

KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Level : B.E.
Year : III
Time : 2 hrs. 30mins.

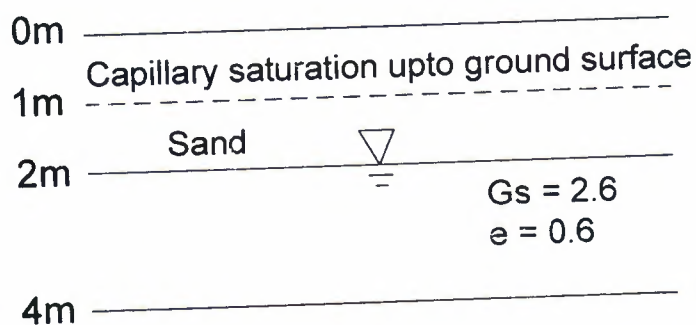
26 JAN 2024

Course : CIEG 303
Semester : I
F. M. : 40

SECTION "B"

Attempt ALL questions. Assume suitable data where necessary.

1. Define flow index and toughness index of soil. A sample of soil with liquid limit of 72.8% was found to have a liquidity index of 1.21 and water content of 81.3%. What are its plastic limit and plasticity index? [2+3]
2. Differentiate between consolidation and compaction of a soil. How can quality control of compaction be assured in the field? Explain. [3+4]
3. A saturated clay stratum 6m thick lies between the two pervious systems. The clay has a compression index of 0.23 and a coefficient of permeability of 3.6×10^{-4} cm/sec. The clay has a void ratio of 2.1 at a stress of 1.6 kg/cm^2 . Determine: [2+3]
 - a. the change in void ratio due to increase of stress to 2.1 kg/cm^2
 - b. Time required for 50% consolidation. Take $T_{50} = 0.197$
4. Determine the Rankine active pressure on a 5m high wall backfilled by a soil with $\phi = 30^\circ, c = 5 \frac{\text{kN}}{\text{m}^2}, \gamma = 17.5 \text{ kN/m}^3$ (a) Before the formation of crack (b) After the formation of crack. [5]
5. For the subsoil conditions containing sand shown in figure below, calculate the effective stress values at 1m, 2m and 4m depths? Draw the stress distributions diagram for total, effective and neutral stresses [7]



6. What can be different causes and remedial measures for slope instability? Explain in detail. [6]
7. What is strike and dip? Also mention the differences between a soil and a rock. [2+3]

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Marks Scored:

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Semester : I

F. M. : 10

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices

- If the liquidity index of the soil is greater than 1, it indicates that the soil is in:
a. Plastic State b. Solid State c. Liquid State d. Semi-solid State
- Which moisture content range is generally considered optimum for achieving maximum compaction in soils?
a. Below the plastic limit b. Between the plastic and liquid limit
c. Above the liquid limit d. At the plastic limit
- Which of the following type of soil is formed by deposition beneath the lake?
a. Lacustrine Soil b. Aeolian Soil c. Colluvium Soil d. Glacial Soil
- Buyoant unit weight equals the saturated density
a. multiplied by unit weight of water b. divided by unit wt. of water
c. plus unit weight of water d. minus unit wt. of water
- What is the angle of internal friction in a soil mass?
a. The angle between the soil particles and the horizontal plane
b. The angle between the soil particles and the vertical plane
c. The angle between the shear stress and the normal stress
d. The angle between the soil particles and the shear plane
- If N_f , N_d and H are total number flow channels, total number of potential drops and total hydraulic head differences respectively, the discharge q through the complete flow is given by
a. $q = \sqrt{H} \cdot \frac{N_f}{N_d}$ b. $q = KH \cdot \frac{N_d}{N_f}$ c. $q = KH \cdot \frac{N_f}{N_d}$ d. $q = KH \cdot \sqrt{\frac{N_f}{N_d}}$
- If the water content of a saturated soil is 40%, and specific gravity of solids is 2.7 then void ratio is
a. 1.04 b. 1.05 c. 1.06 d. 1.08
- The critical height (H_c) or the safe height of the vertical cut without supports can be obtained using
a. $H_c = 4c'/\gamma\sqrt{K_A}$ b. $H_c = 4\gamma\sqrt{K_A}/c'$ c. $H_c = 2\gamma/c'\sqrt{K_A}$ d. $H_c = 4\sqrt{K_A}/\gamma c'$
- What does Darcy's law describe in the context of soil mechanics?
a. Permeability of soils b. Shear Strength of soil
c. Forces acting on soil particles d. Compaction Characteristics

10. The coefficient of compressibility of soil, is the ratio of
 a. stress to strain
 b. strain to stress
 c. stress to settlement
 d. rate of loading to that of settlement
11. The total active pressure after the development of tension cracks is equal to
 a. $\frac{1}{2}\gamma H^2 K_a - 2c'H\sqrt{K_a}$
 b. $\frac{1}{2}\gamma H^2 K_a + 2c'H\sqrt{K_a}$
 c. $\frac{1}{2}\gamma H^2 K_a - 2c'H\sqrt{K_a} - 2\frac{(c')^2}{\gamma}$
 d. $\frac{1}{2}\gamma H^2 K_a - 2c'H\sqrt{K_a} + 2\frac{(c')^2}{\gamma}$
12. The compression index of a soil
 a. decreases with an increase in the liquid limit
 b. increases with an increase in the liquid limit
 c. decreases with an increase in the plastic limit
 d. is not related with liquid limit
13. A vane, 10.8 cm long, 7.2cm diameter was pressed into a soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 48Nm. The shear strength of the clay in kN/m² is
 a. 44.66
 b. 33.77
 c. 55.88
 d. 25.26
14. Which of the following is an example of a metamorphic rock?
 a. Granite
 b. Gneiss
 c. Claystone
 d. Basalt
15. What is the major significance of Mohr-Coloumb failure criterion in soil mechanics?
 a. It describes the relationship between soil density and shear strength
 b. It provides a graphical representation of shear strength
 c. It defines failure envelope for soil under various stress condition
 d. It helps to determine the soil's permeability
16. Which one of the following in triaxial test is also called a Q-test (quick test)?
 a. CD Test
 b. CU test
 c. UU Test
 d. UC test
17. Which of the following test is used to find out the resistance offered by rock to weakening and disintegration?
 a. Point load Test
 b. Slake Durability Test
 c. Seismic Velocity Test
 d. Triaxial Test
18. What is the limiting height of the slope possessing soil with $\gamma = 20\text{kN/m}^3$ and $c=18\text{ kN/m}^2$ if the Taylor's Stability Number is determined as 0.034 and FS =1.5?
 a. 19.61 m
 b. 20.32 m
 c. 18.36 m
 d. 17.64 m
19. In stereographic projection, what is the advantage of equal-area nets?
 a. They preserve angles
 b. They preserve distances
 c. They preserve areas
 d. They preserve shapes
20. In structural geology, what does term "stereonet" refer to?
 a. A type of rock formation
 b. A graphical tool for representing three-dimensional orientations
 c. A type of mineral
 d. A geological time period