SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

DCC3103 : GEOTECHNICAL ENGINEERING

TARIKH : 21 OKTOBER 2015
MASA : 11.15AM – 1.15PM (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
Bahagian A: Esei Berstruktur (2 soalan)
Bahagian B: Esei Berstruktur (4 soalan)
Dokumen sokongan yang disertakan : Formula, Carta Keplastikan, Taylor Stabilization Chart, Terzaghi's Bearing Capacity Factors & Kertas graf

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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
C1

(a) List the processes involved in a rock cycle
Senaraikan proses yang terlibat dalam kitaran batuan.

[6 marks]
[6 markah]

CLO1
C2

(b) Explain about organic soil, residual soil and transported soil.
Terangkan mengenai tanah organik, tanah baki dan tanah terangkut.

[9 marks]
[9 markah]

CLO2
C3

(c) The result of Three Axial Flow Series Test for soil sample is shown in the table below. Calculate the value of **c** and **Ø** for this soil.
Keputusan Ujian Tiga Paksi untuk sampel tanah adalah seperti jadual berikut. Kirakan nilai of **c** dan **Ø** *untuk tanah tersebut.*

[10 marks]
[10 markah]

Sample	Minor normal stress σ'_3 (kN/ m^2)	Deviator stress $\sigma'_1 - \sigma'_3$ (kN/ m^2)	Major normal stress σ'_1 (kN/ m^2)
A	20	150	170
B	80	160	240
C	245	195	440

QUESTION 2

SOALAN 2

CLO1 C2

(a) Explain clearly **THREE (3)** modes of shear failure in shallow foundations design.
*Terangkan dengan jelas **TIGA (3)** jenis mod kegagalan ricih dalam merekabentuk asas cetek.*

[8 marks]
[8 markah]

CLO2 C3

(b) A square foundation is 1.5 m x 1.5 m in plan. The soil supporting the foundation has a friction angle Ø= 20°, and soil cohesion, c'= 15.2 kN/m^2. The unit weight of soil, γ, is 17.8 kN/m^3. Calculate the allowable gross load on the foundation with a factor of safety (FS) of 4. Assume that the depth of the foundation (D_f) is 1 meter.
Sebuah asas segiempat sama berukuran 1.5 m x 1.5 m di atas pelan. Tanah yang menanggung asas tersebut mempunyai sudut geseran tanah, Ø= 20°, dan kejelekitan, c'= 15.2 kN/m^2. Berat unit tentu tanah, γ, ialah 17.8 kN/m^3. Kirakan kekuatan galas dibenarkan ke atas asas dengan faktor keselamatan sebanyak 4. Buat andaian bahawa kedalaman asas (D_f) ialah 1 meter.

[9 marks]
[9 markah]

CLO2 C4

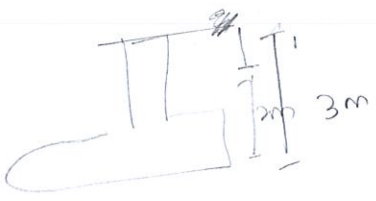
(c) A square foundation with a depth of 3.0 meter is located in granular soil with unit weight of 18 kN/m^3. The foundation is design to carry a 200 kN load with factor of safety of 3.0. Determine the size of foundation if the ground water table is located 1 meter below the ground level. Given :

Ø= 35° γ_{sat} = 20 kN/m^3

Sebuah asas segiempat sama berkedalaman 3.0 meter terletak di atas tanah berpasir dengan berat unit tentu 18 kN/m^3. Asas tersebut akan menanggung beban sebanyak 200 kN dengan faktor keselamatan sebanyak 3.0. Tentukan saiz asas tersebut sekiranya aras air bumi terletak pada kedalaman 1 meter di bawah permukaan tanah. Diberi :

Ø= 35° γ_{sat} = 20 kN/m^3

[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 only.

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

CLO2
C3

QUESTION 1
SOALAN 1

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

Satu sampel tanah dengan berat 48 kg dan isipadu sebanyak 0.026 m^3. Selepas dikeringkan di dalam oven selama 24 jam, beratnya berkurang menjadi 39 kg. Diberi nilai G_S 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 :

Table 1b / *Jadual 1b*

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

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. Calculate:

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. Kirakan:

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 surface sand. Given 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. Diberi berat unit tepu tanah pasir ialah 30 kN/m^3.

