# POLiTEKNiK
## MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

CC502 : GEOTECHNICS 2

TARIKH : 3 NOVEMBER 2015
MASA : 2.30 PM – 4.30 PM (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Soalan Pendek (10 soalan)
Bahagian B: Soalan Struktur (4 soalan)
Dokumen sokongan yang disertakan : Kertas Graf, Formula

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

## SECTION A : 40 MARKS
*BAHAGIAN A : 40 MARKAH*

**INSTRUCTION:**

This section consists of **TEN (10)** short questions. Answer **ALL** questions.

*ARAHAN:*

*Bahagian ini mengandungi SEPULUH (10) soalan pendek. Jawab SEMUA soalan.*

CLO1
C1

**QUESTION 1**

*SOALAN 1*

List down **FOUR (4)** information that can be gathered from a subsurface exploration of a site investigation.

*Senaraikan EMPAT (4) maklumat yang boleh dikumpul daripada penerokaan sub-permukaan tanah dalam Penyiasatan Tapak.*

[4 marks]

[*4 markah*]

CLO1
C2

**QUESTION 2**

*SOALAN 2*

Explain the functions of Hand Auger.

*Terangkan fungsi gerimit tangan.*

[4 marks]

[*4 markah*]

CLO1
C1

**QUESTION 3**

*SOALAN 3*

Flow net can represent the seepage under the dam. Sketch a flow net for the sheet pile and label flow line and equipotential line.

*Jaringan aliran boleh mewakili kadar resipan di bawah empangan. Lukiskan jaringan aliran untuk cerucuk keping dan labelkan garis aliran dan garis sama upaya.*

[4 marks]

[*4 markah*]

CLO1
C3

**QUESTION 4**

*SOALAN 4*

One form of slope failure is the failure of flow. Provide a brief description of this type of failure.

*Salah satu bentuk kegagalan cerun adalah kegagalan aliran, huraikan dengan ringkas jenis kegagalan ini.*

[4 marks]

[*4 markah*]

CLO1
C1

**QUESTION 5**

*SOALAN 5*

List down **FOUR (4)** types of slope failure.

*Senaraikan EMPAT (4) jenis kegagalan cerun.*

[4 marks]

[*4 markah*]

CLO1
C1

**QUESTION 6**

*SOALAN 6*

Draw **TWO (2)** types of shallow foundation .

*Lukiskan DUA(2) contoh asas cetek.*

[4 marks]

[*4 markah*]

CLO1
C2

**QUESTION 7**

*SOALAN 7*

Describe the differences between shallow foundation and deep foundation.

*Nyatakan perbezaan antara asas cetek dan asas dalam.*

[4 marks]

[*4 markah*]

CLO1
C1

**QUESTION 8**

*SOALAN 8*

List down **FOUR (4)** factors that can influence bearing capacity in shallow foundation design.

*Senaraikan EMPAT(4) faktor yang mempengaruhi keupayaan galas dalam reka bentuk asas cetek.*

[4 marks]

[*4 markah*]

CLO1
C1

**QUESTION 9**

*SOALAN 9*

State **TWO (2)** reasons Pile Load Test is required for the design of piles.

*Nyatakan DUA (2) sebab Ujian Beban Cerucuk diperlukan dalam reka bentuk cerucuk.*

[4 marks]

[*4 markah*]

CLO1
C2

**QUESTION 10**

*SOALAN 10*

Identify **FOUR (4)** circumstances in selection of piles for a project.

*Kenal pasti EMPAT (4) keadaan dalam pemilihan cerucuk untuk sesuatu projek.*

[4 marks]

[*4 markah*]

## SECTION B : 60 MARKS
### *BAHAGIAN B : 60 MARKAH*

### INSTRUCTION:
This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

### *ARAHAN:*
*Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab TIGA (3) soalan sahaja.*

CLO2
C4

## QUESTION 1
### *SOALAN 1*

A concrete dam with a sheet pile impounds water to a height of 10m as shown in **Figure B1**. Make a sketch of a flow net for seepage under the concrete dam by using 1cm : 2m scale. Determine the seepage discharge in $m^3$/hr/m length if the soil beneath ground level has a permeability of $2.15 \times 10^{-3}$ mm/sec. Calculate pore water pressure at point X, assuming datum from upstream.

