Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I

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) Define void ratio, porosity, air content and percentage of air voids. 5

b) An embankment having total volume of 2500 m^3 is to be constructed having bulk density of 1.98 gm/cm^3 and placement water content of 18%. The soil is to be obtained from either borrow area A or borrow area B which has void ratio of 0.78 and 0.69 respectively. The water contents of these areas 16% and 12% respectively. If the cost of excavation is Rs. 36/m^3 from each area. The cost of transportation is Rs.33 and Rs.37 per m^3 from borrow area A and borrow area B respectively. Which area is more economical? Take specific gravity of soils as 2.66. 10

2 a) With the help of particle size distribution graph, define the following (i) Well graded soil (ii) poorly graded soil (iii) gap graded soil 5

b) The wet weight of the soil specimen having size 40 mm diameter and 80 mm height is 1.6N. Its weight after 24 hrs of oven drying is 1.4N. Determine the water content, dry unit weight, bulk unit weight, void ratio and degree of saturation. The specific gravity of soil can be taken as 2.7. 10

3 a) Sketch the plasticity chart used for classifying a fine-grained soil. Classify the soil as per IS classification system 7

Percentage of soil finer than 75-micron sieve = 14%

Percentage of soil finer than 4.75 mm sieve = 63%

Liquid limit = 28%

Plasticity index = 12%

b) An air-dried soil sample weighting 500 gm was sieved in the laboratory. The results are given below. Draw the grain size distribution curve and find the uniformity coefficient, coefficient of curvature, effective size, percentage of gravel and percentage of sand. 8

IS sieve (mm)	4.75	2.0	1.0	0.425	0.212	0.15	0.075	pan
Mass retained (gm)	10	165	100	85	40	30	50	20

PART B

Answer any two full questions, each carries 15 marks

4	a)	Determine the ratio of average coefficient of permeability in the horizontal to vertical direction for a deposit consists of three layers 6m, 1.5m and 3m and having coefficient of permeability $2.5X10^{-2}$ mm/s, $3.5X10^{-5}$ mm/s, $4.5X10^{-2}$ mm/s. Assume the layer to be isotropic.	7
	b)	A direct shear test was conducted on sand gave a failure shear stress of 70 kN/m^2 when the normal stress was 200 kN/m^2. Draw the mohr circle, mohr failure envelope and find the angle of shear resistance. Find the principal stresses at failure and orientation principal planes.	8
5	a)	State and explain Darcy' s law.	4
	b)	In a variable head permeability test the initial head is 50 cm. The head drops by 15cm in 15 minutes. Find the time required to run the test for the final head to become 20 cm. Take the height and cross sectional area of the soil sample as 6 cm and 50 cm^2 respectively. Take the area of stand pipe as 0.5 cm^2.	5
	c)	An unconfined compression test was conducted on clay sample 150 mm diameter and 300 mm height. The failure load was 150N and axial deformation at the time of failure was 3 mm. Find the cohesive strength of the soil.	6
6	a)	Write the merits and demerits of direct shear test	6
	b)	A soil profile consists of surface layer of gravel 4 m thickness having density 17 kN/m^3, an intermediate layer of clay 3.5m thickness having saturated density 18 kN/m^3 and bottom layer of sand 4 m thickness having saturated density of 19 kN/m^3. The water table is at 4m from ground level. Determine the total stress, neutral stress and effective stress at bottom and interface layers.	9

PART C

Answer any two full questions, each carries 20 marks

7	a)	Define normally consolidated soil, over consolidated soil and under consolidated soil.	5
	b)	Write down the weight of hammer, height of fall, number of layers, volume of the mould and number of blows per layer for I.S.Light compaction test.	7.5
	c)	At a site the soil consists of sand up to 3.5m depth and from 3.5m to 7m the soil is normally consolidated clay. The water table is at 1.5m from ground level. The density of sand is 19 kN/m^3 above the water table and 20 kN/m^3 below the water table. The natural water content and specific gravity of clay are 60% and 2.65 respectively. The liquid limit of clay is 75%. Estimate the probable settlement of clay layer, if the pressure at mid-height of clay layer increases by 40kPa.	7.5
8	a)	Explain the method to find the preconsolidation pressure.	6
	b)	Explain the procedure for determination of coefficient of consolidation by logarithm of time fitting method.	6

c) An undisturbed sample of clay 20mm thickness consolidated 50% in 25 minutes in the laboratory when drainage allowed at top and bottom. The same clay having thickness 5m exist in the filed with sandy layer at top and bottom of clay. Find the time required to consolidate 50% and 90% in the field. 8

9 a) Find the factor of safety with respect to cohesion of clay laid at a slope of 1 in 2 for a height of 12m. The angle of friction and cohesive strength are respectively 10^0 and 30 kN/m^2. Take the density of soil as 20 kN/m^3. The stability number for the given condition is 0.064. 5

b) Explain Swedish circle method 7

c) The maximum dry density of a soil sample obtained from light compaction test is 1.85 g/cc and optimum moisture content is 14%. If the specific gravity of solids is 2.65, determine the degree of saturation of soil at OMC and the dry density corresponding to zero air void condition at OMC. 8

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