

B. CONS. ENGG. 3RD YR 2ND. SEM. EXAM.-2017(Old)(S)**SUBJECT : SOIL MECHANICS I**

Time : Three hours

Full Marks : 100

Part - I

Use Separate Answer scripts for each Part

No of Questions		Marks
	Answer any two questions.	
Q1.a.	Derive the expression for equivalent co-efficient of permeability in horizontal and vertical direction of a three layer soil system. The individual layer thickness are H1, H2 and H3 and the co-efficient of permeability are k1, k2 and k3.	10
Q1.b.	State whether the following statements are True or False. i) Normally consolidated clays are generally stiffer than over consolidated clays. ii) If the hydraulic gradient is more discharges through a soil sample will be more. iii) The co-efficient of permeability of silty sand is likely to be less than of clean sand. iv) Peat is a incompressible material v) Silty sand indicates a soil which is predominately silt but contains a small amount of sand	05
Q1.c.	Write short notes on i) Method of identification of organic soil ii) Plasticity Chart	04 06
Q2.a.	Visual identification and laboratory test results of a of soil sample are as follows. Write down the classification symbol and description of the soil samples. Colour : brownish grey Natural moisture content: 32% Liquid limit : 40% Plastic Limit : 24%	04
Q2.b.	The time required for 50% consolidation of a 20mm thick clay layer (drained at both top and bottom) in the laboratory is 2 min 30 sec. How long (in days) will it take for a 5m thick clay layer of similar nature 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.	06
Q2.c.	Define liquid limit, plastic limit and shrinkage limit.	05

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Q2.d.	The sub-soil profile at a site is given below.								10
	Depth (m)		Description				Bulk Density (t/m ³)		
	From	To							
	0.00	4.00	Soft grey silty clay				1.790		
	4.00	8.00	Soft grey silty clay				1.810		
	8.00	12.00	Firm grey silty clay				1.850		
	12.00	15.00	Stiff grey silty clay				1.900		
	The water table is at 1.0m depth below ground level. Draw the variation of total, neutral and effective pressure with depth.								
Q3.a.	Discuss the method of identification of pre-consolidation pressure of clayey soil								0
Q3.b.	Visual identification and laboratory test results on a soil sample are given below.								1
	Sieve Size (mm)	10.0	4.75	2.00	1.18	0.600	0.300	0.150	0.075
	Weight related (gm)	-	2.0	3.0	6.0	12.0	18.0	25.0	30.0
	Total weight of soil sample taken = 100gm.								
	Colour : Yellowish brown								
	Calculate the % finer corresponding to each sieve size, plot the grain size distribution curve. Calculate the value of c_u and c_c . Write down the classification symbol and description of the soil sample.								
Q3.c.	A stratum of normally consolidated clay with an average liquid limit of 45% is 4m thick. Its surface is located at a depth of 3m below the present ground surface. The natural water content of the clay is 40% and specific gravity 2.78. Between the ground surface and the clay the subsoil consists of fine sand. The water table is at ground surface. The bulk density of sand is 2.041 gm./cc. Due to construction of a square footing of size 4m x 4m with founding level 1m. below ground level, the pressure increment in the middle of the clay layer is 2.75 t/m ² . Find out the expected settlement of the footing considering the consolidation settlement of the clay layer.								

SOIL MECHANICS –I (Part-II)

Answer any two questions Ref no: EX/CON/T/ 312 /2017 Old (S)

Answer any two questions

1(a) The following results were obtained at failure in a series of consolidated-untrained tests, with pore pressure measurement, on specimens of saturated clay. Determine the values of the effective stress parameters c' and ϕ' by drawing Mohr circles. (10)

Cell pressure (KN/m ²)	Deviator stress (KN/m ²)	Pore pressure (KN/m ²)
150	192	80
300	341	154
450	504	222

(b) Write notes on (i) Direct Shear Test (b) Vane Shear Test. (iii) CU test (15)

2. (a) Explain the theory of Westergaard's equation of stress distribution. (5)

(b) Describe the assumptions made under Boussinesq's theory of stress distribution. (5)

(c) A concentrated load of 1000 KN is acting on ground surface. Compute the vertical pressure (i) At a depth of 1m interval up to 4m below the load (ii) At a horizontal distance of 3 m at the same depth as indicated in part (i) of the question. Use Boussinesq's equation (10).

(d) Explain 2: 1 method for vertical stress distribution. (5)

3. (a) (i) Explain the significance of OMC . (ii) Define relative degree of compaction. (iii) Explain zero air void line. (9)

(b) An airport runway fill needs 5,00,000 cum soil compacted to a void ratio of 0.75. There are two borrow pits P and Q from where the required soil can be taken and transported to the site. Which of the two borrow pits will be more economical? (10)

Borrow pit	In situ void ratio	Transportation cost
P	0.80	Rs 20/ cum
Q	1.70	Rs 10/ cum

© Prove that $e = \frac{n}{1-n}$, where n = porosity of soil and e is the void ratio of soil.

(6)