*Empangan konkrit dengan cerucuk keping seperti Rajah B1 menampung air setinggi 10m. Lakarkan jaringan aliran bagi resipan di bawah empangan konkrit dengan menggunakan skala 1cm : 2m. Tentukan kadaralir resipan dalam unit $m^3$/jam/m panjang jika diberi pekali kebolehtelapan tanah of $2.15 \times 10^{-3}$ mm/s. Kirakan juga tekanan liang tanah pada point X, dengan andaian datum adalah dari hilir empangan.*
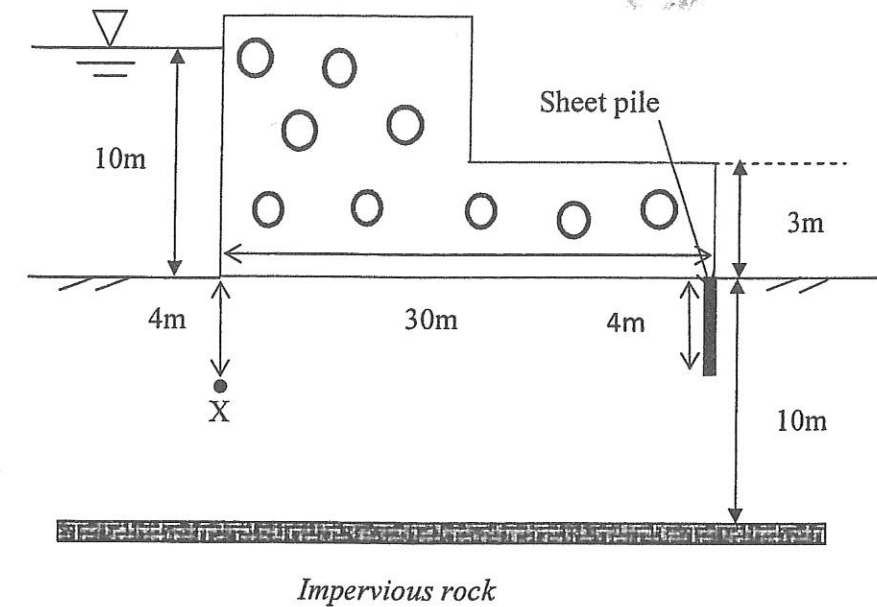
[20 marks]

*[20 markah]*



Figure B1

Rajah B1

CLO2
C4

## QUESTION 2
### *SOALAN 2*

Based on the information given in **Table B2**, calculate the safety of the slope and determine if the slope is safe or not.

*Berdasarkan kepada Jadual B2, kira faktor keselamatan bagi cerun tersebut dan semak sama ada cerun tersebut selamat atau tidak.*

The properties of soil are :
*Ciri-ciri tanah adalah seperti berikut :*

$$C = 20 \text{ kN/m}^2, \quad \gamma = 20 \text{ kN/m}^3 \quad ; \quad \phi = 15^0$$

Table B2

*Jadual B2*

| No of slice/ No hirisan | α | Z(m) | b(m) |
|---|---|---|---|
| 1 | 3 | 0.5 | 1.0 |
| 2 | $10^0$ | 1.3 | 1.0 |
| 3 | $16^0$ | 2.1 | 1.0 |
| 4 | $23^0$ | 2.8 | 1.0 |
| 5 | $30^0$ | 3.3 | 1.0 |
| 6 | $37^0$ | 3.1 | 1.0 |
| 7 | $46^0$ | 2.2 | 1.0 |
| 8 | $55^0$ | 0.95 | 1.0 |

[20 marks]

[20 markah]

## QUESTION 3

*SOALAN 3*

A retaining wall of 6 m high with a vertical back face retains a homogeneous saturated soft clay. The saturated unit weight of the clay is 30 kN/m$^3$ and the angle of friction of soil is $30^0$. Laboratory test showed that the undrained shear strength,$c_u$ of the clay is 16.8 kN/m$^2$.

*Sebuah tembok penahan tegak setinggi 6 m dengan permukaan mendatar menahan tanah liat lembut tepu. Berat unit tepu bagi tanah liat ialah 30 kN/m$^3$ dan sudut geseran tanah ialah $30^0$. Ujian di makmal menunjukkan kekuatan ricih tak tersalir,$c_u$ bagi tanah liat ialah       16.8 kN/m$^2$.*

CLO2
C3

a) Calculate the depth up to which a tensile crack can occur.

   *Kira kedalaman retak tegangan.*

[4 marks]

[4 markah]

CLO2
C3

b) Sketch and calculate the distribution of Rankine's active pressure on the wall with depth.

   *Lakarkan dan kira kedalaman taburan tekanan aktif Rankine yang bertindak di belakang tembok mengikut kedalaman.*

[8 marks]

[8 markah]

CLO2
C4

c) Determine the total active force per unit length of the wall before the tensile crack occurs.

   *Tentukan jumlah tujah aktif per unit panjang sebelum retak tegangan berlaku.*

[4 marks]

[4 markah]

CLO2
C4

d) Determine the total active force per unit length of the wall after the tensile crack occurs.

