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Question Paper Code : 77068

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Civil Engineering

CE 6405 – SOIL MECHANICS

(Regulation 2013)

Time: Three hours   Maximum: 100 marks

PART – A   **(10 x 2= 20 marks)**

1. The natural density of soil deposit was found to be 17.5kN/m^3. A sample of the soil was brought to the laboratory and minimum and maximum dry densities were found as 16kN/m^3 and 19kN/m^3 respectively. Calculate the density index for the soil deposit

2. What are the different equipment's available for compacting the soil in field?

3. How do you know that the flow through a soil obey Darcy's law.

4. The internal diameter of tube is 0.1mm. what will be the maximum capillary rise when it is held vertical with bottom end dipped in pure water taken in a trough? Take for water at 20^0, $Ts = 72.8 \times 10^{-6}$ kN/m.

5. Define over consolidated and normally consolidated soil.

6. Compare Boussineque and Westergard analysis of stress distribution.

7. Draw the strength envelope for fully saturated clay subjected to CD test

8. Draw typical stress-strain curve for specimen failed by brittle failure and plastic failure.

9. Differentiate the modes of failure of finite and infinite slopes

10. What is the effect of depth of failure surface on the stability of infinite slope in cohesion less soil.

Part – B (5 x 16 = 80 marks)

11. (a) (i) A soil sample has a diameter of 38.1mm and length of 76.2mm. its wet weight is 1.843N and its dry weight is 1.647 N. if specific gravity of solid is 2.7, find dry unit weight, bulk unit weight, void ratio, water content and degree of saturation. Suppose the diameter was incorrectly measure to be 75.6mm, what would be the resulting error in the computed value of degree of saturation and water content   (08)

     (ii) Explain IS soil classification system for classifying coarse grain soil   (08)

(OR)

(b) (i) Explain various factors influencing compaction behaviour of soil   (08)

(ii) The sieve analysis of soil gave the following result : % passing 75μ sieve = 8, % retained on 4.75mm sieve =35, coefficient of curvature = 2.5, Uniformity coefficient=7. The fine fraction gave the following result: Plasticity index = 3%, Liquidity index=15%. Classify the soil as per IS soil classification system.   (08)

12. (a) (i) The water table in a certain area is at a depth of 4m below the ground surface. To a depth of 15m, the soil consist of very fine sand having an average void ratio of 0.7, Above the water table the sand has an average degree of saturation 50%. Calculate the effective stress on a horizontal plane at a depth of 10m below the ground surface. What will be the change in effective stress if the soil gets saturated by capillarity for a height of 1m above the water table. Take specific Gravity of solids as 2.65   **(08)**

(ii) In a falling head permeability test the length and area of cross section of soil specimen are 0.17m and 21.8×10^{-4} m^2 respectively. Calculate the time required for the head to drop 0.25m to 0.10 m. The area of cross section of stand pipe is 2×10^{-4} m^2. The sample has three layers with permeabilites 3×10^{-5} m/sec for first 0.06m, 4×10^{-5} m/sec for second 0.06m and 6×10^{-5} m/sec for third 0.05m thickness. Assume the flow is taking place perpendicular to the bedding plane.   (08)

(OR)

(b)   (i) A stratum of sandy soil overlies a horizontal bed of impermeable material, the surface of which is also horizontal. In order to determine the insitu permeability of soil, a test well was made upto the bottom of stratum. Two observations boreholes were made at a distance of 12m and 24m respectively from the test well. Water was pumped out from the well at a rate of 180litres/minute until the water level become steady. The height of water in the two boreholes was found to be 4.2m and 6.3m respectively above the impermeable bed. Find the coefficient of permeability of sandy soil   **(10)**

(ii) What is flow net? List the properties of flow net   **(06)**

13. (a) i) A rectangular foundation 1.5m×3m transmit a uniform pressure of 350kN/m^2 to the underlying soil. Determine the vertical stress at a depth of 1.5m below a point within the loaded area 1m away from the short edge and 0.5m away from long edge   **(08)**

(ii) Derive Terzaghi equation of one dimensional consolidation stating clearly the assumption made.   **(08)**

(OR)

(b) (i) Sub surface exploration at the site of a proposed building revealed that the existence of 2.4m thick layer of soft clay below the stratum of coarse sand which is 4m thick and extend from the ground surface upto the top of the clay layer. The ground water table is at 2.5m below the ground surface. Laboratory test indicate that the natural water content of clay as 40%, average liquid limit as 45% and specific gravity of solids as 2.75. The unit weight of sand above and below the water table is $17.8kN/m^3$ and $21kN/m^3$ respectively, Estimate the probable settlement of building, if its construction increases average vertical pressure on the clay layer by 71kpa. **(10)**

(ii) Explain with sketch Taylor $\sqrt{t}$ method for the determination of coefficient of consolidation **(06)**

14. (a) (i) Two identical specimen of clay were tested in a triaxial apparatus. The first specimen failed at a deviator stress of 770kpa, when the cell pressure was 200kpa. While the second specimen failed at a deviator stress of 1370kpa under a cell pressure of 400kpa. Determine the shear strength parameters, Also find the deviator stress at failure when the cell pressure was 600kpa. If the same soil is tested in direct shear apparatus, estimate the shear stress at which the sample will fail under a normal stress of 600kpa. **(10)**

(ii) Explain vane shear test (06)

(OR)

(b) (i) In a triaxial test, a soil specimen was consolidated under a cell pressure of 200kpa and simultaneously a back pressure of 100kpa is applied to saturate the specimen. Thereafter with drainage prevented, the cell pressure was raised to 250kpa resulting in increased pore pressure of 148kpa. Maintain the same cell pressure of 250kpa, now the deviator stress was increased to 170kpa and pore pressure of 220kpa was observed. Calculate the pore pressure parameter A and B **(08)**

(ii) Write the advantages, disadvantages and limitation of direct shear test **(08)**

15.(a) (i) A 45^0 slope has been excavated to a depth of 8m in a saturated clay, which has the following property: C_u =60kN/m^2, Φ_u = 0 and unit weight of 20kN/m^3. Determine the factor of safety for the trial failure surface whose radius is 12m and arc length is 18.84m. The area of the trial wedge is 70m^2 and centre of gravity of the trial wedge is 4.5 m away from the centre of failure surface **(08)**

(ii) Discuss various methods of improving slope stability (08)

(OR)

(b) (i) An infinite slope is made of soil with C'=20kpa, $\Phi'=20^0$, e= 0.65 and G=2.7 is10m high, The slope angle is 25^0. Find the factor of safety with respect to height for the following condition

      1) When the soil is dry

      2) When the slope is submerged **(08)**

(ii) Discuss the stability analysis of slope by Fellenious method (08)