NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART II SECOND SEMESTER SUPPLEMENTARY EXAM. – AUGUST 2014
SOIL MECHANICS TCW 2201

INSTRUCTIONS
Answer any four questions

Time : 3hrs.
Total Marks : 100

QUESTION 1

Describe any method of classification of soils known to you used for construction purposes and state the physical properties and factors which are considered in that classification.

(25 marks)

QUESTION 2

List the methods used to excavate or drill pits or boreholes for the purpose of collecting soil samples for laboratory tests and describe any two of these methods in detail.

(25 marks)

QUESTION 3

The results of a sieve analysis of two soil samples are as follows :

Sieve	Mass of soil retained on sieve (g)	
Apperture mm	Soil A	Soil B
37,50	0,0	
20,00	26,0	
10,00	31,0	
5,00	11,0	0,0
2,00	18,0	8,0
1,18	24,0	7,0
0,600	21,0	11,0
0,300	41,0	21,0
0,212	32,0	65,0
0,150	16,0	48,0
0,063	15,0	14,0

QUESTION 3 continued

A sedimentation test on the material passing the 63μm sieve indicated that the samples contained :

Particle size(mm)	Mass (g)	
	Soil A	Soil B
0,06 – 0,02	8	2
0,02 – 0,006	4	1
0,006 – 0,002	2	0
Less than 0,002	1	0

Plot the standard grading curves for the two soils and determine the effective size D_{10} , the coefficient of uniformity (Cu) and the coefficient of curvature Cc . Describe briefly the type of soil. **(25 marks)**

(25 marks)

QUESTION 4

(a) Define the following terms associated with soils : (i) permeability , (ii) porosity , (iii) seepage and **(5 marks)**

(b) A horizontal stratified soil deposit consists of three layers , each uniform in itself. The permeabilities of the layers are $8x\ 10^{-4}$, $50x\ 10^{-4}$ and $15x10^{-4}$ cm/sec and their thicknesses are 6 , 3 and 12 m respectively . Calculate the effective average permeability of the deposit in horizontal and vertical directions . **(4 marks)**

© A drainage pipe beneath a dam has clogged with sand whose coefficient of permeability is found to be 8,0m/day . The average difference in head water and tail water elevation is 21,2 m and it has been observed that there is a flow of 162 litres per day through the pipe . The pipe is 94,3 m long and has a cross-sectional area of 180 cm^2 . What length of the pipe is filled with sand ? **(5marks)**

(d) Describe the following : (i) unconfined and (ii) confined aquifers **(11marks)**

(25 marks)

QUESTION 5

(a) The following results were obtained during the determination of moisture content for a soil sample :

Sample No	Mass of container with lid (g)	Mass of container with lid + wet soil (g)	Mass of container with lid + dry soil (g)
1.	26,73	38.80	36,20
2.	25,85	37,20	34,80
3.	26,50	38,60	36,12

Calculate the average moisture content . **(5 marks)**

(b) The following measurements were obtained for the purpose of determining the liquid limit of a soil sample

Sample No.	No. of blows given (N)	Mass of empty crucible (g)	Mass of crucible + wet soil (g)	Mass of crucible + dry soil (g)
1.	24	24,70	41,55	37,75
2.	23	21,73	32,42	30,00
3.	21	22,43	38,20	34,55
4.	15	25,60	41,65	37,70

Determine the liquid limit. **(20 marks)**

(25 marks)

QUESTION 6

(a) A flow net for flow around single row of sheet piles in a permeable soil is shown in fig.6 . Given that Kx = Kz = K = 5x 10-2 mm/s ; determine

(i) how high (above the ground surface) will the water rise , if measured by piezometers placed at points A , B , C and D ? **(16 marks)**

(ii) What will be the rate of seepage through the flow channel II per unit length of the sheet pile ? **(3 marks)**

QUESTION 6 CONTINUED

(iii) What is the total rate of seepage through the permeable layer per unit length ? **(3 marks)**

(b) Define the following : (i) flow line , (ii) flow net and (iii) equipotential lines. **(3 marks)**

(25 marks)

List of formulae

$$\Delta q = K \cdot \frac{H_l}{N_d} \qquad K = \frac{K_1 d_1 + K_2 d_2 + K_3 d_3}{d_1 + d_2 d_3} \qquad K = \frac{d_1 + d_2 + d_3 + \ldots\ldots}{\frac{d_1}{K_1} + \frac{d_2}{K_2} + \frac{d_3}{K_3}}$$

$Q = K \cdot i \cdot A$