Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2014/2015

COURSE NAME	:	GEOTECHNIC 1
COURSE CODE	:	BFC 21702
PROGRAMME	:	2 BFF
EXAMINATION DATE	:	DECEMBER 2014 /JANUARY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER ANY **FIVE (5)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Briefly describe the methods to determine the following indices of a soil in the laboratory:-

(i) the liquid limit, and

(ii) the plastic limit.

(4 marks)

(b) The two common classification systems used in Malaysia to classify a soil are the Malaysian/British Soil Classification System (BSCS) and the Unified Soil Classification System (USCS). List **TWO (2)** major differences in both the systems.

(4 marks)

(c) Grain size distribution curve of a soil is as shown in Figure **Q1 (c)**. The liquid and the plastic limit of the soil were 58% and 34% respectively. Based on the gradation curve of the soil and the indices of the soil, determine:-

(i) D_{60}, D_{30}, and D_{10},

(ii) The coefficient of uniformity (C_u) and the coefficient of concavity (C_c), and

(iii) Classify the soil based on the Unified Soil Classification System (USCS).

(12 marks)

Q2 (a) Define the terms:

(i) Void ratio , e

(ii) Porosity , n

(iii) Unit weight, γ

(iv) Degree of saturation, Sr

(v) Moisture Content, w

(10 marks)

(b) In a sample of clay, the void ratio is 0.73 and the specific gravity of the particles is 2.7. If the voids is 92% saturated, find the bulk density, the dry density and the percentage water content. What would be the water content for complete saturation, the void ratio being the same?

(5 marks)

(c) A sample of soil has a water content 27% and a bulk density of 1.97 Mg/m^3. Determine the dry density and the void ratio of the soil, and the specific gravity of the particles.

(5 marks)

Q3 (a) Compaction is the densification of soil by removal of air, which requires mechanical energy. Briefly explain the factors affecting compaction

(4 marks)

(b) List the method to determine field unit weight of compaction

(2 marks)

(c) Discuss the method of compaction of cohesion less soil and cohesive soils

(4 marks)

(d) Laboratory compaction test results on a clayey soil are listed in table below.

Moisture content (%)	Moist Unit weight (kN/m^3)
6	15.69
8	18.85
9	20.19
11	20.98
12	20.72
14	19.27

Following are the result of a field unit weight determination test on the same soil with sand cone method.

Calibrated dry density of sand	=	1570 kg/m^3
Calibrated mass of sand to fill the cone	=	0.545 kg
Mass of cylinder + cone + sand (before use)	=	7.59 kg
Mass of cylinder + cone + sand (after use)	=	4.78 kg
Mass of moist soil from hole	=	3.007 kg
Moisture content of moist soil	=	10.2%

Determine:

(i) Dry unit weight of compaction in the field
(ii) Relative compaction in the field

(10 marks)

Q4 (a) Describe briefly with a sketch the variable head permeameter.

(5 marks)

(b) A permeameter has a diameter of 75mm and the length of the soil sample is 150mm. The diameter of the standpipe is 15mm. During the test the head decreased from 1300mm to 80 mm in 135 s. Calculate the formula used assuming Darcy's law

(6 marks)

(c) The given data below relate to two falling head permeability test performed on different soils:

Standpipe area	400 mm^2	
Permeameter sample area	2800 mm^2	
Permeameter sample height	50 mm	
Initial water head standpipe	1000 mm	
Final water head in standpipe	200 mm	
Time for decreasing the water head	Soil 1	500s
	Soil 2	15s

Determine the coefficient of permeability of each of these soils in mm/s.

(9 marks)

Q5 (a) Briefly explain with the aid of appropriate diagrams, what is the effective stress in saturated soils with upward and downward seepage.

(5 marks)

(b) Figure **Q5 (b)** shows a layer of soil in a tank with upward seepage.

Given: hydraulic conductivity of soil, k = 0.13 c m/s, H_1 = 1.5 m,
H_2 =2.5 m, h = 1.5 m, γ_{sat} = 18.6 kN/m^3

(i) Explain the critical hydraulic gradient in soil for the upward water seepage through a soil mass.

(3 marks)

(ii) Calculate the upward seepage force per unit volume of soil

(4 marks)

(iii) Determine the rate of upward seepage of water if the area of tank is 0.52 m^2. Give your answer in m^3 /min

(3 marks)

(c) Figure **Q5 (c)** shows the soil profile for silty sand and clay layer. The moist unit weight of silty sand, 15.0 kN/m^3 while saturated unit weight for silty sand and clay layer are given 16.8 kN/m^3 and 17.2 kN/m^3 respectively. Calculate the total stress at point A,B and C.

(5 marks)

Q6 (a) The three types of a triaxial test are the Unconsolidated Undrained (UU), the Consolidated Undrained (CU) and the Consolidated Drained (CD). Briefly described any of the triaxial test mentioned above and shear strength parameters obtained by conducting the test.

(4 marks)

(b) The in-situ shear strength of a soil can be determined directly or indirectly by conducting in-situ shear strength tests such as field Vane Shear Test (VST), Cone Penetration Test (CPT), Standard Penetration Test (SPT), JKR Probe Test, and many others. Describe briefly any one of the test and relate the values obtained from the test to the shear strength of the soil.

