Minor Test I
(I Semester 2013 – 2014)
CEL 610 – Foundation Engineering
Department of Civil Engineering
Indian Institute of Technology Delhi

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Time: 01 Hours **Total marks: 20**

(Answer all the questions)

1. Figure 1 gives the grain-size distribution of two soils *A* and *B*. Determine the group symbols and group names of soil *A* and *B* according to the Unified Soil Classification System. The liquid and plastic limits of minus No. 40 sieve fraction of the soil are as follows:

	Soil *A*	Soil *B*
Liquid limit	30	26
Plastic limit	22	20

[2 + 2]

2. If in the Figure 2, soil *X* has a permeability of 4×10^{-3} cm/s and the head loss in soil *Y* is 9 times the head loss in soil *X*,
   (a) What is the permeability of soil *Y* in cm/s?
   (b) What is the quantity of flow in cm^3/s?
   (c) To what elevation would water rise in a piezometer inserted in soil *Y* at Elevation 5 cm?
   [2 + 1 + 2]

3. Derive the expression of the hydraulic gradient of quicksand condition for upward seepage condition [3]

4. A 8 m depth of sand overlies a 6 m layer of clay, below which is an impermeable stratum (Figure 3); the water table is 2 m below the surface of the sand. A 3 m depth of fill of unit weight 20 kN/m^3 is placed on the surface over an extensive area. The saturated unit weight of the sand is 19 kN/m^3 and that of the clay is 20 kN/m^3; above the water table the unit weight of the sand is 17 kN/m^3. For the clay, the relationship between void ratio and effective stress (units kN/m^2) can be represented by the equation:

$$e = 0.88 - 0.32 \log\left(\frac{\sigma'}{100}\right)$$

   Given: For clay, Coefficient of consolidation = 1.26 m^2/year and Compression index = 0.32.
   (a) Calculate the final settlement of the area due to consolidation of the clay.
   (b) Calculate the settlement after a period of 2.5 years after the fill placement. [3 + 2]

5. Derive the relationship between the principal stresses at failure as per the Mohr-Coulomb failure criterion for given material properties c' and ϕ'. [3]

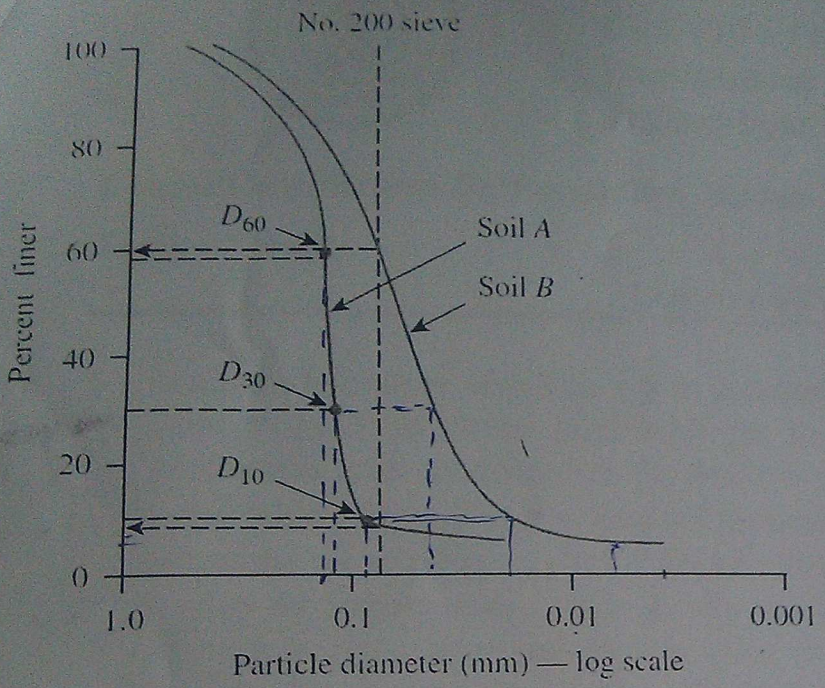

Figure 1

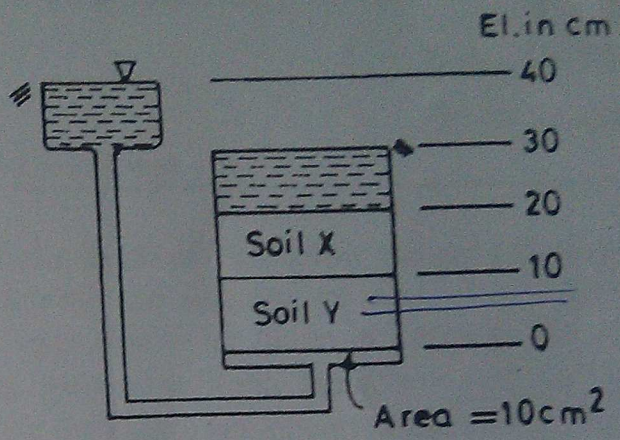

Figure 2