ELIZADE UNIVERSITY

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

B.Eng (Civil and Environmental Engrg.) Degree 2nd Semester Examination 2018/2019 Session

CVE 524: Advanced Soil Mechanics **Units: 3** **Time Allowed: 3Hrs**

INSTRUCTION: Answer FOUR Questions

Question 1 (25 marks)

(a) Referring to the Figure Q1 of an embankment. Taking $r_u = 0.25$ and the soil data as c' = 30kN/m^2, $\Phi = 33^o$, $\gamma = 18.0$kN/m^3. Calculate the factor of safety of the slope. Use the necessary data in the Table Q below and the modified Janbu's method. Let F = 1.0. (18 marks)

$$F_s = \frac{1}{\sum W \sin\alpha} \sum \{c'b + W(1 - r_u)\tan\varphi\}. \frac{\sec\alpha}{1 + \frac{\tan\beta \tan\alpha}{F}}$$

Table Q: Data on the Embankment

Slice No	b (m)	Z (m)	α (degrees)
1	4.9	1.0	-23
2	2.5	3.6	-10
3	2.0	4.6	0
4	2.0	5.6	9
5	2.0	6.5	17
6	2.0	6.9	29
7	2.0	8.8	39.5
8	2.5	5.3	49.5
9	1.6	1.6	65.0

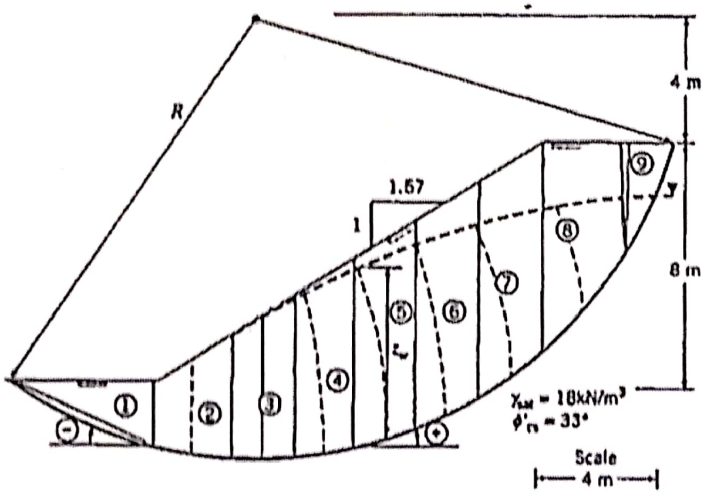

Figure Q1: Earth dam slope

(b) Terzaghi (1925) proposed the first theory to consider the rate of one dimensional consolidation for saturated clay soil based on five assumptions: mention them. (7 marks)

Question 2 (25 marks)

(a) Write short note on each of the following minerals present in clay: kaolinite, montmorillonite and illite minerals. (17 marks)

(b) Write short note on clay water systems. (8 marks)

Question 3 (25 marks)

(a) Two fundamental building blocks are involved in the formation of clay mineral structures. They are tetrahedrah and octahedral units. Describe the mentioned units. (15 marks)

(b) Expalin the concept of unconfined compression test on saturated clay. (10 marks)

Question 4 (25 marks)

(a) The time required for 50% consolidation of a 25mm thick clay layer (drained at both top and bottom) in the laboratory was 2 minutes 20 seconds. How long (in days) will it take for a 3m thick clay layer of the same clay in the field under the same pressure increment to reach 50% consolidation? In the field there is a rock layer at the bottom of the clay. (10 marks)

(b) Explain the operation of vane shear apparatus. (15 marks)

Question 5 (25 marks)

(a) A 3m thick layer (double drainage) of saturated clay under a surcharge loading under went 90% primary consolidation in 75 days. Find the coefficient of consolidation of clay for the pressure range. Assume $T_{90} = 0.848$ (10 marks)

(b) Write short note on each of the following methods of analyzing slope stability: (i) Morgenstern-Price, (ii) Bell and (iii) Sarma methods. (15 marks)

Question 6 (25 marks)

(a) Using diagram, describe the means of accelerating consolidation of clay with the use of sand drains and surcharge. (15 marks).

(b) Explain with diagrams the following types of slope failures: planar and wedge failures. (10 marks)