan bumi, terdiri daripada campuran mineral, bahan organik, air, udara dan organisma hidup.

i. There are three types of soil; residual, transported and organic soil. Explain the characteristics for any **TWO (2)** types of soils mentioned.

*Terdapat tiga jenis tanah ; tanah baki, tanah terangkut dan tanah organik. Terangkan ciri-ciri bagi **DUA (2)** jenis tanah yang telah dinyatakan.*

[6 marks]

[*6 markah*]

ii. Problematic soil refers to soil that poses challenges for construction, agriculture or other land-use activities due to its physical or chemical properties. Identify **THREE (3)** types of problematic soil in the context of construction.

*Tanah bermasalah merujuk kepada tanah yang menimbulkan cabaran untuk pembinaan, pertanian atau aktiviti penggunaan tanah lain disebabkan oleh sifat fizikal atau kimianya. Kenal pasti **TIGA (3)** jenis tanah bermasalah dalam konteks pembinaan.*

[6 marks]

[*6 markah*]

CLO1 (c) The effect of loading in saturated cohesive soils is to squeeze out pore water, this process is called consolidation. With the aid of spring analogy diagram, explain the consolidation process.

Kesan beban di dalam tanah jelekit tepu adalah untuk mengeluarkan air liang, proses ini dikenali sebagai pengukuhan. Dengan bantuan gambarajah analogi spring, terangkan proses pengukuhan yang berlaku.

[8 marks]

[*8 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Soil can be either two-phase or three-phase composition. Illustrate the three phase composition in a diagram by labelling each phase of soils.

Tanah terdiri daripada komposisi dua fasa atau tiga fasa. Lakarkan tiga fasa komposisi tanah pada gambarajah dengan melabelkan setiap fasa tanah.

[5 marks]

[*5 markah*]

CLO1 (b) A soil sample has a mass of 50kg and the volume is $0.036m^3$. After drying it in an oven for 24 hours, the mass has reduced to 44kg. The specific gravity (Gs) is 2.65. Calculate the moisture content (m), dry density (ρ_d) and void ratio (e).

Satu sampel tanah mempunyai berat 50kg dan isipadu sebanyak $0.036m^3$. Selepas dikeringkan di dalam oven selama 24 jam, beratnya menurun menjadi 44kg. Diberi nilai graviti tentu (Gs) sebanyak 2.65. Kirakan kandungan lembapan (m), ketumpatan kering (ρ_d) dan nisbah lompang (e).

[10 marks]

[*10 markah*]

CLO1 (c) The values of void ratio, moisture content and specific gravity for a soil sample are e = 0.85, w = 22% and Gs = 2.75 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 = 0.85, w = 22% and Gs = 2.75. Kirakan berat unit pukal (γ_b), berat unit kering (γ_d) dan darjah ketepuan (Sr%).

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) A soil sample has a water content 35% and a liquid limit (LL) of 45%. If the plastic limit (PL) on the same soil was found to be 33%, classify the soil using plasticty chart in Figure 3(a).

Satu sampel tanah mempunyai kandungan air 35% dan had cecair (LL) 45%. Jika had plastik (PL) pada tanah yang sama didapati 33%, kelaskan tanah tersebut menggunakan carta keplastikan dalam Rajah 3(a).

