

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: CE208**

**Course Name: GEOTECHNICAL ENGINEERING I (CE)**

Max. Marks: 100

Duration: 3 Hours

*(Graph sheets may be supplied on request)*

**PART A**

*Answer any two full questions, each carries 15 marks*

Marks

- 1 a) The wet unit weight of a clay sample is  $18.8 \text{ kN/m}^3$  at 20% water content. What is the degree of saturation? (5)
- b) An embankment of  $10^3 \text{ m}^3$  volume is to be constructed with a soil having a void ratio of 0.8 after compaction. There are three borrow pits marked A, B and C having soils with void ratios of 0.9, 1.5 and 1.8 respectively. The cost of excavation and transporting the soil is Rs. 25, Rs 0.23 and Rs. 0.18 per  $\text{m}^3$  respectively. Calculate the volume of soil to be excavated from each pit. Which borrow pit is most economical? (10)
- 2 a) What are the index properties of soil? Why are they important? (5)
- b) A partially saturated clay weighs 113.4 gm in its natural state and 93.4g in its dry state. If specific gravity is 2.65, find out the void ratio, porosity, degree of saturation,  $\gamma_{\text{wet}}$ ,  $\gamma_d$  and  $\gamma_{\text{sat}}$ . Size of the clay is 3.7 cm in dia. and 7.5 cm ht. (10)
- 3 a) What are the different corrections applied to hydrometer reading? (5)
- b) In a hydrometer analysis 50 g of soil was mixed in water to form 1000ml uniform soil suspension. The corrected hydrometer reading after a lapse of 60mts from the start of sedimentation was 1.010 and the corresponding effective depth was 108 mm. Determine the effective diameter corresponding to 60mts reading and percentage of particles finer than this size.  $G = 2.7$  viscosity of water is  $0.001 \text{ Ns/m}^2$ . (10)

**PART B**

*Answer any two full questions, each carries 15 marks*

- 4 a) Explain the effect of capillarity on effective stress. (5)
- b) A bed of sand consists of three horizontal layers of equal thickness. The magnitude of the coefficient of permeability for both upper and lower layer is  $4 \times 10^{-4} \text{ mm/s}$  and for the middle layer, it is  $6 \times 10^{-2} \text{ mm/s}$ . what is the ratio of the average permeability of the bed in the horizontal direction to that in vertical direction. (10)
- 5 a) List the demerits of direct shear test. (5)
- b) The following data refers to a CU test on a normally consolidated clay. (10)  
 Compute the total stress and effective shear strength parameters.

Sample no	Cell pressure (kPa)	Deviator stress (kPa)	Pore pressure (kPa)
1	100	130	48
2	300	485	140
3	500	645	290

- 6 a) Explain effective stress principle. (5)  
 b) A saturated specimen is permanently under water. Its water content is 50% and  $G=2.72$ . What is the effective stress at 8 m below the clay surface? How many meters of clay must be removed by dredging to reduce the intergranular pressure at that point by 25 kPa. The water levels remain unchanged. (10)

**PART C**

*Answer any two full questions, each carries 20 marks*

- 7 a) What are the different types of finite slopes? Give measures for improving the stability of slopes. (10)  
 b) Explain Friction circle method of slope stability analysis. (10)
- 8 a) A 20 m thick isotropic clay stratum overlies an impervious rock. The coefficient of consolidation is  $5 \times 10^{-2} \text{ mm}^2/\text{s}$ . Find the time required for 50% and 90% consolidation. The time factor for 50% consolidation is 0.2 and for 90% consolidation is 0.85 (10)  
 b) At a building site soil consist of dense sand upto a depth of 3m, clay from 3m to 6m depth and stiff impervious rock below 6m depth. The water table is at 1m below the present ground level. Density of sand is  $19.5 \text{ kN/m}^3$  above water table and  $20 \text{ kN/m}^3$  below it. The natural water content of clay was observed as 60%, and specific gravity is 2.65. Its liquid limit was 75%. Estimate the probable settlement if the ground level is raised by a 2 m thick fill of dense sand of density  $19 \text{ kN/m}^3$ . (10)
- 9 a) A cohesive soil yields a maximum dry density of  $18 \text{ kN/m}^3$  at an optimum moisture content of 16% during a standard proctor test. If the value of  $G$  is 2.65, what is the degree of saturation? What is the maximum dry density it can be further compacted to? (10)  
 b) A 5 m deep cut is made in a soil having  $C_u=15 \text{ kN/m}^2$  and  $\phi=10^\circ$ , if the slope is 1:1 what is the factor of safety with respect to cohesion? If the slope is changed to 1:1.5 H, what will be the change in factor of safety with respect to cohesion? The unit weight of soil is  $18 \text{ kN/m}^3$ . The stability numbers for  $\phi=10^\circ$  are as follows. (10)

Slope angle	$45^\circ$	$30^\circ$	$15^\circ$
Stability number	0.108	0.075	0.023

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