[9 marks]
[9 markah]

CLO2
C4

(b) A retaining wall built during the excavation carried out as shown in **Figure 2b** to bear two soil layers behind it. Regardless of passive pressure in front of the retaining wall.

*Sebuah tembok penahan di bina semasa kerja pengorekan dijalankan seperti dalam **Rajah 2b** untuk menanggung dua lapisan tanah di belakangnya. Dengan mengabaikan tekanan pasif dihadapan tembok penahan tersebut.*

i. Draw the active side pressure 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.

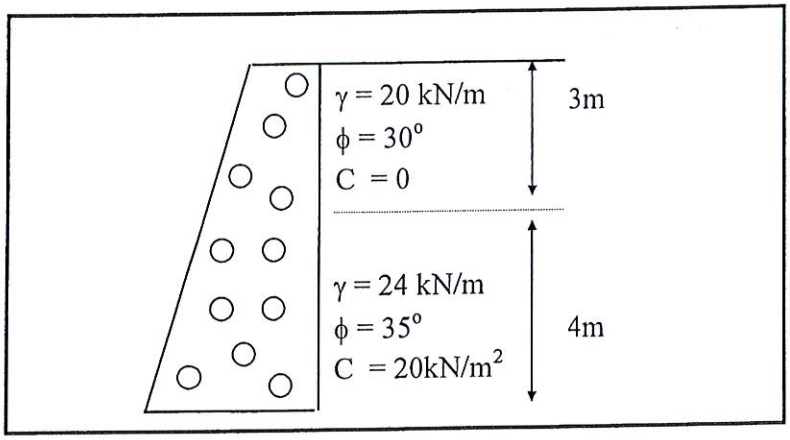


Figure 2b / *Rajah 2b*

[10 marks]
[10 markah]

QUESTION 3

SOALAN 3

CLO2
C3

(a) A cut 13m deep is to be made in clay with a unit weight of 19 kN/m^3 and a cohesion of 30 kN/m^3. A hard stratum exists at a depth of 26m below the ground surface.
Satu cerun bertanah liat dibuat sedalam 13m dengan berat unitnya 19 kN/m^3 dan kejelekitannya 30 kN/m^3. Tanah keras dijumpai sedalam 26m dari permukaan tanah.

(i) By using the Taylor's Charts, determine whether the 20° slope is safe.
Dengan menggunakan Carta Taylor, tentukan sama ada cerun 20° adalah selamat.

[7 marks]
[7 markah]

(ii) If factor of safety of 1.5 is desired, calculate the safe angle of slope.
Sekiranya faktor keselamatan 1.5 diperlukan, kirakan sudut yang selamat bagi cerun tersebut.

[3 marks]
[3 markah]

CLO2
C4

(b) For the **Figure 3b** and **Table 3b** below, determine the factor of safety for the slope by using Fellenius slices method.
*Untuk **Rajah 3b** dan **Jadual 3b** di bawah, tentukan faktor keselamatan cerun dengan menggunakan kaedah hirisan Fellenius.*

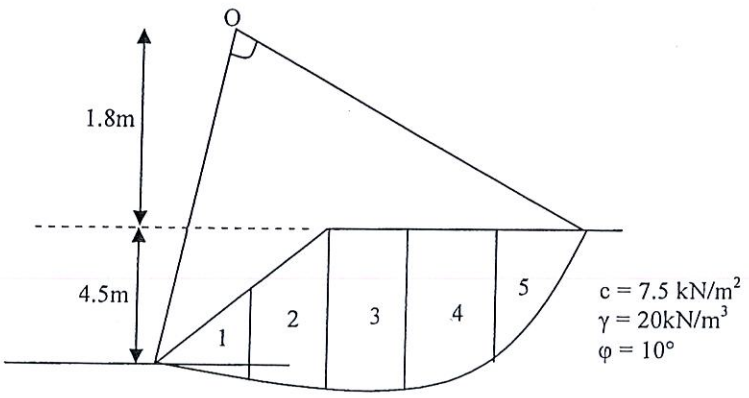


Figure 3b / *Rajah 3b*

Given the width for every slice is 4 m.

Diberi lebar setiap hirisan ialah 4 m.

Table 3b / *Jadual 3b*

Slices *Hirisan*	α	Z (m)
1	-5	2.8
2	3	4.7
3	16	5.6
4	23	4.9
5	38	3.5

[15 marks]

[15 markah]

QUESTION 4

SOALAN 4

CLO2 C3 (a) Explain how the seepage flow in the soil.