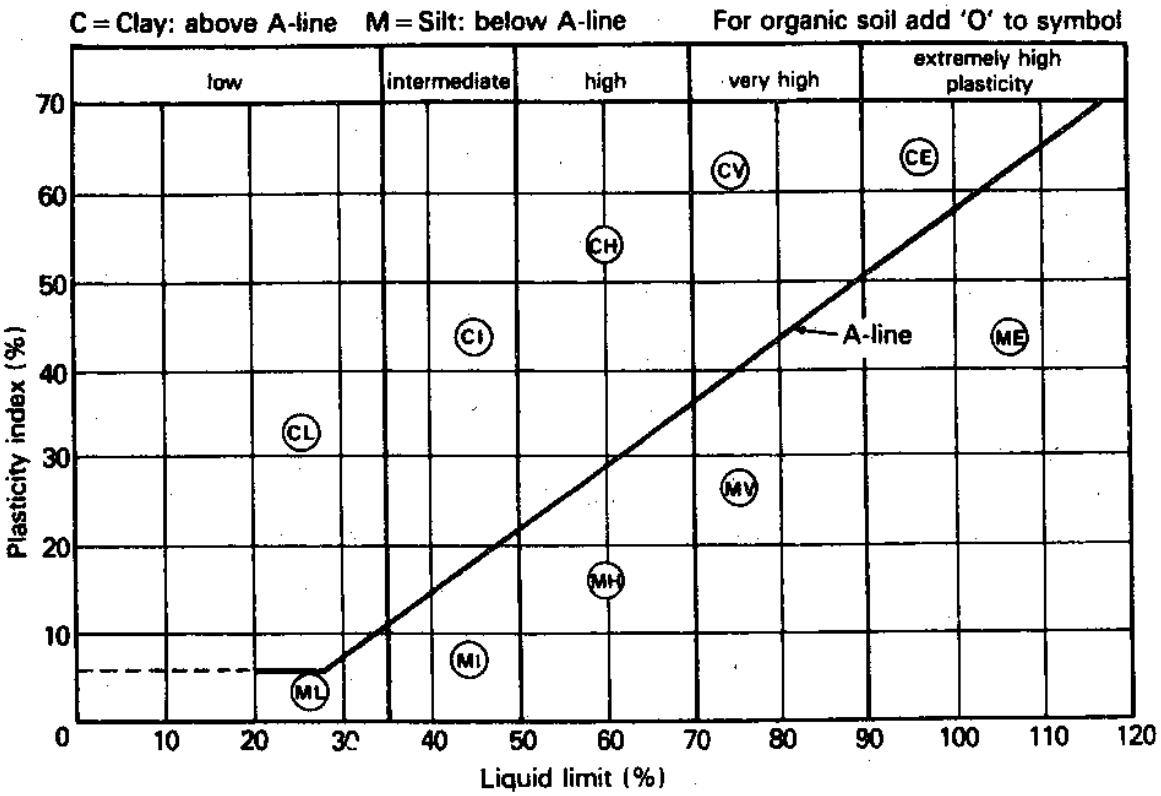


Figure 3(a)/*Rajah 3(a)*

[5 marks]

[*5 markah*]

CLO2 (b) Standard Proctor compaction test was carried out on a sample used to fill up an embankment at a construction area that is shown in Table 3(b).
Ujian pemadatan proktor piawai telah dijalankan ke atas sampel yang digunakan untuk mengisi tambak di kawasan pembinaan yang ditunjukkan dalam Jadual 3(b).

Table3(b)/*Jadual 3(b)*

Bulk Density/ *Ketumpatan pukal* (kN/m^3)	1870	2040	2130	2200	2160
Moisture Content/ *Kandungan lembapan* (%)	5	8	10	13	16

Draw the curve of dry density against moisture content, then find the maximum dry density ($\rho_{d\,max}$) and the optimum moisture content (w_{opt}).
Lukiskan lengkung ketumpatan kering melawan kandungan lembapan, seterusnya cari ketumpatan kering maksimum ($\rho_{d\,max}$) dan kandungan lembapan optimum (w_{opt}).

[8 marks]
[*8 markah*]

CLO2 (c) The profile are shown in a Figure 3 (c) is based on the soil investigation. Calculate the total effective stress of the soil at the depth of 3.5m, 6.0m and 14.0m.
Profil dalam Rajah 3 (c) adalah berdasarkan penyiasatan tapak. Kirakan jumlah tegasan berkesan tanah pada kedalaman 3.5m, 6.0m dan 14.0m.

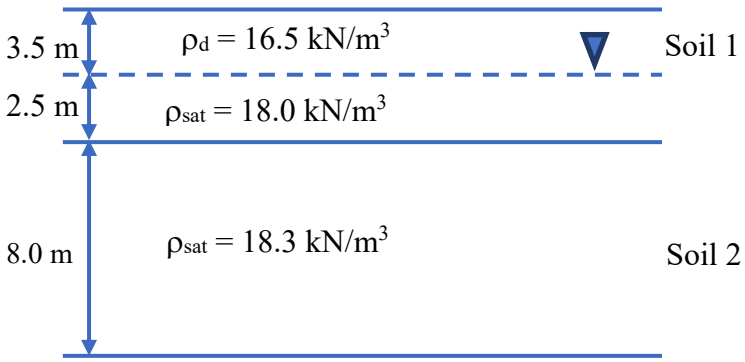


Figure 3(c)/*Rajah 3(c)*

[12 marks]
[*12 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Soils are divided into three main groups based on their characteristics which are cohesive soils, cohesionless soil and clayey sand or silt sand. Illustrate the graph of any **TWO (2)** soil that shows the relationship of shear stress ($\tau_f = c+\sigma_n \tan \phi$).
*Tanah telah dibahagikan kepada tiga kumpulan utama berdasarkan ciri-cirinya iaitu tanah jelekit, tanah tak jelekit dan tanah liat berpasir atau tanah kelodak. Lakarkan graf bagi mana-mana **DUA (2)** jenis tanah yang menunjukkan hubungan tegasan ricih ($\tau_f = c+\sigma_n \tan \phi$).*

