5E1344

Roll No. _____ [Total No. of Pages : 4

5E1344

B.Tech. V- Semester (Main) Examination, Nov. 2019
PCC/PEC Civil Engineering
5CE4-04 Geotechnical Engineering

Time : 3 Hours **Maximum Marks : 120**
Min. Passing Marks : 42

Instructions to Candidates:

*Attempt **all ten** questions from **Part A**, **five** questions out of **Seven** from **Part B** and **Four** questions out of **Five** from **Part C**.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

1. Graph paper (centimeters)

PART - A

(Answer should be given up to **25** words only)

All questions are **compulsory** **(10×2=20)**

1. Define the term 'Soil Mechanics'.
2. State whether the following terms are true or false
   i. The water content of soil can be more than 100%.
   ii. The porosity of soil can be more than 100%.
3. What are the consistency limits of a fine - grained soil?
4. What is quick sand?
5. What are Geostatic stresses?
6. What is an Isobar Diagram?
7. What are normally and over consolidated clays?
8. What are three different types of tri-axial test depending upon different drainage conditions?

9. What do you understand about disturbed and undisturbed soil samples?

10. What is significance of SPT - N value in Geotechnical Engineering?

PART - B

(Analytical/Problem solving questions)

Attempt any five questions (5×8=40)

1. A sample of saturated soil has a water content of 25% and a bulk unit weight of 20 kN/m³. Determine the dry unit weight, void ratio and specific gravity of solids.

2. A falling - head permeability test was performed on a soil sample. One minute was required for the initial head of 100 cm to fall to 50 cm in the stand pipe of X - sectional area 1.50 cm². If the sample was 4 cm in diameter and 30 cm long, calculate the coefficient of permeability of the soil sample.

3. A soil profile consists of a surface layer of clay 4m thick ($\gamma = 19.5 kN/m^3$) and a sand layer 2 m thick ($\gamma = 18.5 kN/m^3$) overlying an impermeable rock. The W.T. is at the ground surface. If the water level in a stand pipe driven into the sand layer rises 2 m above the ground surface. Draw the plot showing the variation of σ, u and σ'. Take $\gamma_w = 10 kN/m^3$.

4. Atterberg limit tests were carried out on soil sample, results are :

   i. Percentage passing 4.75 mm sieve = 60%

   ii. Percentage passing 75 microns sieve = 45%

   iii. Liquid Limit = 40%

   iv. Plasticity index = 10%

   Classify soil according to ISC system.

5. The stresses on a failure plane in a drained test on a cohesionless soil are as : Normal stress (σ) = 100 kN/m² and shear stress (τ) = 40 kN/m². Determine (i) the angle of shearing resistance and the angle which the failure plane makes with the major principal plane. (ii) The major and minor principal stresses.

6. The following results were obtained from a standard compaction test on a sample of soil. The volume of mould used was 1000 ml. Make necessary calculations to plot the compactive curve and from the plot obtain the M.D.D. and the O.M.C.

Water Content (%)	12	14	16	18	20	22
Mass of moist soil (kg)	1.68	1.85	1.91	1.87	1.87	1.85

7. A long strip footing of width 2 m carries a load of 400 kN. Calculate the maximum stress at a depth of 5 m below the centre line of footing. Compare the results with 2:1 load distribution method.

PART - C

(Descriptive/Analytical/Problem Solving/Design Questions)

Attempt any **Four** questions **(4×15=60)**

1. Derive Terzaghi's basic differential equation of 1-D consolidation. Also define degree of consolidation with the help of a sketch of Isocrones. A clay layer 4 m thick is subjected to a pressure of 100 kN/m^2. If the layer has a double drainage and undergoes 50% consolidation in one year,

   i) determine the coefficient of consolidation. Take $T_v = 0.196$. If the coefficient of permeability is 0.020 m/yr,

   ii) determine the settlement in one year and

   iii) rate of flow of water per unit area in one year.

2. What are different types of slope failure? Discuss them briefly. What is a stability number? What is its utility in the analysis of stability of slopes? A vertical cut is to be made in clayey soil ($c = 30kN/m^2$ and $\phi = 0$, $\gamma = 18kN/m^3$). Find the maximum depth of cut for which the cut may be temporarily supported. For $\phi = 0$ and i = 90°, the value of stability number is 0.261.

3. What are the different types of lateral earth pressure? Explain each type with the help of schematic diagrams showing the variation of earth pressure with the wall movement.

   A retaining wall is 7 m high, with its back face smooth and vertical. It retains sand with its surface horizontal. Using Rankine's theory, determine active earth pressure at the base when the backfill is

   i) dry,

   ii) saturated and

   iii) submerged, with W.T. at the surface. Take $\gamma = 18kN/m^3$ and $\phi = 30°$, $\gamma_{sat} = 20kN/m^3$.

4. What are the assumptions made in the derivation of Terzaghi's bearing capacity theory? Sketch failure plane of Terzaghi's analysis with the description of all its zones. Differentiate between the general shear failure and the local shear failure. How the bearing capacity in local shear is determined?

A strip footing 2 m wide is laid at a depth of 1.5 m below the ground surface. Determine the ultimate bearing capacity using Terzaghi's theory for general shear failure, if

i) W.T. is at the base of the footing and

ii) W.T. rises to the ground surface. Take $\gamma or \gamma_{sat} = 20kN/m^3$, $\phi' = 30^o$, $c' = 15kN/m^2$ and $\gamma_w = 10kN/m^3$.

(for $\phi = 30^o$, $N_c = 37.2$, $N_q = 22.5$ and $N_\gamma = 19.7$)

5. Describe plate load test for determining ultimate bearing capacity and settlement of clayey and sandy soils.