   *Tentukan jumlah tujah aktif per unit panjang selepas retak tegangan berlaku.*

[4marks]

[4 markah]

CLO2
C4

# QUESTION 4

## SOALAN 4

A strip footing is to be placed at a depth of 1.2 m below ground level. The footing will carry a total load of 600 kN/m. Determine the size of footing using a factor of safety of 3.

*Satu asas jalur berada pada kedalaman 1.2 m di bawah aras tanah. Asas tersebut akan menanggung beban sebanyak 600 kN/m. Tentukan saiz asas (B) tersebut menggunakan faktor keselamatan 3.*

Given : $\emptyset = 32^\circ$ ; $C = 15 \text{ kN/m}^2$ ; $\gamma = 18 \text{ kN/m}^3$

Diberi : $\emptyset = 32^\circ$ ; $C = 15 \text{ kN/m}^2$ ; $\gamma = 18 \text{ kN/m}^3$

[20 marks]

[*20 markah*]

**SOALAN TAMAT**

## LAMPIRAN FORMULA (CC502 – GEOTECHNICS 2)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

| Slope, α | 30 | 6 | 90 | 120 | 150 | 180 |
|---|---|---|---|---|---|---|
| $\dfrac{\Delta a}{a + \Delta a}$ | 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**

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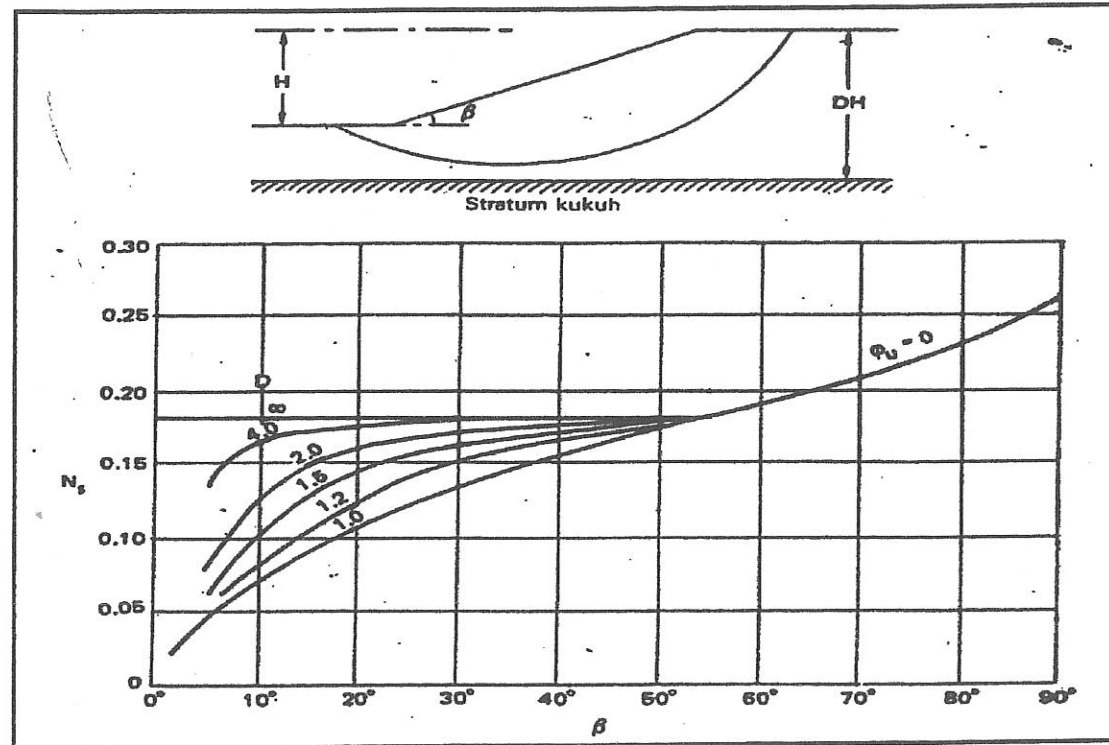
### Taylor Stabilization Chart

## BEARING CAPACITY FACTORS FOR GENERAL SHEAR

| ANGLE OF FRICTION φ (DEGREES) | TERZAGHI | | | MEYERHOF | | | HANSEN | | |
|---|---|---|---|---|---|---|---|---|---|
| | $N_c$ | $N_q$ | $N_\gamma$ | $N_c$ | $N_q$ | $N_\gamma$ | $N_c$ | $N_q$ | $N_\gamma$ |
| 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 | 388.61 |
| 50 | 347.51 | 415.15 | 1153.15 | 266.88 | 319.06 | 873.86 | 266.88 | 319.06 | 568.57 |