UNIVERSITE DE TLEMCEN
DEPARTEMENT D'HYDRAULIQUE
LICENCE : L3 HYDRAULIQUE
MATIERE : MECANIQUE DES SOLS : HS522

Corrigé d'Examen MDS (HS522)

Exercice 1 (03 pts)

1) $$\frac{e}{1+e} = \frac{\frac{V_v}{V_s}}{1+\frac{V_v}{V_s}} = \frac{\frac{V_v}{V_s}}{\frac{V_s+V_v}{V_s}} = \frac{V_v}{V} = n$$

$$\Rightarrow n = \frac{e}{1+e} \qquad (1)$$

2) $$\frac{Sr.e.\gamma_w}{\omega} = \frac{\frac{V_w}{V_v}\cdot\frac{V_v}{V_s}\cdot\frac{W_w}{V_w}}{\frac{W_w}{W_s}}$$

$$= \frac{\frac{W_w}{V_s}}{\frac{W_w}{W_s}} = \frac{W_w}{V_s}\times\frac{W_s}{W_w} = \frac{W_s}{V_s} = \gamma_s$$

$$\Rightarrow \gamma_s = \frac{Sr.e.\gamma_w}{\omega} \qquad (1)$$

3) $$\frac{\gamma}{1+\omega} = \frac{\frac{W}{V}}{1+\frac{W_w}{W_s}} = \frac{\frac{W}{V}}{\frac{W_s+W_w}{W_s}} = \frac{\frac{W}{V}}{\frac{W}{W_s}}$$

$$= \frac{W}{V}\times\frac{W_s}{W} = \frac{W_s}{V} = \gamma_d$$

$$\Rightarrow \gamma_d = \frac{\gamma}{1+\omega} \qquad (1)$$

Exercice 2 (6 pts)

1) $M_w = 180 - 150 = 30g$ (0,5)

$W_w = 30 \times 10^{-3} \times 9,81 = 0,2943\ N$ (0,5)

2) $w = \frac{W_w}{W_s} = \frac{0,2943}{150 \times 10^{-3} \times 9,81} = \frac{0,2943}{1,4715}$

$= 0,20 = 20\%$ (1)

3) $G_s = \frac{\gamma_s}{\gamma_w} = 2,7 \Rightarrow \gamma_s = 2,7 \times 9810 = 26487\ \frac{N}{m^3}$

$\gamma_s = \frac{W_s}{V_s} \Rightarrow V_s = \frac{W_s}{\gamma_s} = \frac{1,4715}{26487} = 55,56 \times 10^{-6}\ m^3$

$= 55,56\ cm^3$ (1)

4) $V_v = V - V_s = 95 - 55,6 = 39,44\ cm^3$ (1)

5) $\gamma = \frac{W}{V} = \frac{180 \times 10^{-3} \times 9,81}{95 \times 10^{-6}} = \frac{1,7658}{95.10^{-6}}$

$= 18587\ N/m^3 = 18,587\ kN/m^3$

$G = \frac{\gamma}{\gamma_w} = \frac{18587}{9810} = 1,8946$ (1)

6) $\gamma_d = \frac{W_s}{V}$

$= \frac{1,4715}{95 \times 10^{-6}} = 15489\ N/m^3 = 15,489\ \frac{kN}{m^3}$

$G_d = \frac{\gamma_d}{\gamma_w} = \frac{15489}{9810} = 1,5789$ (1)

Exercice 3 (4 pts)

1) $n = \frac{e}{1+e} = \frac{0,65}{1+0,65} = 0,394 = 39,4\%$ (1)

2) $n = \frac{V_V}{V} \Rightarrow V_V = n.V = 0,394 \times 1,20 = 0,473 m^3$ (1)

3) $V_S = V - V_V = 1,20 - 0,473 = 0,727 m^3$ (1)

4) Lorsque le sol est compacté la porosité diminue et la densité sèche augmente (1)

Exercice 4 (2,5 pts)

1) $\gamma_s = \frac{S_r . e . \gamma_w}{\omega} \Rightarrow S_r = \frac{\gamma_s . \omega}{e . \gamma_w} = \frac{G_s . \omega}{e}$

$S_r = \frac{2,7 \times 0,20}{0,80} = 0,675 = 67,5\%$ (1)

2) Sol partiellement saturé (1)

3) Lorsque la teneur en eau augmente le degré de saturation augmente. (0,5)

Exercice 5 (2 pts)

$$K = \frac{V \cdot L}{\Delta H \cdot A \cdot \Delta t} = \frac{450 \times 15}{30 \times 50 \times (5 \times 60)}$$

$$= 0{,}015 \text{ cm/s} = 1{,}5 \times 10^{-4} \text{ m/s} \quad (2)$$

Exercice 6 (2,5 pts)

1) $$K_H = \frac{\sum_i K_i H_i}{\sum H_i} = \frac{(2 \times 10^{-4}) + (3 \times 10^{-6}) + (1 \times 10^{-2})}{2 + 3 + 1}$$

$$K_H = 1{,}7 \times 10^{-3} \text{ m/s} \quad (1)$$

2) $$K_V = \frac{H}{\sum_i \frac{H_i}{K_i}} = \frac{6}{\frac{2}{10^{-4}} + \frac{3}{10^{-6}} + \frac{1}{10^{-2}}}$$

$$K_V = 2 \times 10^{-6} \text{ m/s} \quad (1)$$

3) $K_H >> K_V$

la perméabilité horizontale est beaucoup plus grande que la perméabilité verticale (plus que 1000 fois) car la couche peu perméable (10^{-6}) constitue un écran pour l'écoulement vertical

(0,5)