[5 marks]
[*5 markah*]

CLO2 (b) Table 4(b) contains data obtained in consolidated-undrained test on a saturated clay.
Jadual 4(b) mengandungi data-data yang diperolehi daripada ujikaji terkukuh tak tersalir bagi tanah liat tepu.

Table 4(b)/*Jadual 4(b)*

Cell pressure during consolidation and shear/ *Tekanan sel semasa ricih dan pengukuhan* (kN/m^2)	at failure/*ketika kegagalan*	
	Deviator stress / *Tegasan deviator* (kN/m^2)	Pore water pressure/ *Tekanan air liang* (kN/m^2)
300	170	160
600	350	330
1200	680	660

i. From data in Table 4(b), calculate effective stress.
Daripada data di dalam Jadual 4(b), kirakan tegasan berkesan.

[6 marks]
[*6 markah*]

ii. Based on answer (i), draw the graph of shear stress against minor stress/major stress.
Berdasarkan jawapan (i), lukiskan graf tegasan ricih melawan tegasan minor/tegasan major.

[7 marks]
[*7 markah*]

CLO2 (c) The consolidation refers to the process by which a saturated soil undergoes a reduction in volume due to the expulsion of water from its pores when the load applied. Explain the coefficient of volume compressibility (Mv) and degree of consolidation (Uv).
Pengukuhan merujuk kepada proses di mana tanah yang tepu dengan air mengalami pengurangan isipadu akibat pemampatan air dari liang apabila dikenakan beban. Terangkan berkenaan dengan pengukuhan; pekali kebolehmampatan isipadu (Mv) dan darjah pengukuhan (Uv).

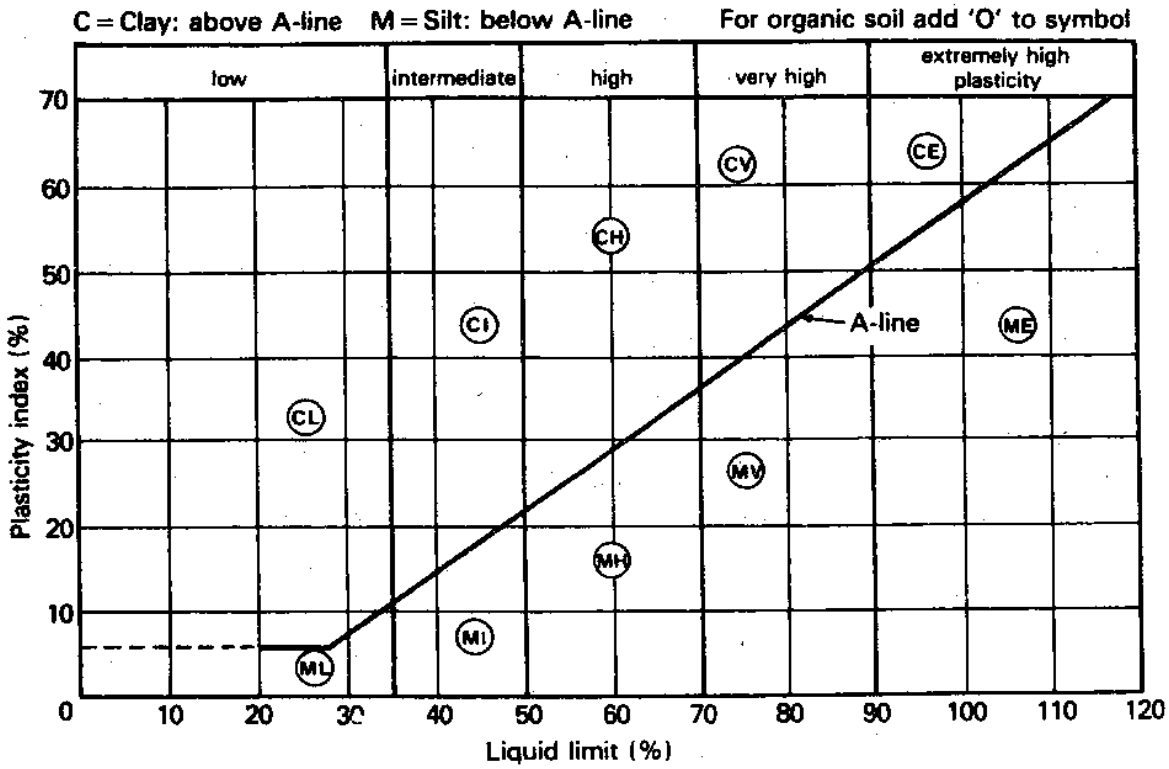
[7 marks]
[*7 markah*]

