KATHMANDU UNIVERSITY
End Semester Examination [C]
June/July 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 303
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 02 JUL 2024

SECTION "A"

[20Q. × 0.5 =10 marks]

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

1. If void ratio is denoted by e, volume of voids is denoted by Vv, volume of solid is denoted by Vs and total volume is denoted by V,
   a. e= V/Vv b. e=Vv/Vs c. e = Vs/Vv d. e= Vs/V

2. For a given soil sample, specific gravity is 2.65, water content is 8%, void ratio is 0.47, calculate degree of saturation
   a. 51 b. 23 c. 10 d. 45

3. As per USCS soil classification what is the range of sand size particles
   a. Smaller than 0.075 mm
   b. Greater than 4.75 mm
   c. Passing through 4.75 mm and retained in 0.075 mm
   d. Passing through 0.075 mm and retained in 0.002 mm

4. In liquid limit test as per IS 2720 (Part V) 1965, the liquid limit is defined as the water content at which number of blows the groove at the bottom closes
   a. 10 blows b. 5 blows c. 25 blows d. 30 blows

5. A sample of soil is pass through the sieve, D_{10}, D_{30} and D_{60} are 0.075, 0.15 and 0.85, calculate C_c
   a. 0.353 b. 0.535 c. 0.255 d. 0.671

6. A cohesive soil sample is provided to you, and you are assigned to find out the percentage of silt and clay, which soil lab test would you carry out?
   a. Mechanical sieve analysis b. Hydrometer test
   c. Atterberg test d. Mechanical sieve and Atterberg test

7. If permeability of a soil in horizontal and vertical direction is represented by k_x and k_y, what is their effective permeability
   a. $k_e=\sqrt{(k_x \times k_y)}$ b. $k_e= k_x \times k_y$ c. $k_e=k_x / k_y$ d. $k_e=k_x + k_y$

8. What change it will bring to the effective stress of a soil, if the water table is lowered by deep pumping?
   a. Remains unchanged b. Decreases
   c. Increases d. Decreases up to 5 m and then increases.

9. The shear strength for saturated clays from unconfined compression test is
   a. Twice the unconfined compression strength
   b. Half the unconfined compression strength
   c. Three times the unconfined compression strength
   d. It is not related to unconfined compression strength

10. If the symbol has the usual meaning, which test is slowest test to run to find out the shear strength parameters of the soil
a. CD b. CU c. UU d. UCS

11. If moist and saturated unit weight of the soil sample is 18 kN/m^3 and 20 kN/m^3. Water table is located 10 m below the ground surface, calculate the effective stress at the depth of 5 m from the ground surface.
a. 90 kPa b. 100 kPa c. 40 kPa d. 50 kPa

12. Rankine's theory of earth pressure assumes that the back of the wall is
a. Rough
b. Rough and Vertical
c. Smooth and Vertical
d. Smooth and Inclined

13. If the effective angle of internal friction is 40°, calculate Rankine active earth pressure coefficient
a. 0.33 b. 0.5 c. 3 d. 0.45

14. Which soil has high degree of permeability
a. Silt
b. Poorly Graded Sand
c. Silty Sand
d. Sandy Silt

15. If the retaining wall is moving away from the backfill, what kind of earth pressure condition it refers to
a. At rest condition
b. At passive condition
c. At Active condition
d. At intact condition

16. Which of the following helps to increase the stability of an existing slope
a. Construction of a road on the crest of the slope
b. By increasing the height of the slope at the same exiting slope gradient
c. Excavation at the toe
d. Construction of the berm at the toe

17. What does primary consolidation of the soil refer to
a. Expulsion of the air from the voids
b. Reduction of the volume of soil mass by a flow of water from the soil voids
c. Reduction of the volume of soil mass by rearrangement of the soil particles
d. Consolidation of soil after the completion of the secondary consolidation

18. Compaction of the cohesion less soil increases
a. Settlement of the soil after the application of the load
b. Permeability of soil mass
c. Shear strength parameters
d. Void ratio of soil mass

19. Flow net can be used to determine
a. Permeability of soil
b. Seepage and permeability only
c. Exit gradient and seepage only
d. Exit gradient, seepage and uplift pressure

20. What is 100% saturated soil referring to
a. Voids filled with water only
b. Voids filled with water and air
c. Voids filled with air only
d. Voids filled with air and solid particles.

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SECTION "B"

Attempt *ALL* questions. Assume suitable data where necessary.

1. Write briefly about the USCS soil classification system, if necessary, please provide the figure. A 50 c.c. volume of moist soil weighs 95 gram. Its dry weight is 75 grams, and the specific gravity of soil is 2.68. Compute the water content, void ratio, porosity and moist unit weight. [1.5 + 3.5 = 5]

2. Define flow lines and equipotential lines with a neat flownet diagram. Also, derive an expression to calculate seepage discharge from a flownet showing the relation between number of potential drops, number of flow channels, permeability of soil and head difference using the Darcy law. [1.5 + 3.5 = 5]

3. A soil profile consists of a surface layer of sand 4.0 m thick (γ = 17kN/m3), an intermediate layer of clay 3.0 m thick (γ = 19 kN/m3), and the bottom layer of gravel 4.0 m thick (γ = 18.5 kN/m3). The water level is at the top of the clay layer. Determine the effective pressure at various levels at the different interface. Also consider the application of surcharge load of 59 kPa on the ground surface. [6]

4. A clay layer 2.5 m thick is below a layer of sand, 4 m in thickness. The clay has compression index (Cc) of 0.22 and moist unit weight of 18 kN/m3. The initial void ratio of clay is 1.30. Calculate the final settlement of clay layer due to an increase in pressure of 30 kN/m2. Also calculate the settlement when the water table rises to the ground surface and the saturated unit weight of clay is 19 kN/m3. Take unit weight of sand as 20 kN/m3 for both cases. [6]

5. A retaining wall of 7.5 m high has two layers of backfill. The soil supported consists of 4.5 m sand with moist unit weight of 17.5 kN/m3 and effective angle of internal friction of 35° overlying saturated sandy clay of unit weight 19.5 kN/m3 and effective angle of internal friction of 30°. Calculate the horizontal force acting on the wall and its point of application. Also, Please draw the neat sketch of the pressure distribution diagram acting on the retaining wall. [8]

6. Define factor of safety based on mechanics of limit equilibrium for slope stability. What are different equilibrium conditions for slope stability. Please compare Swedish circle, Ordinary method slices, Simplified Bishop methods. [1+1+3=5]

7. Distinguish between intact rock and rock mass and write their characteristic. Define strike, strike and dip direction. [2+3=5]