(4 marks)

(c) A specimen of saturated sand was consolidated under a confining pressure of 82.8 kN/m^2. The axial stress was the increased and drainage was prevented. The specimen failed when the axial deviator stress reached 62.8 kN/m^2. The pore water pressure at failure was 46.9 kN/m^2.

(i) Determine the drained and the undrained angle of shearing resistance.

(ii) Determine the deviator stress at failure, if a drained test was conducted with the same confining pressure (82.8 kN/m^2)

(12 marks)

- END OF QUESTIONS –

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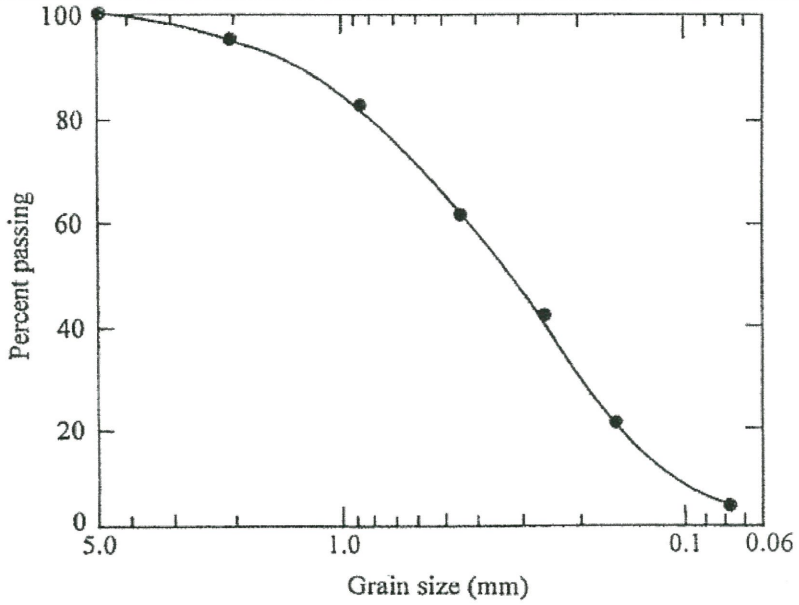

Figure Q1 (c): Grain size distribution curve

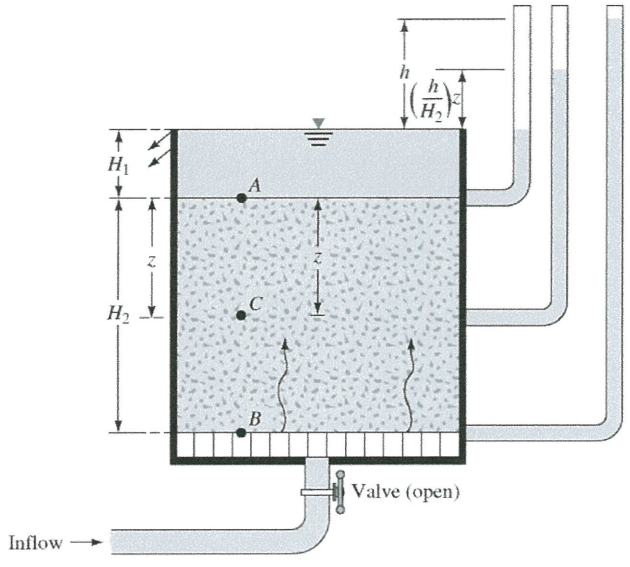

Figure Q5 (b): Layer of soil in tank with upward seepage

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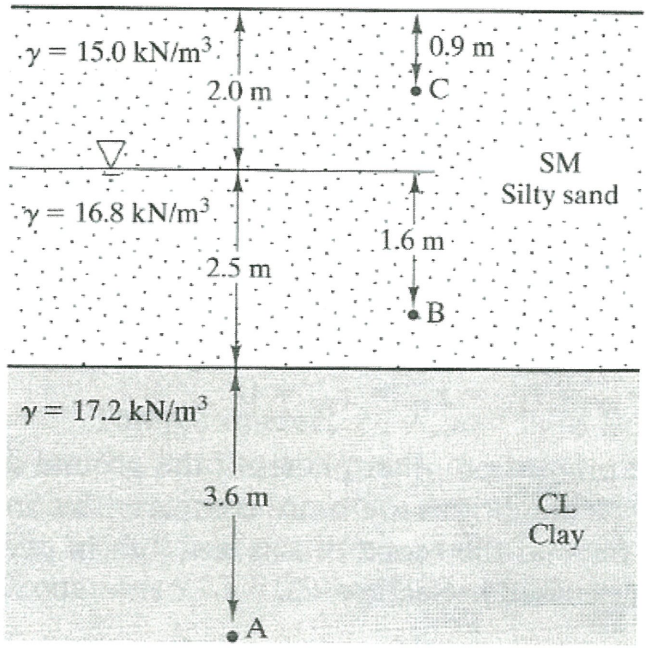

Figure Q5 (c): Soil profile