Terangkan bagaimana aliran resipan berlaku dalam tanah.

[15 marks]

[15 markah]

CLO2 C4 (b) **Figure 4a** show the flow net under the sheet pile. If the soil permeability coefficient is 7.5×10^{-2} mm/s. Calculate permeability of water loss in m^3/hour/m length and pore water pressure at P and Q .

Rajah 4a *menunjukkan jaringan aliran yang berlaku di bawah asas cerucuk. Sekiranya pekali ketelapan tanah adalah* 7.5×10^{-2} *mm/s. Kirakan kehilangan air kebolehterlapan dalam unit* m^3*/jam/m panjang dan tekanan air liang pada titik P dan Q.*

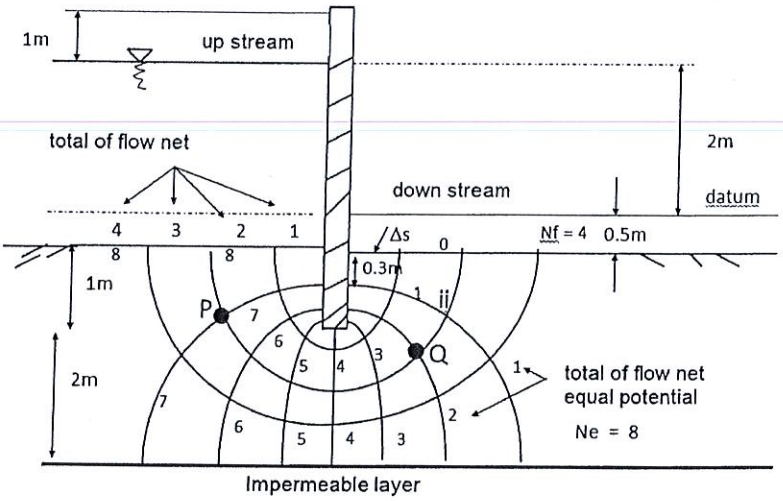


Figure 4a / *Rajah 4a*

[10 marks]

[10 markah]

