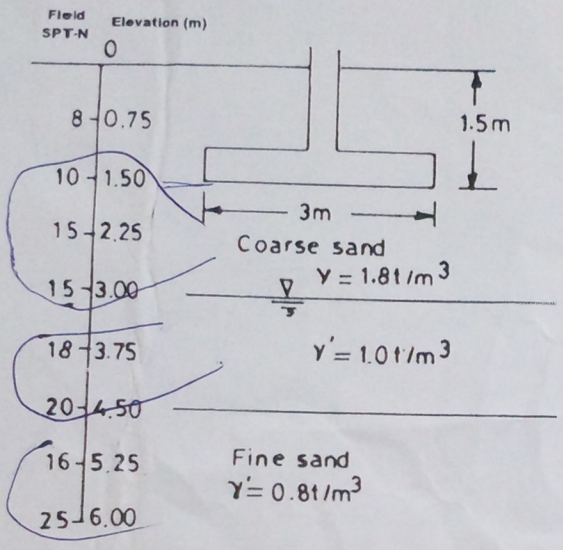

Figure 1

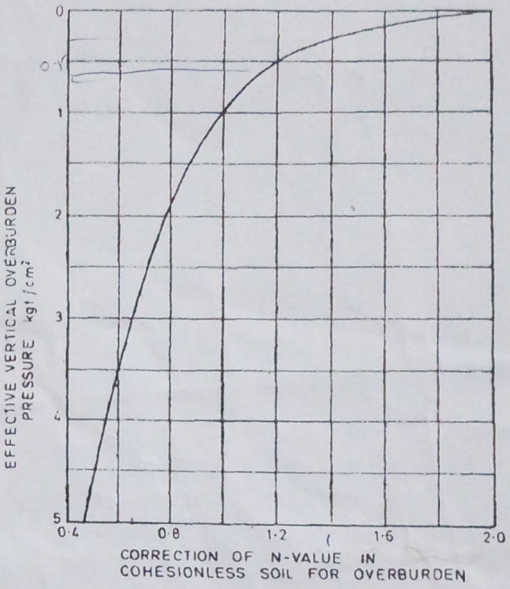

Figure 2

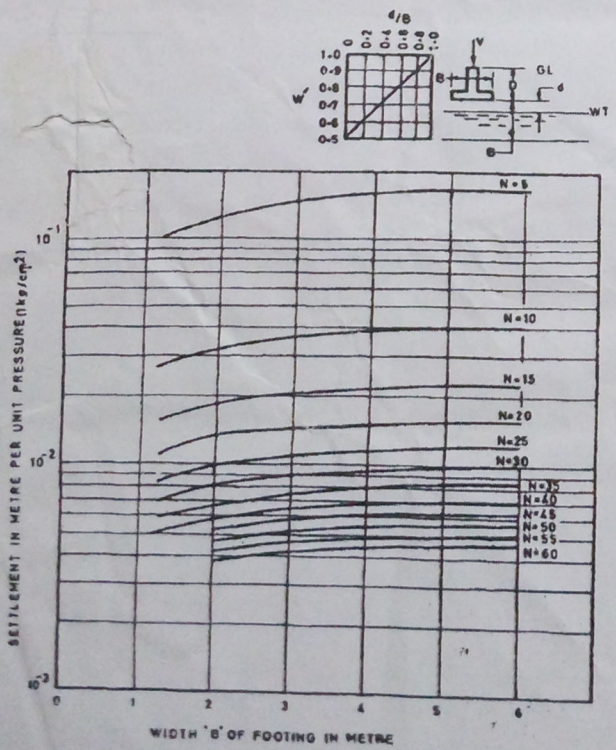

Figure 3

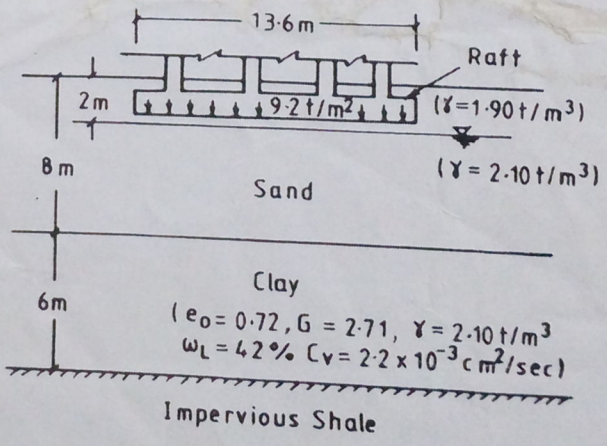

Figure 4

Minor Test I
(II Semester 2014 – 2015)
CEL423 – Design of Foundations and Earth Retaining Structures
Department of Civil Engineering
Indian Institute of Technology Delhi

Time: 01 Hour **Total marks: = 25**

Answer all the questions
Assume suitable data if required

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1. Determine the net safe bearing capacity, safe bearing pressure and net allowable bearing pressure of the footing shown in Figure 1 using IS Code recommendations. Given: Factor of safety = 3, Permissible settlement = 40 mm. The figures of IS codes are given in Figure 2 and Figure 3. [2.5 + 4 + 0.5]

2. A 6 m thick NC clay stratum is overlain by a 8 m thick stratum of coarse sand and is underlain by a impermeable rock as shown in Figure 4. A raft foundation supporting the columns of a building is to be founded at a depth of 1.5 m below ground level. The size of the raft is 8.5 m × 13.6 m and it is loaded uniformly with a stress intensity of 9.2 t/m^2. The water table is located at 2 m below the ground level. The unit weights of sand above and below water table are 1.90 and 2.10 t/m^3 respectively. The properties of the clay are as follows: Initial void ratio = 0.72; Specific gravity = 2.71; Liquid limit = 42 %; Co-efficient of consolidation = 2.2×10^{-3} cm^2/sec. Determine the probable consolidation settlement of the raft. Compute the stress increment by 2 : 1 dispersion method. [5]

3. A building has to be supported on a raft foundation of dimensions 14 m × 21 m. The subsoil is clay which has an average unconfined compressive strength of 1.5 t/m^2. The excavated soil will not going to be replaced since the building will have basement floors. Therefore the pressure on the soil is due to the weight of the building only and the pressure is 14 t/m^2 at the base of the raft. If the unit weight of the excavated soil is 1.9 t/m^2, at what depth should the bottom of the raft be placed to provide a factor of safety of 3 against shear failure. Use Skempton's bearing capacity equation.

Given: $N_c = 5.0\left(1 + 0.2\frac{D_f}{B}\right)\left(1 + 0.2\frac{B}{L}\right)$ for $D_f / B < 2.5$

[4]

4. Load tests were carried out on a 0.3 m square plate and a 0.3 m diameter circular plate on a dense cohesionless sand having a unit weight of 17 kN/m^3. The plates were tested at a depth of 0.6 m below GL. Failure occurred at 10 kN and 7 kN for square and circular plates respectively. What would be the failure load per unit area of 2.0 × 2.0 m square footing. Use Terzaghi's bearing capacity equation. [5]

5. A continuous footing of width 2 m is located at a depth of 1.2 m in a stronger sand. A softer clay layer is located at a depth 1.5 m , measured from the bottom of the foundation. For the top sand layer: Friction angle = 40°, Cohesion = 0, Unit weight = 17.5 kN/m^3. For the bottom clay layer: Friction angle = 0°, Cohesion = 30 kN/m^2, Unit weight = 16.5 kN/m^3. Determine the gross ultimate load per unit length of foundation. [4]