Symbol Number: _____ Invigilator's Sign: _____ Superintendent's Sign: _____

Symbol No. in Words: _____ Code No. [ ]

Faculty: Engineering **Level: Bachelor** **Year/Part: II/II**

Program: Civil Engineering Sample Question **Subject: Soil Mechanics (EG554CE)**

GROUP A (Multiple Choice Questions) **[10x1=10]**

i. Answers should be given by filling the Objective Answer Sheet.
ii. Rough can be done in the main answer sheet
iii. Maximum time of 20 minutes within the total time is given for this group.

Code No. [ ]

1. If the volume of voids is equal to the volume of solids in a soil mass, then the values of porosity and void ratio respectively are.
   a) 1.0 and 0.0 c) 0.5 and 1.0
   b) 0.0 and 1.0 d) 1.0 and 0.5

2. For the given soil, the following are known.
   Percentage passing from 4.75 mm sieve = 62%
   Percentage passing from 75 µm = 4%
   Coefficient of uniformity = 6.5 and Coefficient of curvature = 2.6.
   Classify the soil using the unified soil classification system.
   a) SW c) GC
   b) SC d) GW

3. Which of the following methods is more suitable for the determination of permeability of clayey soil?
   a) Constant head method c) Falling head method
   b) Oedometer test d) Horizontal permeability method

4. There are _____ fundamental building blocks for the clay mineral structures.
   a) 3 c) 4
   b) 5 d) 2

5. The flow net for an earthen dam with a 30 m water depth consists of 25 potential drops and 5 flow channels. The coefficient of permeability of dam material is 0.03 mm/s. The discharge per meter length of the dam is.
   a. 0.00018 m^3/s c) 0.18 m^3/s
   b. 0.0045 m^3/s d) 0.1125 m^3/s

6. Higher density and lower optimum water content is easily achieved by _____
   a. Coarse-grained soil c) Cohesionless soil
   b. Fine-grained soil d) Saturated soil

7. The height of solids method is applicable for _____
   a. only dry specimens c) both saturated and unsaturated samples
   b. only fully saturated specimens d) only partially saturated specimens

8. Which of the following stresses does not have any influence on the strength of a material?
   a. Major principal stress c) Shearing stress
   b. Major principal stress d) Intermediate principal stress

9. Using Boussinesq's stress distribution theory, which one of the following pressure distribution diagrams can be prepared?
   a. Strain isobar
   b. Vertical pressure distribution on a horizontal plane
   c. Vertical pressure distribution on an inclined plane
   d. Pressure distribution diagram on an oblique plane

10. For a clay slope of height 10 m, stability number 0.05, bulk density 20 20kN/m^3, and cohesion 25 kN/m^2, the critical height of the slope will be:
    a. 10 m c) 25 m
    b. 12.5 m d) None of the above

Multiple Choice Questions' Answer Sheet

Marks Secured: _____

In Words: _____

Examiner's Sign: _____ Date: _____

Scrutinizer's Marks: _____

In Words: _____

Scrutinizer's Sign: _____ Date: _____

Corrected Fill: Ⓐ ● Ⓒ Ⓓ

Incorrected Fill: Ⓐ Ⓑ ● Ⓓ

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

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Office of the Controller of Examinations

Budiganga- 4, Morang, Koshi Province, Nepal

Faculty: Engineering **Year/Part: II/II**

Program: Civil Engineering **Level: Bachelor** **F.M.: 50**

Subject: Soil Mechanics (EG554CE) **Time: 3 Hours** **P.M.: 20**

- ✓ *Group A contains Multiple Choice Questions of 10 marks.*
- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary*.

Short answer questions. Attempt any EIGHT from nine questions. (8×2=16)

1. Differentiate between residual and transported soils. What would be a solution to different soil engineering problems?
2. What do you mean by index and engineering properties? Why is it necessary to determine index properties of soil?
3. Classify the given soil according to USCS classification system:
   Percentage of soil passing through sieve no. 200 (0.075 mm) = 40%

   Percentage of soil retained in sieve no. 4 (4.75 mm sieve) = 55%

   The grading characteristics of soil were: D10=1.2mm, D60=3.8mm, and D30=2.6 mm
4. Explain double diffuse layer. Among Kaolinite, Montmorillonite and Illite clay minerals, which one swells the most and why?
5. What is quicksand condition? At site, the initial investigation showed that the soil is cohesive (clay). If you have to determine coefficient of permeability of the soil, which method is most appropriate in laboratory and why?
6. Briefly explain Newmark's Influence Chart. What is the main use of this Chart?
7. Define consolidation settlement, preconsolidation pressure (maximum overburden pressure) and degree of consolidation?
8. What are the differences between drained and undrained shear strength?
9. What are the probable types of failure of slope? Explain remedial measures that can be used to prevent slope failure.

Long answer questions. Attempt any SIX from seven questions. (6×4=24)

10. A field density test was conducted by core cutter method and the following data were obtained.
    Weight of empty core cutter = 22.80 N

    Weight of soil and core cutter = 50.05 N

    Inside diameter of the core cutter = 90.0 mm

    Height of-core-cutter= 180.0 mm

    Weight of wet sample for moisture determination = 0.5405 N

    Weight of oven-dry sample = 0.5112 N

    Specific gravity of soil grains = 2.72

    Determine (i) dry density, (ii) void-ratio, and (iii) degree of saturation.

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11. A The following data refers to a compaction test.

Water content (%)	8.5	12.2	13.75	15.5	18.2	20.2
Weight of wet sample (kg)	1.8	1.94	2.00	2.05	2.03	1.98

If the specific gravity of soil grains was 2.7.

i) Plot the compaction curve and obtain the maximum dry unit weight and the OMC.

ii) Plot the 80% and 100% saturation lines.

iii) Would the 20% air voids curve be the same as the 80% saturation curve?

12. A sand deposit consists of two layers. The top layer is 3m thick (γ =17 kN/m^3) and the bottom layer is 3.5m thick (γ_{sat} = 21 kN/m^3). The water table is at a depth of 4m from the surface and zone of capillary saturation is 1 m above the water table. Draw the diagram showing the variation of total stress, neutral stress (pore water pressure) and effective stress.

13. What is confined and unconfined flow in seepage flow? Prove that flow lines intersect the equipotential line at right angles.

14. What is an Isobar Diagram? Draw Isobar Diagram of 0.1Q. What are the limitations of Boussinesq's theory?

15. A 5 m thick saturated soil layer has a compression index of 0.25 and coefficient of permeability of 3.2x10^{-3} mm/s. If the void ratio is l.9 at vertical stress of 0.15 N/mm^2, calculate the void ratio when the vertical stress is increased to 0.20 N/mm^2. Also calculate settlement due to above stress increase and time required for 65% consolidation.

16. Consolidated undrained (CU) triaxial test was performed for a normally consolidated saturated clay and cell pressure, σ_3= 200kN/m^2, axial stress, σ_1= 550kN/m^2 and pore water pressure, u_w = 80kN/m^2 were measured. For this arrangement,

i) Plot the Mohr circle of stresses in regard to the total stress.

ii) Plot the Mohr circle of stresses in regard to the effective stress.

iii) Assume the condition of normal consolidation and c'=0. Then obtain the value of Φ'.

**** The End ***