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Fifth Semester B.E. Degree Examination, June/July 2015
Geotechnical Engineering - I

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Assume missing data suitably if any.

PART - A

- 1 a. Derive an expression for the dry density of the soil in the form

$$\gamma_d = \frac{(1 - n_a)G\gamma_w}{1 + GW}$$
 with usual notations. (06 Marks)
- b. Define the following with the help of three phase diagram. Indicate the units :
 i) Water content ii) Void ratio iii) Saturated unit weight iv) Degree of saturation. (08 Marks)
- c. An embankment is to be constructed with a void ratio of 0.85 and the quantity of embankment being 5000m³. Three borrow pits are available for the construction of the embankment and the corresponding void ratio and the cost of transportation for 1.0m³ of soil is given below. Determine the most economical borrow pit. (06 Marks)

Borrow Pit	Void ratio e %	Cost / m ³ Rupees
A	0.95	30
B	1.90	16
C	1.65	25

- 2 a. What is Consistency of soil? List and briefly explain consistency limits. (06 Marks)
- b. Explain the following with the help of particle size distribution curve :
 i) Well graded soil ii) Poorly graded soil iii) Gap graded soil. (06 Marks)
- c. In a liquid limit test on the clayey soil the following results are obtained :

No. of flows	34	22	19	12
Water contents %	44.6	49.4	51.4	55.6

Plot the flow curve and obtain i) Liquid limit ii) Plasticity Index if the plastic limit is 22% iii) Flow Index iv) Toughness Index. (08 Marks)

- 3 a. Explain any two clay minerals with the help of neat sketches. (08 Marks)
- b. Classify the soil on the basis of the following data as per IS 1498 - 1970. (12 Marks)

Soil	Liquid limit %	Plastic limit %	Percent passing through 75 μ	Percent gravel	Percent sand	C _u	C _c
A	40	45	100	0	0	-	-
B	40	20	70	10	20	-	-
C	40	20	20	20	60	7	2
D	-	Non plastic	10	10	80	5	10

- 4 a. Explain briefly constant head permeameter test. Derive an expression to obtain coefficient of permeability under constant head condition. (08 Marks)
- b. List and explain factors affecting the permeability of soil. (06 Marks)

- c. In a falling head permeability test the length and area of cross section of soil specimen are 0.17m and $21.8 \times 10^{-4} \text{m}^2$ respectively. Calculate the time required for the head to drop from 0.25m to 0.10m. The cross sectional area of stand pipe is $2 \times 10^{-4} \text{m}^2$. The sample has three layers having permeabilities $3 \times 10^{-5} \text{m/s}$ for first layer of 0.06m, $4 \times 10^{-5} \text{m/s}$ for second 0.06m and $6 \times 10^{-5} \text{m/s}$ for third 0.05m height. Assume the flow is taking place perpendicular to the bedding plane (06 Marks)

PART - B

- 5 a. What are the advantages and limitations of direct shear test? (06 Marks)
 b. Explain the types of shear test based on different drainage conditions. (06 Marks)
 c. A consolidated undrained test was carried out on a clay sample and the results are as follows

Cell pressure, kN/m^2	100	200	400	600
Deviator stress at failure, kN/m^2	300	410	610	850
Pore water pressure at failure kN/m^2	-45	-15	+50	+110

Find total and effective shear parameters of soil. (08 Marks)

- 6 a. List the differences between standard and modified proctor compaction test. (05 Marks)
 b. Briefly explain the use of proctor needle in field compaction control. (06 Marks)
 c. On a compaction test following results are obtained

Water content %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil, N	16.67	18.54	19.92	19.52	19.23	18.83

Volume of compaction mould is $9.5 \times 10^{-4} \text{m}^3$. Determine maximum dry density and OMC. Also plot zero air void line assuming the specific gravity of solids 2.65. (09 Marks)

- 7 a. Explain Mass Spring Analog of theory of consolidation of soils. (07 Marks)
 b. What is Preconsolidation Pressure? How it is determined by Casagrande's method. (07 Marks)
 c. List and briefly explain the assumptions of one dimensional Terzaghi's theory of consolidation. (06 Marks)
- 8 a. Differentiate Compaction and Consolidation. (04 Marks)
 b. Define Thixotropy and Sensitivity. (06 Marks)
 c. The time to reach 40% consolidation of a two way drained saturated clay sample of 10mm thick in the laboratory is 40s. Determine the time required for 60% consolidation of the same soil 12m thick on an impervious layer subjected to same loading conditions as the laboratory sample. (10 Marks)
