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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MID SEMESTER EXAMINATION -- 2015

B.Tech Civil VI Semester

COURSE CODE: 10B11CE612 MAX. MARKS: 30

COURSE NAME: Foundation Engineering

COURSE CREDITS: 4 MAX. TIME: 2 HRS

Note: *All questions are compulsory. All questions in a section must be done in continuation.*

Section A **(Marks: 6; each question is of 1 mark.)**

1. A 1m x 1m square footing transmits a load of 1000 kN to a depth of 1.5 m. The water table is near the ground surface. Compute the **net load intensity (nli)**. Is the footing a shallow foundation?
2. A foundation must satisfy 3 basic criteria so as to guarantee a satisfactory performance. State the three criteria.
3. What are three components of total vertical settlement in shallow footings? Which component do you need for (a) granular soils, and (b) saturated clays?
4. Design a square footing to support a column load of 80 tonne if nabp = 20 t/m^2.
5. A seamless thin-walled sampler called Shelby tube is often employed in taking undisturbed samples in soft clay deposits. If the tube has OD = 106 mm and ID = 100 mm, what must be the area ratio for the tube. Can the tube take undisturbed samples?
6. If the corrected value of N is 32 for a clay deposit, estimate its consistency and an approximate value of unconfined compressive strength in kPa.

Section B **(Marks: 9; each question carries 3 marks.)**

1. What are the assumptions behind Terzaghi's theory of bearing capacity? Sketch the rupture surface assumed in the theory. What is the approximate depth of the rupture zone? Specialize Terzaghi's bearing capacity equation for square footings on (a) sands, and (b) clays.

2. The **net allowable bearing pressure** (nabp) is commonly called by civil engineers the **bearing capacity** of the ground. Determine nabp if the ultimate bearing capacity = 95 t/m^2 and the safe settlement pressure = 16 t/m^2. The depth of the footing is 1.5 m and F.S. = 3. Unit wt. of soil = 1.85 t/m^3.

P. T. O.

3. The base of a 20 m by 50 m raft applies a stress of 100kN/m² to the soil. The base of the raft rests on dense sand; 4 m below the base is a 2 m thick layer of overconsolidated clay with $m_v = 2 \times 10^{-4}$ m²/kN. Below the clay is more dense sand. Estimate the settlement that will occur due to consolidation in the clay layer.

Section C **(There are 3 questions; each question carries 5 marks.)**

1a. Determine the ultimate bearing capacity of a 2 m wide strip footing placed at a depth of 1.5 m on a dry sand stratum with $\gamma = 18$ kN/m³ and $\varphi = 36°$. The water table is at a great depth. (N_c=63.5, N_q=47.2, N_γ=56.7).

1b. What will be the percent change in the bearing capacity if the water table rises to the base of the footing?

1c. What will be the percent change in the ultimate bearing capacity if the water table rises to the ground surface?

2. A building has to be supported on R.C. raft foundation of dimensions 14 m x 21 m. The soil is clay, which has an average compressive strength of 15 kPa. The pressure on the soil due to the weight of the building and the loads that it will carry will be 140 kPa at the base of the raft. The building has a provision for basement floors. At what depth should the bottom of the raft be placed to provide a factor of safety of 3 against shear failure? Unit weight of the clay is 19 kN/m³. Use Skempton's approach for bearing capacity calculations.

3a. Standard Penetration Test, popularly known as SPT, is the most used field test for soils in India. SPT gives us a very useful number called N. What is N? State N vs. compactness classification for sands.

3b. Calculate the corrected N if the field value in fully submerged fine sand at a depth of 5.5m is 38. The saturated unit weight of soil is 19 kN/m². What is the compactness classification for this deposit?