本試題雙面印刷

1. [20%] For the stressed soil element shown in the Figure, determine
   (a). Major principal stress and minor principal stress
   (b). Normal and shear stresses on the plane *AE*
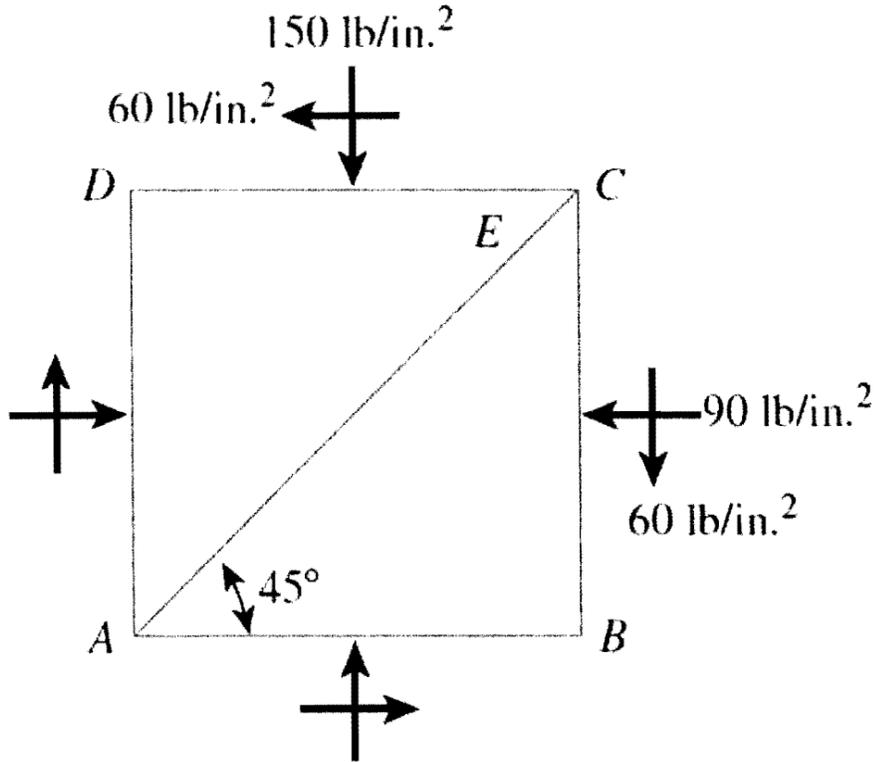
2. [15%] Following are the results of four drained direct shear tests on an *overconsolidated clay:*

    Diameter of specimen = 50 mm

    Height of specimen = 25 mm

Determine the peak friction angle and cohesion according to Mohr-Coulomb criterion.

Test no.	Normal force, N (N)	Shear force at failure, S_{peak} (N)
1	150	157.5
2	250	199.9
3	350	257.6
4	550	363.4

3. [25%] Consider the upward flow of water through a layer of sand in a tank as shown in the following figure. For the sand, the following are given: void ratio (e)= 0.52 and specific gravity of solids = 2.67.　Calculate

(a). The hydraulic gradient of the soil.

(b). The total stress, pore water pressure, and effective stress at points A and B.