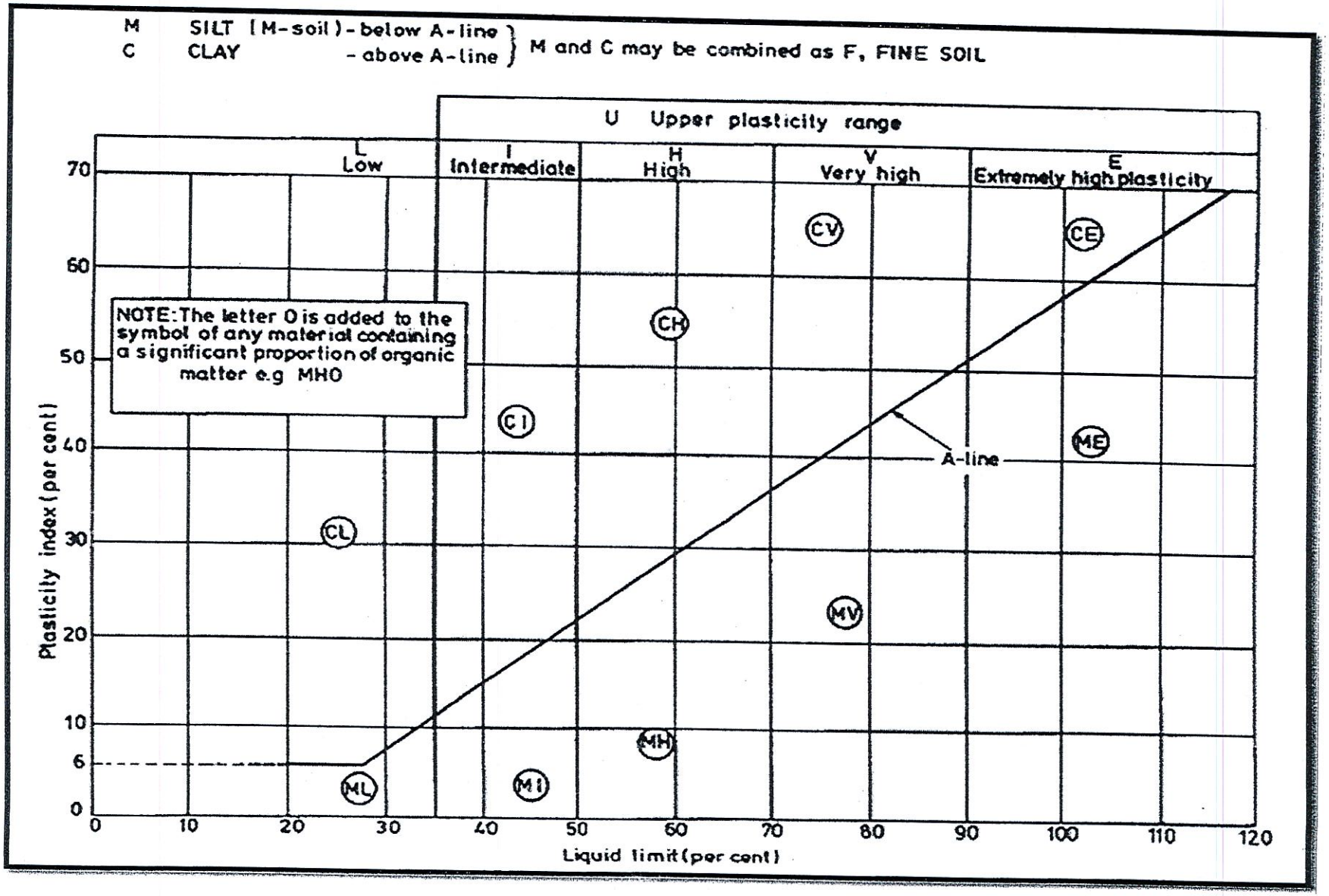
SOALAN TAMAT

BEARING CAPACITY FACTORS FOR GENERAL SHEAR

ANGLE OF FRICTION	TERZAGHI			MEYERHOF			HANSEN		
ϕ (DEGREES)	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

BEARING CAPACITY FACTORS FOR GENERAL SHEAR

PLASTICITY CHART – CARTA KEPLASTIKAN



RUMUS DCC 3103 – GEOTECHNICAL ENGINEERING

1. $V_t = V_s + V_v = V_s + V_w + V_a$
2. $G_s = \frac{m_s}{V_s \rho_w}$
3. $\rho_d = \frac{\rho b}{1+w}$
4. $\rho_b = \frac{Ms(1+w)}{v}$
5. $\rho_b = \frac{Gs\rho w(1+w)}{1+e}$
6. $\rho_d = \frac{Gs\rho w}{1+e}$
7. $S = \frac{wGs}{e}$
8. $\rho_{sat} = \frac{\rho w(Gs+e)}{1+e}$
9. $\rho_d = \frac{G_s \rho_w (1-A_r)}{(1+\omega G_s)}$
10. $n = \frac{e}{1+e}$

1. $Q = KH \frac{Nf}{Ne}$
2. $\sigma_a = Ka\,(q + \gamma z) - 2C\sqrt{Ka}$
3. $Ka = \frac{1 - \sin \emptyset}{1 + \sin \emptyset}$
4. $\sigma_p = Kp\,(q + \gamma z) + 2C\sqrt{Kp}$
5. $Kp = \frac{1 + \sin \emptyset}{1 - \sin \emptyset}$
6. $Ka = \frac{\cos \beta - \sqrt{\cos^2 \beta - \cos^2 \emptyset}}{\cos \beta + \sqrt{\cos^2 \beta - \cos^2 \emptyset}}$
7. $P = \frac{Rv}{B}\left(1 \pm \frac{6e}{B}\right)$
8. $F.K = \frac{Rv \tan \delta}{Rh}$
9. $F.K = \frac{CuR^2\theta}{Wd}$
10. $F.K = \frac{Rv \times (B - \bar{x})}{Rh \times \bar{y}}$
11. $hc = \frac{2C}{\gamma\sqrt{Ka}}$
12. $N = \frac{\gamma z}{Cu}$

17. $\sigma = \rho g h = \gamma h$
18. $\sigma = \sigma' + u$
19. $u = \gamma_w h$

13. $F.K = \frac{\sum CL + \sum W \cos \alpha (\tan \emptyset)}{\sum W \sin \alpha}$
14. $F.K = \frac{\sum CL + (\sum W \cos \alpha - \sum UL)\tan \emptyset}{\sum W \sin \alpha}$

CARTA KESTABILAN TAYLOR