SOALAN TAMAT

LAMPIRAN FORMULA DCC20332 – SOIL MECHANICS

$\rho_b = \frac{M_T}{V_T}$	$\rho_d = \frac{M_S}{V_T}$	$A = \frac{V_a}{V_T}$
$w = \frac{M_W}{M_S}$	$\rho_d = \frac{G_s \rho_w}{1+e}$	$S_r\, e = w G_s$
$e = \frac{V_v}{V_s}$	$G_s = \frac{M_s}{V_s \rho_w}$	$n = \frac{V_v}{V_T}$
$\gamma = \rho g$	$n = \frac{e}{1+e}$	$A = n\,(1 - S_r)$
$A = \frac{e - wG_s}{1+e}$	$\gamma_b = \frac{G_s \gamma_w\,(1+w)}{1+e}$	$\gamma_d = \frac{\gamma_b}{1+w}$
$S_r = \frac{V_w}{V_v}$	$\rho_d = \frac{\rho_b}{1+w}$	$\rho_d = \frac{G_s \rho_w}{1+wG_s}\,(1 - A_r)$
$\tau_f = \sigma_n \tan \emptyset$	$T_v = \frac{C_v\,.\,t}{Hd^2}$	$M_v = \frac{e_1 - e_2}{1 - e_1}\; x\; \frac{1}{\Delta P}$
$C_v = \frac{k}{M_v \gamma_w}$		

Appendix 1/*Lampiran 1*



IF RELATED (*Please submit this chart together with your answer)

Soil Groups, Descriptors and Symbols

Major Soil Group	Descriptor
Gravel (G) Sand (S)	Well Graded (W) Poorly Graded (P) Silty (M) Clayey (C)
Silt (M) Clay (C) Organic (O)	Low Plasticity (L) Medium Plasticity (I) High Plasticity (H)

Degree of Consolidation (U%) vs. Time Factor (T_v)

U (%)	T_v	U (%)	T_v	U (%)	T_v	U (%)	T_v
0	0	26	0.0531	52	0.212	78	0.529
1	0.00008	27	0.0572	53	0.221	79	0.547
2	0.0003	28	0.0615	54	0.230	80	0.567
3	0.00071	29	0.0660	55	0.239	81	0.588
4	0.00126	30	0.0707	56	0.248	82	0.610
5	0.00196	31	0.0754	57	0.257	83	0.633
6	0.00283	32	0.0803	58	0.267	84	0.658
7	0.00385	33	0.0855	59	0.276	85	0.684
8	0.00502	34	0.0907	60	0.286	86	0.712
9	0.00636	35	0.0962	61	0.297	87	0.742
10	0.00785	36	0.102	62	0.307	88	0.774
11	0.0095	37	0.107	63	0.318	89	0.809
12	0.0113	38	0.113	64	0.329	90	0.848
13	0.0133	39	0.119	65	0.304	91	0.891
14	0.0154	40	0.126	66	0.352	92	0.938
15	0.0177	41	0.132	67	0.364	93	0.993
16	0.0201	42	0.138	68	0.377	94	1.055
17	0.0227	43	0.145	69	0.390	95	1.129
18	0.0254	44	0.152	70	0.403	96	1.219
19	0.0283	45	0.159	71	0.417	97	1.336
20	0.0314	46	0.166	72	0.431	98	1.500
21	0.0346	47	0.173	73	0.446	99	1.781
22	0.0380	48	0.181	74	0.461	100	∞
23	0.0415	49	0.188	75	0.477		
24	0.0452	50	0.197	76	0.493		
25	0.0491	51	0.204	77	0.511		