(c). The head loss from B to A.
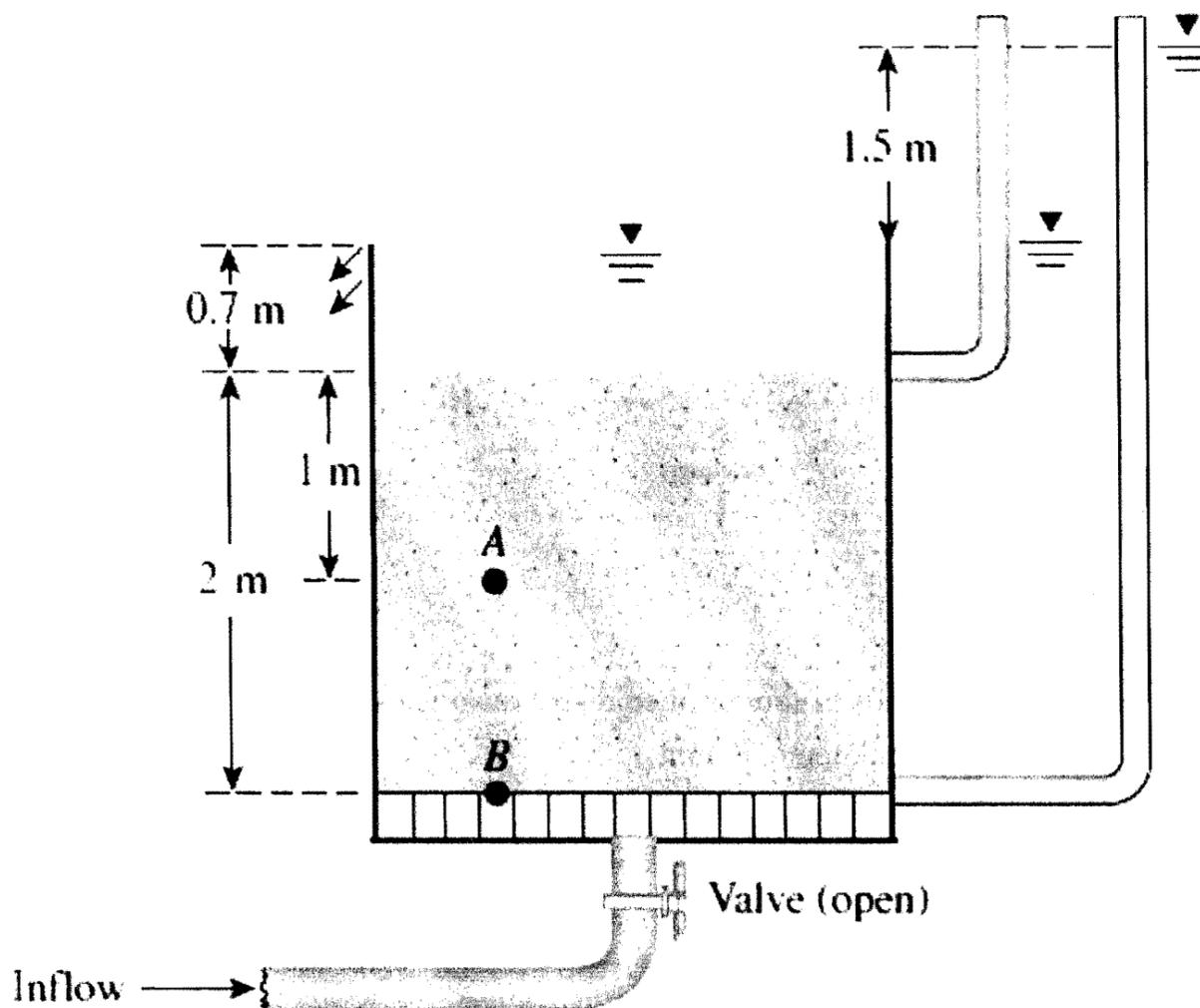
4. [20%] A soil profile is shown in the following figure.　If a uniformly distributed load, $\Delta\sigma$, is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if the preconsolidation pressure $\sigma'_c = 170$ kN/m^2.　(Use $Cs = 0.15Cc$).
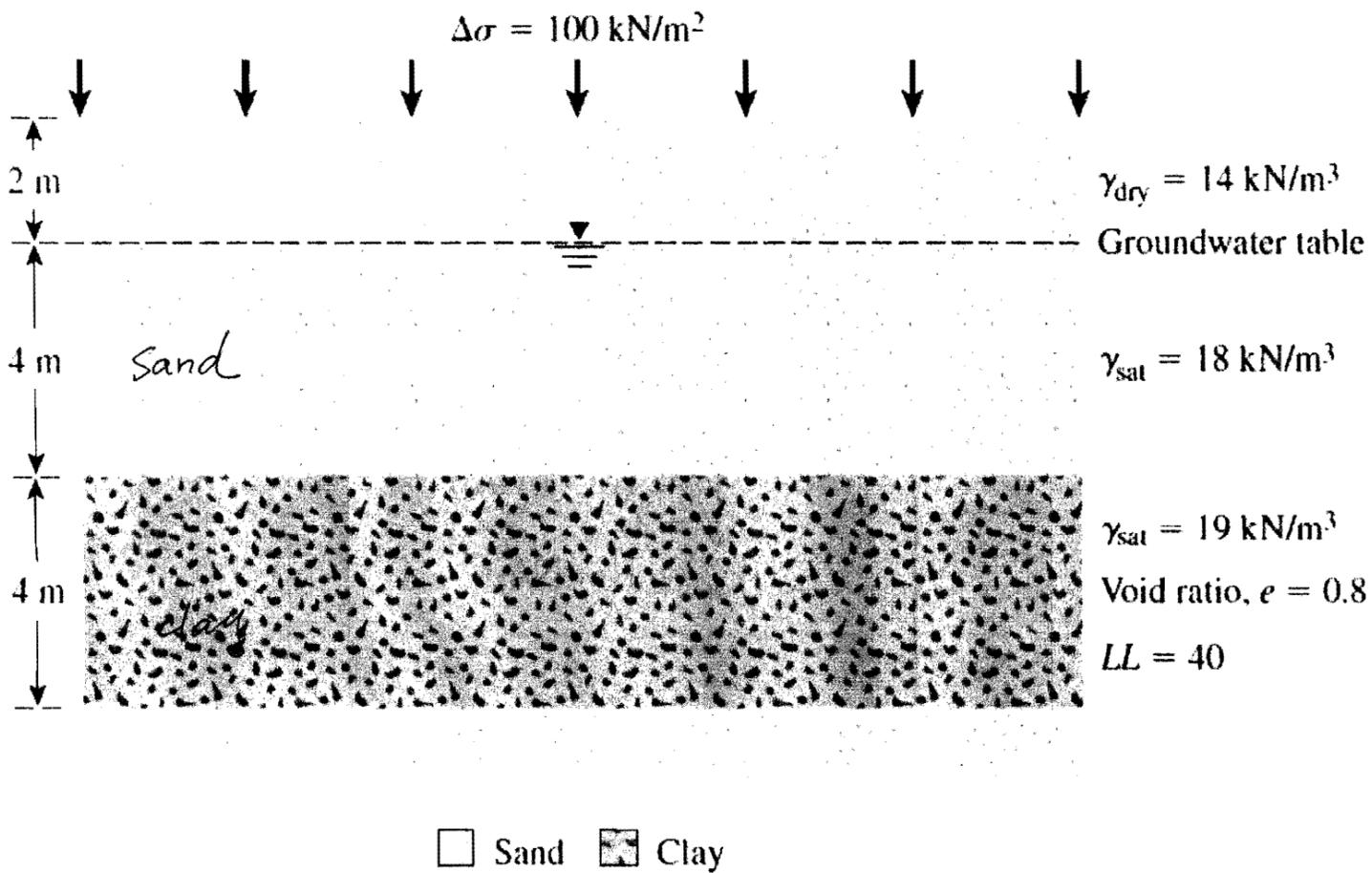
$\Delta\sigma = 100$ kN/m^2

2 m

$\gamma_{dry} = 14$ kN/m^3

Groundwater table

4 m　Sand

$\gamma_{sat} = 18$ kN/m^3

4 m　clay

$\gamma_{sat} = 19$ kN/m^3

Void ratio, $e = 0.8$

$LL = 40$

☐ Sand　▨ Clay

5. [20%] A retaining wall that has a soft, saturated clay backfill is shown in the following figure. For the undrained condition ($\phi = 0$) of the backfill, determine

    (a). The maximum depth of the tensile crack

    (b). The lateral earth pressure-distribution diagram and the active force per unit length of the wall (P_a) after the tensile crack developing.

Soft saturated clay

6 m

$$\gamma = 16.5 \text{ kN/m}^3$$
$$\phi = 0$$
$$c_u = 10 \text{ kN/m}^2$$